Report and Proceedings

OF THE

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1898-99.

BELFAST:
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CONTENTS.

Belfast Natural History and Philosophical Society.

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ESTABLISHED 1821.

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SHAREHOLDERS.

1 Share in the Society		costs £7.
2 Shares	,,	cost £14.
3 Shares	,,	cost £21.

The Proprietor of 1 Share pays 10s. per annum ; the proprietor of 2 Shares pays 5s. per annum; the proprietor of 3 or more Shares stands exempt from further payment.

Shareholders are only eligible for election on the Council of Management.

MEMBERS.

There are two classes—Ordinary Members, who are expected to read Papers, and Visiting Members who, by joining under the latter title, are understood to intimate that they do not wish to read Papers. The Session for Lectures extends from November in one year till May in the succeeding one. Members, Ordinary or Visiting, pay £1 1s. per annum, due 1st November in each year.

Each Shareholder and Member has the right of personal attendance at all meetings of the Society, and of admitting a friend thereto; also of access to the Museum and Library for himself and family, with the privilege of granting admission orders for inspecting the collections for any friend not residing in Belfast.

Any further information can be obtained by application to the Secretary. It is requested that all accounts due by the Society be sent to the Treasurer.

The Museum, College Square North, is open daily from 10 till 4 o'clock. Admission for Strangers, 6d. each. The Curator is in constant attendance, and will take charge of any Donation kindly left for the Museum or Library.

Belfast Natural History and Philosophical Society.

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ANNUAL REPORT, 1898.

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THE Annual Meeting of the Shareholders of this Society was held on 18th July, at three o'clock, in the Belfast Museum, College Square North. Mr. Thomas Workman, J.P., President, occupied the chair, and the attendance included Drs. MacCormac and Leathem, Messrs. Geoge Kidd, J.P.; Robert Young, J.P.; Edward Allworthy, W. H. Patterson, J. H. Davies, Joseph Wright, John M'Knight, W. M. F. Patterson, Isaac Ward, Seaton F. Milligan, John Brown, W. Faren, G. F. Patterson, and Robert M. Young, B.A., M.R.I.A., Hon. Secretary. Letters of apology for non-attendance were received from the Lord Mayor (Mr. Otto Jaffe, J.P.) and Sir James Henderson.

The notice convening the Meeting having been read,

MR. ROBERT YOUNG, Hon. Secretary, submitted the annual report, which stated :—" The Council desire to submit to the shareholders their report of the working of the Society during the past year. The winter session was opened on 8th November, 1898, when the President of the Society, Mr. Thomas Workman, J.P., delivered an inaugural address on the subject " Incentives to the Study of Natural History," illustrated by limelight views, &c. The second meeting was held on 6th December, 1898, when a paper was read by Mr. Walter Chambers, C.E., on " Refuse Disposal and Sewage Purification," illustrated by diagrams, &c., followed by an interesting discussion. The third meeting was held on 13th December, 1898, when a paper was read by Mr. Arthur J. Martin, A.M.I.C.E., Exeter, on " The Purification of Sewage by Bacteria," illustrated by limelight views. The fourth meeting took place on 10th January, 1899, when Mr. John Brown read a paper on "The Viagraph, a new Instrument for Testing Road Surfaces," illustrated by diagrams and exhibition of the viagraph. A discussion followed at its close. The fifth meeting, on 7th February, 1899, was devoted to a popular lecture in the Y.M.C.A. Hall, at which the Lord Mayor (Mr. Otto Jaffe, J.P.) presided. Mr. Seaton F. Milligan delivered an interesting lecture upon "The Boyne Valley, its History, Scenery, and Antiquities." which was illustrated by over one hundred lantern slides. The proceeds were in aid of the Giant's Causeway Defence Fund, and there was a large attendance of members and the general public. The sixth meeting was arranged for the 14th March, when Dr. J. Lorrain Smith, M.A., kindly lectured on "Pathogenic Bacteria, with Special Reference to the Typhoid Bacillus," illustrated by actual specimens and lantern views. The closing meeting took place on 11th April, 1899, when Mr. John N. Finnegan, B.A., B.Sc., gave a lecture on "Luminous Discharges in Rarefied Gases," illustrated by experiments and photograph slides. All these meetings were well attended, both by the members and the general public, the two on sanitary subjects attracting special audiences. Largely through the good offices of Mr. John Horner, your Council have secured that the Gilchrist lectures for a second time be given in Belfast, commencing in September next. A public meeting will be summoned at an early date to make detailed arrangements in connection with their delivery. It will be observed from the Hon. Treasurer's statement of accounts that the usual satisfactory balance in favour of the Society is fully maintained. The number of societies meeting in the Museum shows no falling off, and its accommodation was sometimes taxed to provide for two meetings on the same evening. Mr. Stewart, our Curator, reports that during the year further additions have been made to the herbarium of local plants, and many specimens have been mounted and placed in their order in the cabinet. The local collection is now almost complete, but the type set of

British plants is still far from being so. At the Easter holidays the Museum was less crowded than it has been on some former occasions. Nevertheless the attendance was very large, and at times the building was taxed to its utmost capacity. On ordinary days the admissions continue much as in recent years. Since the last annual meeting the Society has to deplore the loss of one of its most valued members—the late Mr. Lavens M. Ewart, J.P. He was a most useful and active member of the Council since 1894, and took the greatest interest in the wellfare of the Society in every way. A vote of condolence with his widow and family was passed at the first public meeting after his lamented decease. Your Council have co-opted the Lord Mayor of Belfast (Mr. Otto Jaffe, J.P.) to fill the vacancy caused by his untimely death. They have received with much regret Mr. John H. Greenhill's resignation from the Council owing to change of residence. A list of donations to the Musem and of publications received in exchange from home and foreign scientific societies will be printed with the present report. The Council desire to tender their best thanks to the local Press for their admirable reports of the Society's meetings. This meeting will be asked to elect five members of Council in place of the following gentlemen, who retire by rotation, the first three of whom are eligible and offer themselves for re-election :—Messrs. John Brown, William Swanston, W. H. F. Patterson, Professor FitzGerald, and John H. Greenhill."

Mr. Wm. H. F. Patterson, Assistant Treasurer, read the Treasurer's report, which showed a balance in hands of £76 1s. 2½d. The donations had increased during the year, but there was a slight decrease in subscriptions.

Dr. MacCormac, in moving the adoption of the rêport and statement of accounts, said it afforded him much pleasure to do so on account of their financial condition, and also because of the growing interest taken by the general public of Belfast and the surrounding districts in the working of that Society. It could not be otherwise when they remembered the valuable scientific information brought before the meetings held there.

Those scientific investigations, he thought, must be of incalculable value to the general community.

Mr. Edward Allworthy seconded the motion. He was of opinion that the general public did not take that interest in the proceedings of that Society as its worth demanded, and he urged that some special effort should be made to create a fresh interest from the citizens, which, he felt sure, would be a boon to the people themselves and a blessing to the community where they lived. It was remarkable how few out of the three hundred thousand in Belfast and the numerous visitors to the city who came into the Museum. Speaking of the late Mr. Ewart, he referred to him as a very able, excellent, and good friend to that Society, and had done more than had ever been made public. He was always doing a little towards gathering in articles and information, and, now he was gone, they felt his loss. In conclusion, he expressed the hope that the Council and President would endeavour to make next year still more attractive than the past.

Mr. John Horner supported the resolution, and, in doing so, said on account of the immense success of the Gilchrist lectures the last time they were held in Belfast, the trustees had decided to allow a series to be given in the five towns, as before, on the understanding that a certain amount of money will be subscribed to the trustees for the purpose of helping on educational work in Ireland. Another condition was that there should be some educational movement or scheme brought out from the lectures. In that matter it was suggested that representatives from the other towns should meet at a meeting in Belfast, under the auspices of the Lord Mayor, to discuss some feasible scheme for university extension or some other form of education. At that meeting resolutions could be passed on the subject. He (Mr. Horner) had spoken to the Lord Mayor, and he had kindly consented to co-operate and do all in his power on behalf of the scheme.

The Chairman referred to the great loss which the Society had sustained by the death of Mr. Lavens M. Ewart. He had for a long time taken a very great interest in that Society, as well as in kindred societies. At the same time, he (the Chairman) thought they had good reason to congratulate themselves in co-opting the Lord Mayor to fill the vacancy created by Mr. Ewart's death. Already his Lordship had shown a great deal of interest since his appointment on the Council.

The motion was passed by acclamation.

Messrs. John Brown, W. Swanston, W. H. Patterson Andrew Gibson, and Seaton F. Milligan were unanimously elected members of the Council of Management for 1899-1900, in place of the retiring members.

Mr. John Brown moved, Mr. Robert Young, J.P., seconded, and it was passed, that the meeting approves of the Council's decision to appoint delegates to confer with other kindred societies to invite the British Association to Belfast. In making the proposition, Mr. Brown said the Association had not met in Belfast since 1874, and the meeting prior to that was 1852. On both occasions the initiative was taken by their Society, and consequently he felt they should strengthen the Council's hands in every possible way.

On the motion of Mr. George Kidd, J.P., seconded by Dr. Leathem, a cordial vote of thanks was passed to the Chairman and Hon. Secretary for the amount of attention they bestowed upon the working of the Society during the year. Each of these gentlemen having returned thanks, the meeting terminated.

The members of the Council then proceeded to elect office-bearers for the ensuing year as follows:—President, Mr. Thomas Workman, J.P.; Vice-Presidents, Messrs. John Brown, W. Swanston, F.G.S.; and Robert Young, J.P.; Hon. Librarian, Mr. Thomas Workman, J.P.; Hon. Treasurer, Mr. William H. F. Patterson; Hon. Secretary, Mr. R. M. Young, J.P.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict. ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended 30th April, 1899.

Dr. — **Cr.**

CHARGE.

To Balance as per last Account				£45	1	0½
,, Amount of Donations, Bequests, and other Endowments, received in the year ended 30th April, 1899				16	0	0
,, Amount of Subscriptions received in the year ended 30th April, 1899				112	18	0
,, Amount of Dividends received in the year ended 30th April, 1899				17	8	0
,, Amount of Rents received in the year ended 30th April, 1899				55	4	0
,, Amount of Fees received in the year ended 30th April, 1899				0	10	6
,, Amount realized by Sales in the year ended 30th April, 1899				1	6	0
,, Amount of Miscellaneous Receipts in the year ended 30th April, 1899 (not included in the foregoing), viz.:—						
Entrance Fees at door, Easter Monday	£15	7	2			
Do. do. Tuesday	2	13	10			
Do. do. during year ended 30th April, 1899	23	0	2			
				41	1	2
Total				£289	8	8½

DISCHARGE.

By Amount of Payments made in the year ended 30th April, 1899, under the following headings—						
Maintenance of Premises, &c. ..	£19	5	6			
Rent and Taxes, &c.	27	11	0			
Salaries	89	17	4			
				136	13	10
Other Payments, viz.:—						
Printing and Stationery	12	19	0			
Advertising	7	17	11			
Postage and Carriage	3	18	6			
Fuel and Gas	15	12	1			
Auditor's Fee	1	1	0			
Insurance	6	12	0			
Subscription to *Irish Naturalist* ..	2	2	0			
,, to Feis Ceoil	2	0	0			
Hire of Lantern	1	11	0			
Printing Report	16	1	0			
Expenses at Easter	6	18	8			
Commission on Cheques	0	0	6			
				76	13	8
Total Payment				213	7	6
,, Balance in favour of this Account on the 30th April, 1899				76	1	2½
Total				£289	8	8½

N.B.—Besides the above Balance there is a sum of **£400** standing to the credit of this Account in the **York** Street **Flax** Spinning Co., Ltd., 4½ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.
W. H. F. PATTERSON, Accounting Officer.

Dated this 23rd day of May, 1899.

I certify that the foregoing Account is correct.
J. F. MAYNE, Auditor.
27th day of May, 1899.

DONATIONS TO THE MUSEUM, 1898-99.

From Dr. W. S. Young.

Lignite and clay concretions from a well sinking in County Donegal.

From Miss Montgomery.

A birch rod used at school in the North of Ireland over 100 years ago.

From Mr. W. Swanston, F.G.S.

Five wooden food dishes, three wooden spoons, eight vessels of pottery used as cooking utensils, one cane basket-work dish, from South Africa, and three war knives, from India. Also a collection of Eocene fossil plants from County Antrim.

From Mr. Lavens M. Ewart, J.P., M.R.I.A.

A pair of pampooties, or cowhide shoes, from the Arran Islands.

From Mr. George Donaldson.

A mounted collection of North American Lepidoptera, including *Vanessa Milbertii* and *Colias cæsonia.*

From Mr. R. J. Welch.

A number of the rarer land and freshwater shells.

From Mr. Wm. J. King.

Ancient sword and scabbard, found eight feet below the surface in White Mountain Quarry, Co. Antrim.

From Mr. R. Lloyd Praeger, M.R.I.A., *and* Mr. S. A. Stewart, F.B.S.Edin.

A large number of native plants of the North of Ireland.

From Egypt Exploration Fund.

A collection of various objects excavated at Oxyrhynchus.

ADDITIONS TO THE LIBRARY, 1st MAY, 1898 TILL 1st MAY, 1899.

ADELAIDE.—Transactions of the Royal Society of South Australia. Vol. 22, parts 1 and 2, 1898.

ALBANY.—Forty-ninth Annual Report of the Regents of the New York State Museum, 1897. *The University of New York.*

BELFAST.—Proceedings of the Belfast Naturalists' Field Club. Ser. 2, vol. 4, part 5, 1898. *The Club.*

BERGEN.—Bergens Museums Aarbog, for 1898 ; also Account of the Crustacea of Norway. Vol. 2, Isopoda, parts 9-12, 1898. *Bergen Museum.*

BERLIN.—Verhandlungen der Gesellschaft für Erdkunde. Vol. 25, nos. 4-10, 1898 ; and vol. 26, nos. 1-4, 1899. *The Society.*

BOSTON.—Memoirs of Boston Society of Natural History. Vol. 5, no. 3, 1898 ; and Proceedings, Vol. 28, no. 6, 1897 ; and nos. 7, 9, 10, 11 and 12, 1898. *The Society.*

BREMEN.—Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine zu Bremen. Vol. 14, part 3 ; and vol. 15, part 2, 1897 ; also vol. 16, part 1, 1898. *The Society.*

BRESLAU.—Zeitschrift für Entomologie herausgegeben vom Verein für Schlessiche Insektenkunde zu Breslau. *The Society*

BRIGHTON.—Annual Report of Brighton and Sussex Natural History and Philosophical Society, 1898. *The Society.*

BRUSSELS.—Annales de la Société Entomologique de Belgique. Vol. 42, 1898. *The Society.*

Annales de la Société Malacologique de Belgique. Vol. 28, 1893; vol. 29, 1894; vol. 30, 1895; and vol. 31, fasc. 1, 1896; also Procès-Verbal, June, 1895, till July, 1898. *The Society.*

BUENOS AYRES.—Comunicaciones del Museo Nacional de Buenos Aires. Vol. 1, nos. 1 and 2, 1898. *The Director.*

BUFFALO.—Bulletin of Buffalo Society of Natural Science. Vol. 5, nos. 2-5, 1896-1897; and vol. 6, no. 1, 1898. *The Society.*

CALCUTTA.—Memoirs of the Geological Survey of India (Palæontologica Indica). Ser. 15, vol. 1, part 3, No. 1, 1898.

Manual of the Geology of India—Economic Geology. Part 1, Corundum, 1898; and General Report of the Survey, 1898. *The Director of the Survey.*

CAMBRIDGE.—Proceedings of Cambridge Philosophical Society. Vol. 9, part 5, 1897; and parts 8 and 9, 1898; also vol. 10, part 1, 1899. *The Society.*

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Anatomy. Vol. 28, nos. 4 and 6, 1898; vol. 31, no. 7, 1898; and vol. 32, nos. 1-9, 1898-99. Also Annual Report. 1898. *The Curator.*

CARDIFF.—Transactions of Cardiff Naturalists' Society. Vol. 29, 1897. *The Society.*

CASSEL.—Abhandlungen & Bericht des Vereins für Naturkunde zu Kassel (43), 1898. *The Society.*

COLORADO SPRINGS.—Colorado College Studies. Vol. 7, 1898. *Colorado Coll. Scientific Society.*

CHRISTIANIA.—Forhandlinger i Videnskabs Selskabet i Christiania, for 1897; and nos. 1-6, 1898; Oversigt, 1897 and 1898; and Royal University Program, 2nd semestre, 1895; and 1st and 2nd semestre, 1897. *The Royal Norske Frederiks University.*

DANTZIC.—Schriften der Naturforschenden Gesellschaft in Danzig, Vol. 9, parts 3 and 4, 1898.
The Society.

DUBLIN.—Scientific Transactions of the Royal Dublin Society. Ser. 2, vol. 6, parts 14-16, 1898; and vol. 7, part 1, 1898; Proceedings, vol. 8, part 6, 1898.
The Society.

EDINBURGH.—Proceedings of the Royal Society of Edinburgh, Vol. 21, 1897. *The Society.*

Proceedings of the Royal Physical Society. Vol. 13, part 3, 1897. *The Society.*

EMDEN.—Jahresbericht der Naturforschenden Gesellschaft in Emden für 1896-97. *The Society.*

GENOA.—Giornale della Società di Letture et Conversazione Scientifiche di Genova. Anno 20, fasc. 3 and 4, 1898; and vol. 21, fasc. 1, 1899. *The Society.*

GLASGOW.—Proceedings of the Philosophical Society of Glasgow. Vol. 29, 1898. *The Society.*

GORLITZ.—Abhandlungen der Naturforschenden Gesellschaft zu Gorlitz. Vol. 22, 1898. *The Society.*

GOTHENBURG.—Goteborg's Kungl. Vetenskaps och Vitterhets Samhälles Handlingar, Fjarde folgden. Part 1, 1898. *The Society.*

HALLE.—Leopoldina Amptliches Organ der Kaiserlichen Leopoldine-Carolinischen Deutschen Akademie der Naturforscher. Part 33, 1897.
The Academy.

HAMBURG. — Verhandlungen des Naturwissenschaftlichen Vereins. Ser. 3, parts 5, 1898, and 6, 1899.
The Society.

IGLO.—Jahrbuch des Ungarischen Karpathen Vereines. 25th year, 1898. *The Society.*

INDIANAPOLIS.—Proceedings of the Indiana Academy of Science for the year 1897. *The Academy.*

JALAPA.—Boletin Mensual Meteorologica del Observatorio Central del Estado de Veracroz. Nov. and Dec., 1897, and January, 1898. *The Director.*

KIEW.—Memoirs of the Kiew Naturalists' Society. Vol. 14, part 2, 1897; and vol. 15, part 1, 1896; and part 2, 1898. *The Society.*

LAUSANNE.—Bulletin de la Societé Vandoise des Sciences, Naturelles. Vol. 34, nos. 127-130, 1898. *The Society.*

LAWRENCE, KANSAS.—The Kansas University Quarterly. Ser. A, vol. 7, nos. 1-4, 1898; and vol. 8, no. 1, 1899; ser. B., vol. 7, nos. 1-3, 1898. *The University.*

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig, 1897. *The Society.*

LONDON.—Report of the Meeting of the British Association at Bristol, 1898. *The Association.*

„ Quarterly Journal of the Geological Society of London. Vol. 54, part 4, 1898; vol. 55, part 1, 1899; and List of Fellows, 1898. *The Society.*

„ Journal of the Royal Microscopical Society. Parts 3-6, 1898, and part 1, 1899. *The Society.*

„ Transactions of the Zoological Society of London. Vol. 14, parts 6-8, 1898, and vol. 15, part 1, 1898. Proceedings, parts 1-4, 1898; also, List of Fellows, 1898. *The Society.*

MADISON.—Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 11, 1898. *The Academy.*

„ Bulletin of the Wisconsin Geological and Natural History Society. Nos. 1 and 2, 1898. *The Society.*

MADRAS.—Bulletin of Madras Government Museum. Vol. 2, no. 2, 1898; also, Administration Report for 1897-98. *The Superintendent.*

MANCHESTER.—Journal of Manchester Geographical Society. Vol. 11, nos. 10-12, 1895; vol. 13, nos. 7-12, 1897; and vol. 14, nos. 1-6, 1898. *The Society.*

" Transactions of the Manchester Geological Society. Vol. 25, parts 15. 16, 20, 21; vol. 26, part 1, 1898; and parts 2 and 3, 1899. *The Society.*

MARSEILLES.—Annales de la Faculté des Sciences de Marseille. Vol. 8, fasc., 5-10, 1898. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. New series, vol. 10, part 2; and vol. 11, part 1, 1898. *The Society.*

MERIDEN, CONN.—Transactions of Meriden Scientific Association. Vol. 8, 1898. *The Association.*

MEXICO.—Boletin Mensual del Observatorio Meteorologico Central de Mexico. January to November, 1898. *The Director.*

" Boletin del Observatorio Astronomico Nacional de Tacubaya. Nos. 3 and 4, 1898. *The Director.*

" Boletin del Instituto Geologico de Mexico. No. 10, 1898. *The Institute.*

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Vol. 3., fasc. 9 and 10, 1898. *The Director.*

MOSCOW.—Bulletin of the Imperial Society of Naturalists of Moscow. Nos. 3 and 4, 1897; and nos. 1-3 1898. *The Society.*

NANTES.—Bulletin de la Société des Sciences Naturelles de l'Ouest de France. Vol. 7, part 4, 1897; and vol. 8, parts 1-4, 1898. *The Society.*

NEW YORK.—Transactions of the New York Academy of Sciences. Vol. 16, nos. 1-12, 1898; and Annals, vol. 10, 1898; and 11, parts 1 and 2, 1898. *The Academy.*

" Bulletin of the American Geographical Society. Vol. 30, no. 25, 1898; and vol. 31, no. 1, 1899. *The Society.*

" Bulletin of the American Museum of Natural History. Vol. 10, 1898. *The Museum.*

ODESSA.—Memoirs of the Society of Naturalists of New Russia. Vol. 18, part 2, 1897; vol. 21, part 2, 1897; and vol. 22, part 1, 1898. *The Society.*

OPORTO.—Annaes de Sciencias Naturaes. Vol. 5, nos. 1-3, 1898. *The Editor.*

OSNABRUCK.—Twelfth Jahresbericht des Naturwissenschaftlichen Vereins zu Osnabruck, 1897. *The Society.*

OTTAWA.—Annual Report of the Geological Survey of Canada. New series, vol 9, 1898. *The Director of the Survey.*

PADUA.—Atti della Società Veneto-Trentina di Scienze Naturali. Series 2, vol. 3, fasc. 3, 1899; also Bullettino. Vol. 6, no. 3, 1898. *The Society.*

PHILADELPHIA.—Proceedings of the Academy of Natural Sciences. Part 3, 1897; and parts 1-3, 1898. *The Academy.*

Proceedings of the American Philosophical Society. No. 156, 1897, and nos. 157 and 158, 1898. *The Society.*

Transactions of the Wagner Free Institute of Science. Vol. 4, part 4, 1898; and vol. 5, part 1, 1898. *The Institute.*

PISA.—Atti della Società Toscana di Scienze Naturali Processi Verbali. January-July, 1898. *The Society.*

RIO DE JANEIRO.—Revista do Museo Nacional do Rio de Janeiro. Vol. 1, 1896. *The Director.*

ROME.—Atti della Reale Accademia dei Lincei. Ser. 5, vol. 7, semestre 1, fasc. 8-12, 1898; semestre 2, nos. 1-12, 1898; vol. 8, semestre 1, fasc. 1-6, 1899; also Rendiconto del Adunanza Solenne, 1897. *The Academy.*

Bollettino della Società Romana per gli Studi Zoologici. Vol. 6, fasc. 5 and 6, 1897; and vol. 7, fasc. 1-6, 1898. *The Society.*

Journal of the British and American Archæological Society of Rome. Vol 2, no. 8, 1898. *The Society.*

SAN FRANCISCO.—Proceedings of the California Academy of Sciences. Ser. 3, vol. 1., nos. 4, 6, 7, 8, 9, 10, 1898. *The Academy.*

STAVANGER.—Stavanger Museums Aarsberetning for 1897. *The Museum Trustees.*

STIRLING.—Transactions of Stirling Natural History and Archæological Society, 1898. *The Society.*

ST. LOUIS.—Ninth Annual Report of the Missouri Botanical Garden, 1898. *The Director.*

STOCKHOLM.—Kongliga Svenska Vetenskaps Akademiens Handlingar. New series, vol. 30, 1898; Bihang, vol. 23, parts 1-4, 1898; and Ofversigt; no. 54, 1897. *The Academy.*

SYDNEY.—Science of Man. Vol. 2, no. 1, 1899. *The Editor.*

TOKYO—Die Sprichwörter. Two parts, 1898. *The Author.*

TOPEKA.—Transactions of Kansas Academy of Science. Vol. 15, 1898. *The Academy.*

TORONTO.—Transactions of the Canadian Institute. Vol. 5, part 2, 1898; Proceedings, new series, vol. 1, parts 4-6, 1898. *The Institute.*

UPSALA.—Bulletin of the Geological Institution of the University of Upsala. Vol. 3, part 2, 1897.
The University.

VIENNA.—Verhandlungen der Kaiserlich Koniglichen Zoologisch-Botanischen Gesellschaft. Vol. 48, 1898.
The Society.

Verhandlungen der Kaiserlich Koniglichen Geologischen Reichsanstalt. Nos. 4-18, 1898; and nos. 1-4, 1899. *The Society.*

WASHINGTON.—United States Department of Agriculture, Bulletin. Nos. 9, 10, 11, and 50, 1898; also, Secretary's Report for 1898; and Year-book of Agriculture for 1897.
The Secretary of Agriculture.

Bulletin of the United States Geological Survey. No. 149, 1897; and nos. 88 and 89, 1898; also, Monographs; vol. 30, 1898. *The Director.*

Annual Report of the American Historical Association for the year 1896. Vols. 1 and 2, 1897.
The Association.

Annual Report of the Bureau of Ethnology, part 2, 1896. *The Director of the Bureau.*

Annual Report of the United States National Museum for the year 1895, and Report for 1896; also Proceedings of U.S. Museum, vol. 19, 1897; and Annual Report of Smithsonian Institution, to July, 1896; Smithsonian Contributions to Knowledge, no. 1,126, 1898; Smithsonian Miscellaneous Collections, nos. 1,087, 1,090, 1,093, and 1,125, 1898; also vol. 39, no. 1,170, 1899.
The Smithsonian Institution.

YORK.—Annual Report of the Yorkshire Philosophical Society for 1898. *The Society.*

ZURICH.—Vierteljahrschrift der Naturforschenden Gesellschaft in Zurich. 43rd year, parts 1-4, 1898. Neujahrsblatt; no. 101, 1899. *The Society.*

From EGYPT EXPLORATION FUND.—The Oxyrhynchus Papyri. Part 1, 1898; also Archæological Report for 1896-97.

From MONS. CHARLES JANET.—Etudes sur les Fourmis, les Guepes, et les Abeilles. 5 nos., 1897-98; also, Notice sur les Travaux Scientìfiques of M. Janet.

From MR. R. LLOYD-PATTERSON, J.P., F.L.S.—Journal of the Linnean Society—Botany. Vol. 33, nos. 232 234, 1898; vol. 34, no. 235, 1898; and 236,1899.

From MR. THOMAS WORKMAN, J.P.—Exploration Scientifique de la Tunisie. Illustrations, plates, 1-20, Champignons and Phanerogames; also, Catalogue Raisonné des Plantes Cellulaires de la Tunisie, 1897.

From MISS CARRUTHERS.—Belfast Almanac, 1809; and *Belfast News-Letter*, Dec. 8th and Dec. 15th, 1818.

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

SESSION 1898-99.

8th November, 1898.

INAUGURAL ADDRESS BY THE PRESIDENT,

Mr. Thomas Workman, J.P.

(*Abstract.*)

It appears to me that of late years this Society has largely drifted away from the study that was the life-work of our illustrious founders. I refer to Natural History; and seeing that your Council has done me the honour of electing me President for this Session, I think I cannot better occupy your time than by addressing you on "Incentives to the Study of Natural History." We must all feel that there is much going on in Nature around us to which we shut our eyes, and to not a few Nature has no more interest than it had to Wordsworth's Hero—

> ". . . Nature ne'er could find the way
> Into the heart of Peter Bell.
> In vain through every changeful year,
> Did Nature lead him as before;
> A pimrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more."

I had intended to take as incentives some of the interesting facts that are known about the lives of plants and animals. I found, however, that this would be too extensive, and therefore shall confine my remarks this evening to the botanical part only.

Ordinary flowering plants may be divided into three pretty well marked groups—

The single flower,
The grouped flower,
and The compressed flower.

We quite understand why a plant has a root, as it must have a hold on the ground, from which it pumps up water and mineral salts. Also the need to it of stalk and branches ; that it may be raised from the ground and have its leaves spread out to the sun and air ; and the use of the leaves are quite apparent, as we know them to be the mouths and lungs of plants. But have we grasped the need to it of the wonderfully shaped and beadtifully coloured parts we call the flower.

All these curious shapes and bright colouring of flowers are simply an advertisement to the wandering hordes of flying insects that "good honey is kept here." The floral world no more believes in the old adage, that "good wine requires no bush," than do our modern houses of entertainment, as one can see by our city hoardings.

Our modern advertisers do not offer to give away their goods for nothing, and, though flowers seem to do that, it is only in appearance, for their little deceits are very wily. Before or after they entertain their insect visitor they ask for no fee or payment. They simply practically say, after having feasted him, "Thanks, old fellow, for your visit—come soon back," and then pat him on the head or back, or rub a little pollen on his whiskers, so that he goes away quite satisfied, feeling that he has got quite a lot for nothing, little thinking that he is doing a good hard day's work for the flower for very little pay. Just look at the work a humble bee does from early morning to late at night, visiting hundreds and hundreds of flowers, and carrying the pollen from the stamen of one flower to the pistil of another, so that they may be fertilised.

It is to this insect industry that we owe the glorious masses of colour in heaths and whins and buttercups, that make the fields so beautiful in spring and summer.

Several of our native plants, are very curious and of great interest, such as the Cuckoo Pint (*Arum maculatum*), so conspicuous in the early spring with its curious heated chamber or fly prison, and the spotted orchid (*Ophrys maculata*) that has its pollen in two club-like masses called pollinia which have a viscid disk by which they are fastened to the proboscis of the bumble bee when it comes to suck the honey from the flower. The pollinia after being fastened on the proboscis in a vertical position automatically turn to a horizontal position so as to project forward and thus to strike the stigma when the bee visits a fresh flower. Among the interesting foreign plants, is the *Marcgravia nepenthoides*, described by Belt in his remarkable book "The Naturalist in Nicaragua." The flowers of this lofty climber are disposed in a circle, hanging downwards, like an inverted candelabrum. From the centre of the circle of flowers is suspended a number of pitcher-like vessels, which when the flowers expand, in February and March, are filled with a sweetish liquid. This liquid attracts insects, and the insects numerous insectiverous birds, including many kinds of humming birds.

The flowers are so disposed, with the stamens hanging downwards, that the birds, to get at the pitchers, must brush against them, and thus convey the pollen from one plant to another.

This writer also describes the curious bull's horn thorn. It is a species of acacia, belonging to the section *Gummiferæ*, growing to the height of fifteen or twenty feet. The branches and trunk are covered with strong curved spines, set in pairs, from which it receives the name of the bull's horn thorn, they having a very strong resemblance to the horns of that quadruped.

These thorns are hollow, and are tenanted by ants, that make a small hole for their entrance and exit near one end of the thorn, and also burrow through the partition that separates the two horns ; so that the one entrance serves for both.

Here they rear their young, and in the wet season every one of the thorns is tenanted ; and hundreds of ants are to be seen running about, especially over the young leaves. If one of them be touched or a branch shaken, the little ants (*Pseudomyrma bicolor* Guer.) swarm out from the hollow thorns, and attack the aggressor with jaws and sting. These ants form a most efficient standing army for the plant, which prevents not only the mammalia from browsing on the leaves, but delivers it from the attacks of a much more dangerous enemy—the leaf cutting ants. For these services the ants are not only securely housed by the plant, but are provided with a bountiful supply of food ; and to secure their attendance at the right time and place, this food is so arranged and distributed as to effect that object with wonderful perfection. The leaves are bi-pinnate.

At the base of each pair of leaflets, on the mid-rib, is a crater-formed gland, which, when the leaves are young, secrets a honey-like liquid. Of this the ants are very fond ; and they are constantly running about from one gland to another to sip up the honey as it is secreted. But this is not all ; there is a still more wonderful provision of more solid food. At the end of each of the small divisions of the compound leaflet there is, when the leaf first unfolds, a little yellow fruit-like body united by a point at its base to the end of the pinnule. Examined through a microscope, this little appendage looks a golden pear. When the leaf first unfolds, the little pears are not quite ripe, and the ants are continually employed going from one to another, examining them.

When the ant finds one sufficiently advanced, it bites the small point of attachment ; then, bending down the fruit-like body, it breaks it off and bears it away in triumph to the nest.

All the fruit-like bodies do not ripen at once, but successively, so that the ants are kept about the young leaf for sometime after it unfolds.

Thus the young leaf is always guarded by the ants ; and no caterpillar or larger animal could attempt to injure them without being attacked by the little warriors. These facts seem to show that the ants are really kept by the acacia as a standing army, to protect its leaves from the attacks of herbiverous mammals and insects.

. . . hark! how blythe the throstle sings!
He, too, is no mean preacher:
Come forth into the light of things;
Let Nature be your teacher.

She has a world of ready wealth,
Our minds and hearts to bless—
Spontaneous wisdom breathed by health,
Truth breathed by cheerfulness.

One impulse from a vernal wood
May teach you more of man,
Of moral evil and of good,
Than all the sages can.

Sweet is the lore which Nature brings;
Our meddling intellect
Misshapes the beauteous forms of things;—
We murder to dissect.

Enough of Science and of Art;
Close up those barren leaves;
Come forth, and bring with you a heart,
That watches and receives. —*Wordsworth*, 1798.

6th December, 1898.

Mr. Thomas Workman, J.P., President in the Chair.

REFUSE DISPOSAL AND SEWAGE PURIFICATION,

By W. Chambers.

(*Abstract.*)

From an economic standpoint, much of the rubbish of to-day is quite unessential and due to habits of wastefulness, which will doubtless be corrected as education advances and science works out her destiny. It may be considered under four divisions :—

1. Road scrapings, which are comparatively harmless

2. Stable manure, abattoir and fish offal, all containing good manurial properties.

3. Refuse from household operations, constituting legitimate sewer matters.

4. Dustbin and market refuse, of which our urban population contributes, it is estimated, about six million tons per annum ; that can only be disposed of in one way to satisfy the requirements of public health, viz.: destruction by burning. A destructor furnace reduces all organic matter to its component gases, and by a system (illustrated on the diagram) they are rendered odourless and innoxious. The resultant heat is utilised in boilers of large size, having supplementary fire grates to augment the power, and so make it available for generating current for tramway traction, at a cost of less than one penny

per B.T.U. The Corporations of St. Helens and Llandudno are arranging to use current from their destructor stations for working the tramways, and at Bradford electric current is supplied to the tramways at one penny per B.T.U., and at that price yields a profit of 25 per cent. This question has an important bearing on the economic and efficient administration of municipal matters. At St. Helens the Corporation are laying and equiping a network of tramways, leasing them to a private company, and supplying current at a nominal price, to enable a large scattered industrial population to have rapid communication at cheap fares. Professor Forbes estimates ashbin refuse to contain 50 per cent. breeze and cinders, 25 per cent. incombustible matter, and 25 per cent moisture. The non-combustible elements, chiefly mineral, leave the furnace in the form of hard clinker, which is perfectly innocuous and serviceable for concrete, mortar, and—when mixed with a proportion of fine dust from the flues together with cement—can be formed into paving slabs, both they and the mortar being produced at a cheap rate, and adding to the profit bearing revenue derived from destructor stations. From an economic standpoint water-carriage for sewage is a wasteful system, as Sir William Crookes estimates this national loss to the soil of nitrogen, phosphates, and potash at £16,000,000 per annum.

Sewage purification involves biological problems, and in a great measure it is due to the researches of Mr. S. R. Lowcock, Mr. W. E. Adeney, and Mr. Donald Cameron that general acceptance is given to the idea that bacteria are the scavengers of nature. Dead organic matter is perpetually undergoing decomposition into the gaseous and saline compounds that, in the economy of nature, go to sustain vegetable life, this decomposition being brought about by the agency of micro-organisms of various kinds, which may be either putrefactive or by oxidation, the latter being the work of those healthy micro-organismal scavengers that cover the whole surface of the earth, and without whose beneficient work all terrestrial life, vegetable and animal alike, would cease to be.

In the system originated by Mr. Adeney the polluted liquid sewage, after separation of solid matter, is reduced to simple substances by micro-organisms, the process being facilitated by the introduction of materials into a series of tanks for maintaining a healthy condition of the microbes, the operations being continued until the fluid is sufficiently purified to enable it to be safely discharged into any ordinary outfall.

The septic system is of a different character, and is differentiated from the previous process by encouraging putrefaction of the solid elements in sewage. It is an accepted dictum that "the tendency of nature is to return to the *status quo*," and the modern science of bacteriology teaches that if seriously polluted water is given sufficient time and oxygen, it will be changed back to a wholesome fluid. Mr. H. E. P. Cottrell states that water bacteria consume all substances that are eatable, including putrefying matter, the germs and spores of other bacteria, and even each other. A lack of food produces a curious phenomenon: the dead bodies of myriads of deceased generations which preceded them exert a toxic effect, by which the living are quickly exterminated, and the water becomes sterilized.

Mr. Cameron proves that the disappearance of solids in sewage is due to micro-organisms feeding on the organic matter which they exude in a simpler and liquid form; this action taking place in a closed tank. The fluid is then subjected to filtration and a clear effluent obtained.

Sewage farming offers three great advantages:—1. The effluent is thoroughly purified. 2. A profitable agricultural return is ensured. 3. Under proper management the public health is not endangered. These essentials are not easily realised owing to the difficulty of obtaining suitable land near large cities, but farming may be used as an adjunct to any sewage scheme for utilizing the resultant sludge. Chemical precipitation has now been in constant operation for over thirty years, and is a ready process for effecting a clear affluent. It involves the use of collecting tanks, which, however, can be emptied at any time, so that the process is a continuous one. In dealing with a large quanity of sewage there is necessarily a considerable deposit of solid matter, commonly called sludge, and its ultimate disposal involves careful consideration. Practical science is at fault in not determining its utilization as manure. It can be applied to raise the level of low-lying lands which can be afterwards cultivated with advantage, or carried away and dumped into the sea, or pressed, to remove the surplus water, and then burnt in destructor furnaces. The mal-odorous condition of the fore shore of Belfast Lough demands that the sewage should be treated so as to produce a clear effluent. So far back as 1866 Mr. Montgomery, the then Borough Surveyor, considered it to be essential to his able and comprehensive Main Drainage Scheme to prevent any pollution to the shores of the Lough. Had that proposal been carried out as intended 22 years ago, there can be no reasonable doubt that the surface soil of our city would have been free from the disease germs that now render some portions of the city unhealthy.

The adoption of a clarification process requires that the collecting tanks be fitted with a stirring apparatus to thoroughly mix the chemicals used for precipitation of the solid matter. The direct result of such mixture is that the solid particles are thrown into a flocculent state, permeating the entire contents of the tank, which gradually settle down, leaving the liquid clear and innoxious. The chemical combinations necessary to produce this hygienic effect are prepared chiefly from iron oxide, alumina, and lime. All these exist in immense quantities in our own immediate neighbourhood, and under these favourable local conditions it follows that the cost of precipitating materials should be cheaper here than in any other part of the United Kingdom.

Refuse disposal and sewage purification are pregnant with possibilities for our material welfare. The destructor, while absolutely destroying those germs of evil that are the accompaniments of disease, will furnish the power for locomotion, lighting, or other useful purposes. A precipitation process furnishes plant nourishment from its residuals, and at the same time confers the beneficent result of a comparatively pure effluent from the sewer outfall, and so contribues to the public weal by establishing a thorough sanitary system.

Mr. R. M. Young, B.A., M.R.I.A. (Hon. Secretary), announced that letters of apology for non-attendance had been received from Professor Letts, Messrs. H. H. M'Neile, D.L., Parkmount ; Thomas Andrews, J.P. ; and John Lanyon, C.E.

Mr. Young read the following letter from Prof. Letts :—

"Dear Mr. Young,—I very much regret that owing to another engagement I shall not be able to have the pleasure of attending the meeting on Tuesday evening and of listening to what will, I am sure, prove a most interesting paper. It comes at a very opportune time, for, as you are aware, we who live on the shores of the lough suffer from a nuisance which at times is well nigh intolerable, and which we are convinced is caused almost entirely by the discharge of the untreated sewage of the city of Belfast into the lough. I say almost entirely, because we do not deny that small quantities of sewage are discharged from the villages on the lough shores, but it must be recollected that a large proportion of this sewage is from cesspools, and is therefore free from solids—a very important distinction between it and the Belfast sewage, which runs bodily into the lough, solids and all.

"The deputation which waited upon the City Council last Friday was gratified to learn from the Lord Mayor that something would have to be done in a comprehensive way as regards the whole subject of the disposal of the Belfast sewage, but it was by no means so satisfactory to hear that nothing could attempted until the Royal Commission on Sewage Disposal, which is now sitting, had furnished its report. This may take a long time, and the questions arise—(1) Can we afford to wait so long? and (2) Is there any necessity for the delay?

"There are three, and only three, alternative methods for the disposal of the Belfast sewage I believe, viz.: (1) irrigation; (2) the construction of a main sewer to Blackhead, or at all events to some spot on the coast where the sewage would be swept out to sea by the turn ocean tide; and (3) chemical treatment.

"Of these three the conditions for the first are so unsuitable that there is no chance of its being adopted, while the cost of the second would, I understand, place it out of the question. This leaves the third as alone within the range of practical politics. If that is the case can anything be gained by a delay in executing the necessary works and in immediately starting some precipitation process?

"I do not think that the local conditions require any very elaborate treatment of the sewage, because it is not a question of running the effluent into a river or watercourse, but into a shallow-sea lough, where a large aerating surface exists quite sufficient, I believe, to cope with the dissolved organic matter which would remain after the employment of any of the present precipitation processes.

"One of the chief advantages of the immediate adoption of a precipitation process would be that the effluent could be run off at any time of the tide, and not as at present (under the Main Drainage Act) during a restricted interval which I am told is impossible frequently.—Yours, &c., E. A. LETTS."

The CHAIRMAN then called for discussion, and said he would ask Mr. John MacIlwaine to open the discussion on Mr. Chambers's able paper.

Mr. MACILWAINE said they were much obliged to Mr. Chambers for the most interesting paper he had read. He (Mr. MacIlwaine) could offer nothing but friendly criticism on the paper. He knew something about combustion, and, judging the paper from that part of the subject with which he (Mr. MacIlwaine) was familiar, he would say that the other part was all right. They owed a debt of gratitude to their American cousins for having, after twenty years' experience, brought electric lighting and electric traction to perfection, and he thought the time had come when they in this country might profit by that experience, and go in at once for electric tramways and electric lighting.

Mr. OTTO JAFFE, J.P., T.C., said that, speaking as a Town Councillor, he was in the unfortunate position of not being a member of either the Improvement Committee or the Public Health Committee, but perhaps he had the advantage of being able to speak more freely about the subject. He might say that the Town Council had decided to adopt refuse destructors, and the only question at issue was what was the best kind of destructor to get? The deputation that had visited various centres in England in connection with the subject had not yet made up their minds on that point, but he believed they were gradually coming to a decision. He might say that the destructors at first would not be put up at the electric station, but would be erected at the outfall pumping station, where the power could be used in the pumping. Mr. Chambers had estimated the amount of the refuse at 30,000 tons per year, but he (Mr. Jaffe) understood that, with road scrapings, the refuse amounted to 100,000 tons a year, and the plant which the Corporation would put down would deal with the destruction of one-fourth of that quantity. Some people condemned the main drainage system, but, as the Lord Mayor had told the deputation at the last meeting of the Corporation, there was no doubt that when the present system was put down it was done under the best technical advice of the time. If the citizens agitated he was quite sure that the Corporation would see its way very soon to chemically precipitate the sewage at the outfall station. There was no doubt that when the main drainage scheme was designed it was assumed that the sewage would run further into the tidal part of the lough than it did now. In other words, the tide brought it back sooner and nearer than was anticipated. He feared that Mr. Chambers's estimate of £4,500 a year as the cost of precipitating the sewage was one-half lower than the actual cost would be; for he (Mr. Jaffe) believed that if an expenditure of £4,500 a year would purify the sewage of Belfast it would not be necessary to call on the liberality of the Council at all—they would vote that sum with the greatest of pleasure in two minutes. And when the proper time came he believed the Council would not hesitate about voting four or five or six times the amount mentioned for the purpose referred to.

Professor FITZGERALD said he had listened to the paper with great satisfaction, and admired the practical way in which Mr. Chambers had attacked his subject, and treated it in general. He (the Professor) took it they did not want particularly any wonderful plan, with elaborate chemicals, much machinery, and so-forth, which was to produce an affluent that could be put into a small stream, the size, for instance, of the Dodder, near Dublin. What they wanted was a simple precipitation plan, which would render the sewage matter sufficiently innocuous to be put safely into the lough, and unlikely to lead to the accummulation of sludge banks, which seemed to be certainly going on now in a way very much analogous to what began to be noticeable in the Thames about the year 1872, and the result of which was that the London sewage had to be precipitated, and the sludge taken out to sea as it was now. With regard to the use of the destructor, and the advantage of utilising the heat, he thought the destructor which Mr. Chambers had shown them was an extremely well-designed one, but in spite of Edinburgh, he had not been converted to the belief that there was really anything to be got out of the utilisation of the heat in the way of raising steam.

Dr. ST. GEORGE (Lisburn) favourably criticised the paper. He said that in Lisburn they laboured under difficulties somewhat similar to those in Belfast with reference to the disposal of sewage. They discharged the sewage into the River Lagan —but they did not want to make it a gigantic cesspool any longer, and they had now a Bill before Parliament to get their sewerage system into a better state.

Alderman JAMES DEMPSEY spoke of the absolute necessity of destroying the sewage by either a burning process or taking out to sea in barges, and the latter method was said to be attended with danger, considering the state of the weather at certain periods. The question of precipitating the sewage matter was a much more serious one than that of erecting a destructor. The erection of a destructor was within measurable distance, and the precipitating business must come within measurable distance also.

Mr. F. D Ward, J.P., said he had visited Paris ten or twelve years ago, and a friend had brought him to see the wonderfully complete system of sewerage that existed in that city. All the sewage went into a river, and this river ran through a district where there was a wonderful irrigation farm, and here the water came out perfectly pure, as he (Mr. Ward) could testify by having tasted it. He would like to hear from the lecturer whether the system of Paris had been improved or not since the time he referred to.

Mr. Conway Scott, Executive Sanitary Officer, disagreed with Mr. Chambers's estimate of 1s. 6d. per ton for carting rubbish to burn in the destructors. He did not believe the work could be done for that. The sludge was comparatively worthless—it was the liquid form of sewage that supplied plant life—and the sludge of London sewage was so valueless that they towed it out into the channel and dumped it into the sea. He thought the real question was how to get rid of it in the cheapest possible way. He also disagreed with Mr. Chambers about the power to be obtained from the destructor. While he admitted there was power to be gained, the citizens need not imagine that the rates would be reduced immediately by the introduction of electric lights and electric trams through the power derived from destructors. There was no doubt that sewage could be purified, but it was all a question of expense. The reason the Corporation did not purify the sewage was because it was a matter of £ s d, and that appealed to the rate-payers.

Mr. Munce, Assistant City Surveyor, said that Mr. Chambers spoke of 6,000,000 gallons of sewage having to be dealt with every day in Belfast, but the usual amount was about 12,000,000 gallons daily, and very often it was much more, so that Mr. Chamber's estimate of the cost fell far short of the mark.

Mr. CHAMBERS, in replying to the various speakers, said that in estimating £4,500 a year as the cost of precipitating the sewage he only meant the cost of the materials to be employed, without reference to labour, but the latter was a small item. The cost of precipitation depended upon the quantity of materials used and the degree of excellence of the resulting effluent. As to the sludge, it could be used for reclaiming land, or it could be used on sewage farms, or dumped into the sea. Paris did not come within the scope of his paper, but, as they all knew, it was a model sewage farm that was in the village outside the French capital. With regard to the destructor, he believed the mere work of burning could be done for the amount he had stated, but the wages bill and other charges would increase it. He was surprised at the figures given by Mr. Munce as to the quantity of sewage matter daily. He (Mr. Chambers) took the population of Belfast at 300,000, including the added area, and, allowing 30 gallons per head, which was the general estimate, that would give 9,000,000 gallons per day. But, as the whole of the area was not included in the main drainage scheme, he deducted one-third, and that gave his figures 6,000,000 gallons.

13th December, 1898.

Mr. Thomas Workman, J.P., President, in the Chair.

THE PURIFICATION OF SEWAGE BY BACTERIA.

By Arthur J. Martin, Assoc. M.Inst. C.E.

(Abstract.)

I cannot pass on to the special side of my subject without first referring briefly to the nature and properties of sewage, as a proper understanding of these is absolutely necessary for the comprehension of a process of purification. There is often a disposition to regard sewage as consisting, either wholly or in great part, of excremental matter. This is very far from being the case. There are, for instance, many towns in the North of England where the excreta are dealt with on the dry-earth or privy system, and do not find their way into the sewers; but in such cases, as the Rivers Pollution Commissioners have shown, the sewage differs very slightly in composition and strength from that of water-closeted towns, in which the whole of the excrement is admitted to the sewers.

Fresh sewage is generally comparatively free from smell; but when it has lain about for any length of time, as it does in the depressions of badly-laid sewers, it often becomes exceedingly offensive. In other words, it begins to decompose. This process of decomposition serves a definite purpose of supreme importance in the economy of nature. The materials which are suitable as food for the vegetable and animal world exist in extremely limited quantities, and must therefore be used over and over again. But the refuse of animal life has to be prepared for the plants before they can feed upon it. This all-important work is performed by myriads of unpaid scavengers, whose existence was not even suspected until late in the seventeenth century. They are so tiny that it required the powerful microscopes of the present day to make them visible at all; they are known as "bacteria" or more familiarly as "microbes." There are other low forms of life which bear a part with them; but it will simplify our task to-night if we confine ourselves to bacteria and their work. It is they who seize on the foul matter given off by the animal world, and bring it into such a condition that it can support vegetable life. This work is accomplished in at least two stages. The products of animal life become first of all the prey of the decomposition moulds and bacteria, whereby they are converted into the various products of decomposition, such as ammonia and nitrites. These, again, are seized upon by the other workers, which it is convenient to classify as nitrifying bacteria, and converted by them into nitrates, which I need hardly remind you, are among the most valuable of our artificial fertilisers.

As I shall point out later, the decomposition moulds and bacteria are made use of in the septic tank to break down the polluting matter of sewage; and the work of purification is completed by the nitrifying bacteria in the filters.

When the sewage problem first began to make itself felt, the eyes of sanitary authorities turned hopefully towards sewage farms. They expected not only to get rid of their sewage, but also to derive a profit from its utilisation on the land. The creed of many sanitarians was summed up in the phrase "The rainfall to the river, the sewage to the land." These hopes were, in nearly every instance, doomed to be blasted. In all but a very small minority of instances, where local circumstances were exceptionally favourable, the sewage farm has turned out a source of l ss instead of profit; and in too many cases it has completely failed to purify the sewage. Often enough it has proved to be an unmitigated nuisance. The reason for this is not far to seek. Land is undoubtedly the natural receptacle for the refuse of the animal world; and, if we were content to live the life of the primitive man, we might safely throw upon the soil the duty of dealing with our leavings. But it does not follow that this is the natural way to deal with town sewage. It is not a natural state of things to concentrate the excrement of several thousand people upon a few acres of land. It is still less a natural proceeding to swamp this land daily with several thousands of tons of dirty water in addition. It is because we do these things that nature rebels, and our sewage farms turn out failures. The successful purification of sewage by means of land, day in and day out throughout the year, demands far larger areas than are generally available. And, what is not less important, the task requires skilled management of a high order, which it is hard to find, and still harder to induce a sewage committee to pay for. We are therefore thrown back on what are called "artificial" processes of sewage purification.

For many years attempts have been made to solve the difficulty by means of strainers, followed by chemical precipitation. This process, when properly carried out, does undoubtedly remove from sewage the larger proportion of the suspended impurities, that is to say, of the solid matter visible to the eye, as well as part of the dissolved polluting matter. But the suspended matters are not got rid of by precipitation: they are merely thrown down as sludge. Great expectations were at one time entertained of the manurial value of sewage sludge; but here again the hopes formed have been doomed to disappointment; and in most cases the cost of disposing of this embarrassing substance adds very largely to the expense of dealing with the sewage.

The capability of filters, when properly handled, to deal with the liquid portion of sewage has long been recognised. It remained to find an effective and inexpensive means of preparing sewage for filtration by freeing it from its suspended solids, and of grappling with the sludge difficulty. Among others whose duties brought them face to face with this problem was the City Surveyor of Exeter, Mr. Donald Cameron. After many years of study and research Mr. Cameron came to the conclusion that the polluting matter of sewage might be so changed as to be rendered harmless solely by the operation of natural agencies, provided that these were properly directed and controlled. The outcome of his work in this direction is the septic tank, which is probably known by name, at least, to most of those present.

The septic tank and filters at Belleisle have now been dealing for more than two years with the sewage of St. Leonards, a suburb of the city of Exeter, having a population of about 1,500. The sewage is turned without any screening or preliminary treatment into the septic tank, in which the solid matter is retained, the clear water then being drawn off between the scum on the surface and the heavy deposit which lies at the bottom of the tank.

If we did nothing more than arrest the solid matter of the sewage, we should still be confronted with the difficulty of getting rid of the sludge. But, fortunately, sewage contains within itself the seeds of its own destruction. Dr. Poore, among others, has drawn attention to the fact that excrement simply teems with bacteria. Under the conditions provided in the septic tank, these tiny scavengers attack the impurities of the sewage, and gradually resolve them into simpler and simpler forms. The scum which covers the surface is full of bacteria, and serves as the "barm" so to speak, which sets up the fermentation or decomposition by which the solid matter is eventually broken down.

As the outcome of these operations we get an effluent practically free from solid matter, and showing a marked purification even as regards the impurities in solution.

Among the final products of the decomposition which takes place in the septic tank, are marsh gas and free hydrogen, both of which are highly inflammable gases. The flame from these gases, though a very hot one, is not luminous; but it becomes so by the aid of an incandescent mantle. For some months past the works at Exeter have been lighted at night with the gases generated in the tank.

During the preliminary decomposition in the septic tank, it was important to exclude oxygen as far as possible ; but having brought the solids into solution, it becomes necessary to oxidise them ; and this process requires the free access of air. Accordingly the effluent, after flowing through an aerator, passes into the filters, in which the work of oxidation is chiefly accomplished. This duty, like the preliminary liquefaction of the solids in the tank, is the work of bacteria ; but the workers in the filters, unlike those in the tank, which only thrive in the absence of air, require a plentiful supply of oxygen to enable them to perform their functions. Each filter therefore is first filled, then allowed to rest full for a certain time, then emptied, and finally left to drain and aerate. In this way the nitrifying bacteria obtain the necessary supply of oxygen. The need for constant attention is done away with by means of an alternating gear, which automatically opens and closes the valves in their proper order. The works are thus rendered completely automatic, and one man, visiting them for a few minutes on two or three days per week, is able to give all the attention which they ordinarily require. The filtered effluent from these works has been examined at various times by many of the foremost chemists in the kingdom, and found to be of a high quality and perfectly inoffensive ; and it remains so when kept for any length of time.

A marked characteristic of works on this system is their entire freedom from nuisance. At Exeter there is a good house within seventy yards of the works, and three other high-class residences within two or three hundred yards. At the Local Government Board Inquiry held at Exeter with reference to the scheme for laying down tanks and filters for the whole city, there was not one word of opposition thereto, although the new works will be some thirty times as large as the installation already laid down, and right under the windows of these houses.

At Yeovil there is a factory within three paces of the works, and the proprietors state that they have never experienced any nuisance therefrom. A doubt has often been expressed whether the system would be as successful in dealing with sewage strongly charged with manufacturing refuse as it is with an ordinary domestic sewage ; but this has now been completely demonstrated at Yeovil with a sewage which is pronounced by competent judges to be one of the foulest in England.

There is one function of sewage works which must not be overlooked. The bacteria which bring about the decomposition of sewage matter are the sworn foes of disease germs ; and it is by their means that the ravages of disease are kept within bounds. In the septic tank, and again in the filters, any disease germs which the sewage contains are systematically exposed to the attack of their deadly enemies, first of one kind, then of another. The works thus furnish an efficient safeguard against the propagation of disease by the sewage with which they are dealing.

Professor Redfern, in proposing a vote of thanks to the lecturer, said Mr. Martin's discourse had been so lucid and able on the new method of sewage treatment, that everyone who had thought anything on the matter should be deeply interested. The world seemed to have come to a general conclusion that bacteria did nothing but mischief, but Mr. Martin had shown that they were the great scavengers of effete matter. and played an important part in the economy of nature. Belfast had been recently visited by a typhoid epidemic, but so had other towns and cities, and that ought to be remembered when the present outcry was raised. The lecturer had shown—and he (Professor Redfern) was prepared to believe it—that these bacteria destroyed the solid matter in sewage. Exeter had already shown in this matter of sewage purification what could be done on a small scale, and they all looked forward with great zest to its showing them the way in what could be done on a large scale in this very important matter.

Mr. J. W. Gilliland, C.E., seconded the vote of thanks. He said that a sewage farm, which system seemed to find favour with some, was quite impracticable for a large city like Belfast, as the area required would be about 3,000 acres ; and chemical precipitation he did not favour, because it left the sludge question undealt with, which was the *bête noir* of sanitary engineers. The question of the disposal of the sludge had practically sounded the death-knell of chemical precipitation as a means of purifying sewage. There was, then, only left the bacterial method, which the septic tank treatment carried out. They in Belfast therefore should not be any longer lax in this matter, but should benefit by the able lecture they had heard from Mr. Martin and see that the sewage of the city should not be any longer discharged in a crude state into Belfast Lough. The question of the purification of the sewage was, as has been said, one of £ s d ; but the septic tank treatment was merely one of first cost, with practically a minimum of working expense afterwards, the system being automatic.

Dr. St. George (Lisburn), after complimenting Mr. Martin on the clearness of his lecture, said that dirt was only matter in a wrong place, and that sewage only was a nuisance and required to be grappled with on acccount of the aggregation of people in towns, therefore the disposal of it (sewage) by nature's methods was at once the simplest, the cheapest, and the best. The sooner the public could be made to understand that Bacteria were not all raging lions ready to prey on the human race the better, but that even bacteria had their part in the cycle of nature, acting and reacting, each in its proper sphere. There seemed no manner of doubt that the septic tank system fulfilled this, and from personal observation during August, 1897, he was prepared to support all that had been said by the lecturer. The other systems he had visited first screened their sewage, none admitting raw sewage in the true sense of the word. The chemical precipitation left enormous quantities of sludge to be disposed of, which was valueless as manure, being deprived of nearly all its nitrogen. Then the initial cost being the only expense was a very considerable factor for the system, one labourer being sufficient to look after the works. The effluent having no chemicals, solution could be freely discharged into any stream without fear of damage, and the sample to be shown by Dr. Jefferson, M.O.H for Lisburn, taken August, 1897, showed no signs of change or decomposition at that time.

Dr. JEFFERSON (Lisburn) said—Mr. Chairman, I can add very little to what Dr. St. George has said, but shall, with your permission, read a few notes I took when examining the different schemes. In the universal system at Ilkeston there is an Ives Settling Tank, the sludge is pumped out night and morning with a gas engine, and during this operation gives off a most offensive smell. The effluent is very cloudy, and gives off a strong smell of sewage. The International at Hendon has a Candy's Patent Sludge Removal Apparatus. There is an enormous quantity of sludge, viz.—1,300 tons for a population of 14,500. The treatment and disposal of the sewage cost £979 17s. 7d. for years 1896-1897. In the above systems chemicals are used. The solids are screened, raked out every hour, carted away and buried. The Hendon authorities were threatened with an action by the River Conservators for pollution of the river Brent, on account of the reaction that occurred when chemicals are used. The following are, in my opinion, the advantages of the Exeter system, viz.—1, no screening; 2, no chemicals, and consequently no reaction in rivers; 3, no expensive machinery, it is automatic; 4, working expenses very light, a man about an hour two days in the week would be quite sufficient; 5, very little sludge, which would not require removal for several years; 6, effluent very good, no smell whatever, and may be discharged into a river without further treatment of any sort.

Mr. PEDDIE (Belfast) was in favour of the system, and showed that there would be a great saving in both the initial expense and also in the upkeep of this system, as compared with the one that had been promoted for Armagh.

Mr. MUNCE, Assistant City Surveyor, Belfast, said he had from the first formed a good opinion of the septic tank system, and he believed the precipitation idea was dead, because the cost of disposing of the sludge completely barred its adoption in any large town.

Mr. J. Brown said he had listened to the paper with great interest, an interest enhanced by his long acquaintance with the inventor of the Septic Tank System, Mr. Donald Cameron, for whom he had the highest regard. He believed that anything recommended by Mr. Cameron would merit their most careful consideration.

Mr. Martin then acknowledged the vote of thanks, and replied briefly to questions which had been asked during the discussion. He concluded by thanking the Chairman for presiding.

11th January, 1899.

Mr. Thomas Workman, J.P., President, in the Chair.

THE VIAGRAPH, A NEW INSTRUMENT FOR TESTING ROAD SURFACES.

By J. Brown.

(*Abstract.*)

It is almost needless to refer to the importance to all classes of the public highways. or to the necessity of good roads for the purposes of that commerce which is the mainstay of our empire and of our power as a nation, and which depends for its existence on the interchange of commodities. In England the need of good roads has been long recognised. In Ireland there is still much room for improvement. Those who have become acquainted with the highways in both countries, either by cycling or driving over them, tell us there is a vast difference, that the worst road in England, for instance, is better than the best in Ireland, and so on; and they endeavour to convey some idea from their observations of the comparative qualities. Till now, however, no means existed of making an accurate comparison, of telling how much and in what way English or foreign roads were better than ours. It was in the hope of providing such means, and thereby attempting to convince our local authorities of the great need of improvement, that the viagraph has been designed.

The viagraph consists practically of a straight edge applied continuously to to the road surface along which it may be drawn, and conveying an apparatus for (1st) recording on paper a profile of the road-surface, and (2nd) indicating a numerical index of the unevenness of the surface. These taken together give a quite fair estimate of the quality of the road at the part tested.

Fig. 1 gives a general view of the instrument, the frame of which is in form like a sled, with straight runners. On this are mounted the working parts shown in Fig. 2. The lever T, pivoted to the main frame at H, carries on its free end a serrated wheel, the upper part of which is seen at V. While the main frame, in being drawn along the road, preserves a sufficiently even line, the road wheel V rises and falls over all the unevennesses of the surface, carrying with it the lever T, and thereby transmitting its movements by means of the link and lever S to the pencil P, which marks the full amplitude of these motions on the paper passing round the drum A. (In the figure this pencil is raised above its usual position, from the necessity of raising the road-wheel V so as to bring it into view.) While the motion of the pencil takes place in a vertical direction, the paper on which it marks is carried under it by the drum A, which is rotated by a worm and wheel below it connected by a shaft and bevel gear with the road wheel V. The paper is thus drawn from the stock-roll C, passed under the pencil and wound up on the receiving-drum B. The result is a profile of the road surface, of which the scale is *full size vertically, and ⅛in. to 1ft. longitudinally.* A second pencil seen below P draws a datum line corresponding to that which the indicating pencil P would produce from a perfectly even road. From this can be measured the depths of the "ruts" or "cups," or other unevennesses indicated on the diagram. The sum of the depths of all these unevennesses constitutes the numerical index of unevenness, and is indicated on the decimal counter W, which is worked as follows:—A cord attached to the free end of the lever T is passed once round the double-grooved pulley X, and connected to the stretched rubber band at O. When the lever T descends, owing to the fall of the road-wheel V, into a rut or cup in the surface, this cord rotates

Fig. 1

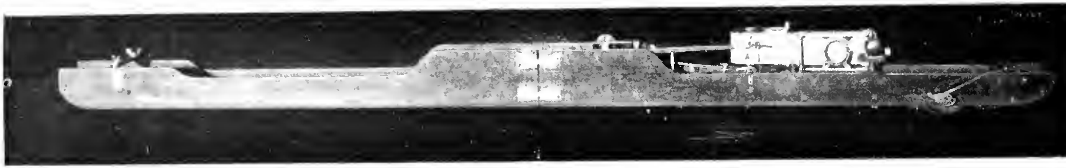


Fig. 2

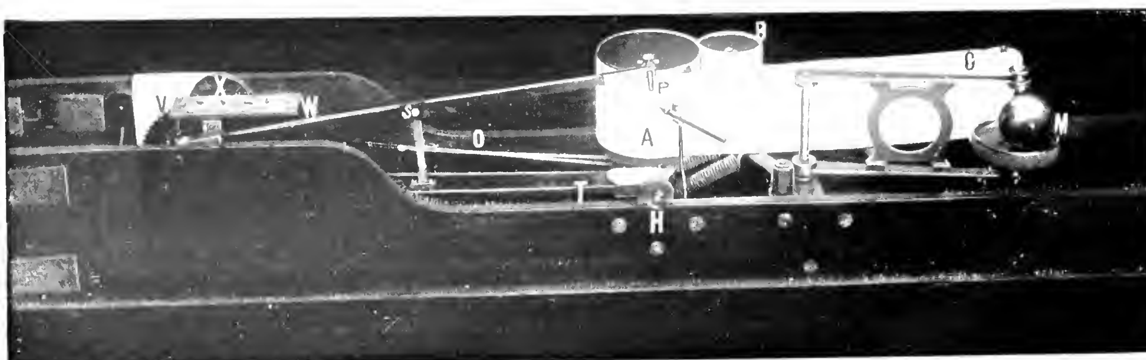
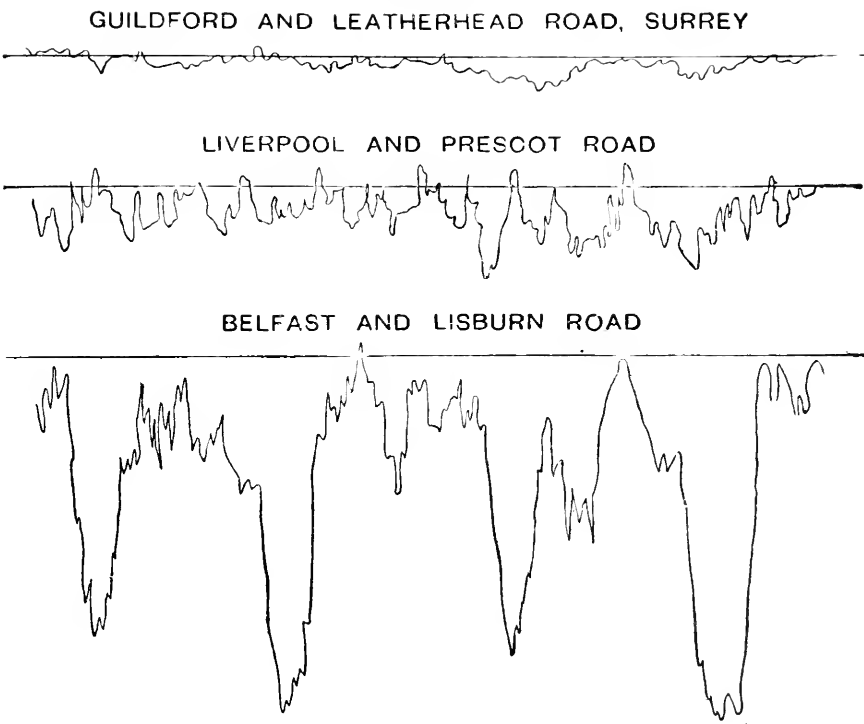


Fig. 3


GUILDFORD AND LEATHERHEAD ROAD, SURREY
LIVERPOOL AND PRESCOT ROAD
BELFAST AND LISBURN ROAD

the pulley X by the amount of the drop, the rubber band O stretching to allow the necessary movement of the cord. When the road-wheel and lever rise again the cord slips back on the pulley, the rubber taking up the slack while the pulley is held fast by a brake, consisting of a quite similar rubber-tightened cord attached to a rigid part of the frame instead of the lever T, and passing round a separate groove on X. The pulley X therefore rotates intermittently, in one direction only, to an amount proportionate to the sum of all the unevennesses passed over, which amount is indicated in inches on the decimal counter, and constitutes the index of unevenness.

In order to compare the index of one road with another, it is obviously necessary that the same length of each be taken as a unit. For this purpose a length of 88 yards, being one-twentieth of a mile, is convenient, and this is measured in inches of paper, run off the roll C, proportionate to the scale arranged. That is to say, when 88 yards of road have been traversed 33in. of paper will have run off the roll. Each 33in. length is measured off by the pulley at M in contact with the stock roll of paper, and at the end of the length it rings the bell above it, thus indicating that the unit length of road has been traversed.

In a newer form of the instrument this alarm-bell has been transferred to the interior of the drum A, thus making it more simple and compact, and the working parts are protected from passing showers by a suitable glass case.

A number of diagrams are on the table, showing profiles of roads in Antrim, Down, Norfolk, Suffolk, Surrey, and Lancashire taken by myself, also of roads near Exeter, for which I am indebted to Mr. Donald Cameron, City Surveyor of that town. Three examples of these profiles are given. Fig. 2. The first is a flint road, once a main coaching route from London to Portsmouth, and still carrying considerable heavy traffic. It was selected by the advice of Mr. Shipton, Secretary Cyclists' Touring Club, as an example of a good bit of a good English country road. The second is chosen for the special reason that in point of amount and weight of traffic it may compare with the one below it, our own awful example of a main road. This last diagram was taken in December near Lambeg, a part of the road which had been thoroughly coated with stone and steam-rolled in the previous August, The Prescot road had also been repaired just about four or five months before this test was taken last May, so that the comparison as regards lapse of time since each was repaired is fair.

The diagram of the Prescot road is an average specimen, and was not taken from the best part of this road. Further comment on the comparison between these roads is almost superfluous, but it may be noted that, while the greatest depth of ruts generally found on these English roads is usually a fraction of an inch, those on the Lisburn and other Irish main roads quite commonly exceed 1 inch in depth, and can easily be found over 2 inches, as in the diagram above.

The index of unevenness, as measured in the manner described above for each of the three roads, of which diagrams are here given, is as follows :—For the Gilford road the sum of the depths of ruts is 12 to 14 feet per mile ; for the Prescott road, 42 feet per mile (an average of all the indications taken) ; for the Lisburn road in the part here taken, 134 feet per mile.

Besides the discomfort of travelling and the extra wear and tear on vehicles entailed by such roads as this last, there is another objection distinctly brought out by the viagraph. In considering the passage over a rough road of a carriage wheel we may probably assume that there is no impetus gained in dropping into a rut which is available as a help to rise out of it at the other side. We may therefore conclude that the power necessary to raise the wheel out of each and every rut must be supplied from the horse or other tractive force. We may accordingly take the sum of unevenness as representing in effect an artificial hill interposed by the badness of the road. On our Lisburn road, for instance, taking the average sum of unevenness as 100 feet per mile, we have an artificial hill of that amount in each mile ; consequently any vehicle making a 30 mile journey on such a road has in effect to climb a hill (over and above any recognised hills on the road), which is greater in height than Slieve Donard, and is made up of ruts alone. A simple calculation shows that if we consider a vehicle weighing with its load one ton, and travelling at 7 miles per hour, the extra power required to take it over these ruts is just over $\frac{3}{4}$ horse power; or, if we take as an example of heavy traffic a weight of 35 cwt., at $3\frac{1}{2}$ miles per hour, the extra power required is just under $\frac{3}{4}$ horse-power. The same calculation, applied to the Liverpool and Prescot road gives about $\frac{1}{4}$ horse-power in each case. A comparison therefore shows that the ruts on the Lisburn road entail either the use of about half as many more horses than are really needed on a good road, or a loss to an equivalent amount in speed or in weight carried.

The instrument here shown, was constructed to my design, by Mr. Alexander Gass, of College Street South, and is a very creditable example of finely-executed work. The name of the workman chiefly employed on it, Alexander Cook, ought also to be mentioned as having taken great pains in carrying out the details.

The records of the instrument would be of use to those criticising the state of the roads in any district, also to surveyors wishing to test various methods of road maintenance or to convince their county authorities of the need of improvement or of the advantages already obtained by a given treatment. They would also be valuable to cyclists and others desirous of knowing the condition of the roads in any distant district in which they proposed to travel.

Having shown that our Irish roads compare so unfavourably with those across the Channel, it may be asked why, and how can they be improved. Not being an expert in road management, I feel diffident about saying much on this question. I would point out, however, that Macadam, the father of the modern English road, insisted chiefly on three points—first, thorough drying of the road-bed by underground drains or other means; second, no stone in the road to exceed 6oz. in weight, or, as he sometimes put it, "any stone you can put in your mouth may go on the road;" third, cleanness of the metal. Now, none of these points appear to be sufficiently recognised here, while they appear to be still accepted in England, except of course that Telford's system of paving the bottom with large stones first may be used instead of the macadam metalling only. In our neighbourhood the modern practice seems to omit all subsoil drainage; consequently all the evils of wet roads are multiplied, though in our climate drainage would seem doubly necessary. The grade of road metal used here would seem to be excessively large. Samples of stones from English roads are on the table, which weigh between 1oz. and 2oz., and measure 1¾in greatest diameter. While English engineers with whom I have spoken seem to be in doubt whether 2in. or 2½in. metal was best, on the Lisburn road the stones (specimens of which are shown) seem to average 3¼in., and weigh 10oz. to 15oz., even 4in. to 5in. being not uncommon. A piece of road metal from the Malone Road, some distance within the city boundary, is on the table, measuring 5½in. long and weighing 1lb. 6oz. In County Down, however, a more reasonable grade of metal is now observable, and it will be generally admitted that the roads in that county are at least somewhat smoother than those in County Antrim This is apparent in the diagrams from the Belfast and Saintfield Road exhibited. No excuse for bad roads in the North of Ireland could be offered on account of the inferiority of the material available. Basalt and granite are both excellent if selected of a tough and wear-resisting quality —a matter perhaps not always attended to. Basalt metalling can be delivered in the neighbourhood of Belfast for little more than 3s per ton, whereas in Cambridge, for example, the granite metalling is said to cost 25s per ton, and in Lancashire the broken syenite used on the Prescot Road costs 10s to 12s per ton. Referring to the recognised smoothness of the flint roads in England, such as that shown above, I hope that some of the road engineers, if present, will say why a similar smooth and good road for moderate traffic has not been made here from the abundance of flint now thrown aside as a waste product in our limestone quarries.

As to cleanness of metal, it would appear from the description of the practice on the Prescot Road, given by its Surveyor (Mr. Goldsworth), and also from a very well-considered opinion kindly given by the Surveyor of County Down, that a little road scrapings judiciously applied after the first rolling may be requisite. Too much mud, Mr. Cowan remarks, is a real fault. If, however, the local authorities do not consider that the above are the causes of the defects, or if they doubt the applicability of the English methods to this country, might I suggest that these be at least tried. Let an experiment on the most approved lines be earnestly and faithfully carried out, say, upon 100 yards of the Lisburn, the Malone, or any other of our wretched leading thoroughfares. Once it was understood what a road might be, we should never permit the present state of things to occur again.

The PRESIDENT said he was sure they were all pleased highly with Mr. Brown's exceedingly interesting lecture. It was remarkably lucid and clear, and they owed a great deal to Mr. Brown for the way in which he had brought the subject before us.

Professor DOUGAN said he had been much impressed with the ingenuity and usefulness of Mr. Brown's invention. The viagraph gave a very convincing test for any road which anyone might wish to examine, and it came at a very opportune moment and should be forced upon the attention of everyone responsible for the care of our roads. Cyclists took a great interest in the condition of the roads. It might be supposed by non-cyclists, who were still a considerable body, that the cyclist is fastidious ; his tendency to go to the footpath might blind non-cyclists as to his real character. When the history of cycling comes to be written it will be seen that the cyclist is not fastidious, and that the qualities which will be forced upon the historian of that movement would be the patience and moderation of the cyclist.

The condition of the road, however, was not peculiarly a matter for the cyclist only, it was a subject which engaged the attention of every section of the community. The roads of the country were a distinct portion of the national wealth, and, moreover, they were not an unproductive portion, and it was obvious that the more efficient the roads were, the more valuable they were. They might be sure that visitors to these parts, whether British or foreign, when endeavouring to form an opinion as to the stage in civilisation to which the people in these districts had attained, would take the quality of the roads into account. It would be an element in forming their opinion. Good roads were cheaper to the taxpayer than bad roads in the long run, and not in the very long run either. The surface of the roads around Belfast turned to dust in dry, and mud in wet weather, at a far too rapid rate. He believed this was due to want of drainage, and if that were so it would pay the taxpayer to have the roads drained as a fresh start. The work done by the steam roller did not seem to be as effective as it ought to be. Many of the roads are dotted with pools of water. The road from Belfast to Holywood is a county road, and it is in this state, though only six weeks ago the steam-roller passed over it. He thought the new County Councils should borrow a sufficient sum of money, to put the roads into perfect order, draining them, and giving them a proper convexity of surface. That amount the taxpayer would not have to pay all at once, it would be spread over a few years.

Mr. JOHN HORNER felt that Mr. Brown had entered upon a field of real philanthropy and was bringing before them a true Irish grievance. Their English friends did not suffer in the same way as the people of Ireland. The apparatus which Mr. Brown had produced was undoubtedly one of very great ingenuity and it opened up a field for investigation as to their roads in a way which was probably never done before. He could not help remarking on the enormous "ruts" or indeed chasms which appeared on the Lisburn road, but if Mr. Brown were to take his apparatus to the Antrim road it might be almost swamped in some of the "ruts" there. They should give Mr. Brown their heartiest thanks for his excellent lecture.

Mr. William Armstrong, speaking as a cyclist, believed the viagraph would be most valuable in the future. The whole success of tramway traction was entirely owing to the fact that the cars had a beautiful level surface to go upon. Cyclists were an increasing community and had a right to be considered. In Ireland the roads were tremendously behind what they were in England and on the Continent, and it would take a considerable time to bring the Irish roads up to what they should be. He believed that expenditure upon the proper maintenance of roads was bound to be remunerative. A scientific appliance like the viagraph would soon speak for itself. He hoped it would be extensively adopted.

Mr. Stewart C. Kelly thought the County Antrim roads had been a glaring eye-sore to a great number of people for a length of time past, and they seemed to be getting worse instead of better. It used to be said they were better than the County Down roads, but now it was the reverse. That he believed was owing to the amount of scientific knowledge brought to bear upon the roads in Down by Mr. Cowan, County Surveyor. (The speaker here produced stones of large size which he had picked up on some of the County Antrim roads—the Crumlin, Antrim, and Lisburn Roads). It was largely owing to the size of the metal used that the roads were getting into such bad form. The County Down roads had immensely improved during the last few years, and that was to be attributed to the class of metal Mr. Cowan had been using. In Antrim an inferior class of metal was used in the city as well as in the county.

Mr. P. C. Cowan, M. Inst., C.E., Chief Engineering Inspector to the Local Government Board, Ireland (lately County Surveyor of Down), said the viagraph must be of great

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use in settling the constantly occurring disputes with contractors for road maintenance. Mr. Brown showed the usual Irish modesty in attributing the indifferent quality of Irish roads to want of knowledge, but the real want was money. Too little was allowed for supervision in Ireland, for example, in County Down, about £60,000 per annum was spent on roads, bridges, &c., and only about £1,500 on the surveyor's staff, including all travelling expenses. The deficiencies in the County Down roads were serious on account of very imperfect construction and long periods of insufficient maintenance, and he did not see how the roads could be made much better without a very large expenditure of money. He had lately reported to the Grand Jury of County Down that to put the 2,500 miles of roads in the county into really good order, to a not unreasonable standard, would require an immediate outlay of about £3,000,000, which, even if the money were borrowed on the most favourable terms, would raise the county rate to four times its present figure for a generation. However, such a sweeping policy was not necessary, and the fact was that most of the County Down farmers did not seem to want much better roads, and considered any improvement, especially at increased cost, unnecessary. Times had not been prosperous with the farmers for many years, and he thought unless some of the millions said to be due by England to Ireland could be obtained for the expenditure on Irish roads, only a very slow rate of improvement was possible. However, a liking for good roads was apparently spreading in Ireland, and now that the burden of road maintenance was partly taken off the landholders by the new Local Government Act, more money might be granted for road maintenance. The only way in which Irish roads might be improved without a greater expenditure would be by the use of wider tyres on cart wheels, and by regular cutting down of high hedges. At present the narrow farm cart wheels cut the weak roads like knives, and it is most difficult to induce the farmers to keep their hedges low.

Dr. Cecil Shaw spoke of the importance of the road question in connection with tourist development. He believed that last summer a great many more tourists came to Ireland than ever came before. A great many of them were cyclists and they were somewhat disgusted with the condition of the roads. Some declared they would never come back, the roads were in such a bad state. The Irish roads should be improved so as to induce the cyclist to come to the country.

Professor FITZGERALD said Mr. Cowan had spoken of a good many of the things to which he had intended to refer. concerning the condition of our roads, far better than he could have done. Mr. Cowan mentioned the very heavy expense that would be required to bring the roads into anything like decent condition, and it was sufficient to look at Mr. Brown's diagrams to see how much would have to be done. Those diagrams were far more eloquent than any words descriptive of the state of the roads. Mr. Cowan had mentioned £3,000,000 as the cost of putting the County Down roads in good condition throughout. He (Professor FitzGerald) believed that the value to the county of good roads was so great that that sum of money, if it were obtainable, would be well spent for the purpose. The City of Belfast was certainly much to blame for permitting stones of the size produced to be used; he had often seen similar stones on the roads and wondered how they had got there. He thought Mr. Brown's machine most ingenious and suggested that Mr. Brown should show, after the lecture, how the machine could be folded up into a reasonable compass. Twelve feet was, no doubt, an inconvenient length for carriage, but Mr. Brown had so contrived that the machine would fold up into half that length.

The PRESIDENT, while joining in the expressions of thanks to Mr. Brown for this most interesting paper describing his very ingenious appliance, said that in reference to the question of road surfaces in Belfast, he thought they should not use square setts so extensively. In some thoroughfares the noise was so great that at times nothing else could be heard.

Mr. BROWN, in replying, said he agreed very cordially with the remarks of Professor Dougan, and desired to thank him, as also Mr. Horner, Mr. Armstrong, Mr. Cowan, and Professor FitzGerald, for the approval they had expressed of the subject of the paper. He was pleased to hear Mr. Kelly confirming his views regarding road metal, and he felt sure they were all greatly indebted to Mr. Cowan for his very full and clear reference to the road question generally. Mr. Cowan was, no doubt, quite right in advising more effective supervision. Since, in the paper, a rather pointed comparison had been made between the Lisburn Road and the Prescot Road showing that while alike in size, importance, amount of traffic, and subsoil, they were very different in quality of surface, attention should be drawn to another point of difference—viz., cost of repairs. It was stated on the best authority that the Lisburn Road (buying its metal at, say 4s per ton) cost £220 per mile per annum, while the Prescot Road (with metal at 10s to 12s per ton) costs £100 only. Truly a bad road was dearer than a good one. It might be suggested that the difference in these items, if capitalized, would put the Lisburn Road in a good condition to start with. In reference to the difference in width of Irish cart wheel tyres as compared with English, it should be pointed out that the loads commonly carted here are much less than in England. The load per inch width of tyre was therefore perhaps not very different. While agreeing with the President as to the discomfort of the noise from our square setts, Mr. Brown thought one must admit that the smallness of the tractive force required on square setts is very advantageous. He observed this markedly when driving a motor car over them.

7th February, 1899.

THE LORD MAYOR (MR. OTTO JAFFE, J.P.) in the Chair.

THE BOYNE VALLEY: ITS HISTORY, SCENERY AND ANTIQUITIES.

BY S. F. MILLIGAN, M.R.I.A.

(*Abstract.*)

In Ireland the Boyne Valley was the first inhabited territory, as well as the seat of central sovereignty for a period of two thousand years. It has within its borders the richest and most fertile soil; its lands have always been eagerly sought after and fought for by every race that landed on our shores. From its source in County Kildare to Drogheda, where it empties into the Irish Sea, it has a course of seventy miles. It flows through a level country, beautifully wooded. Its banks are adorned with memorials of every age—Pagan, Early Christian, Anglo-Norman, Elizabethan, and modern. It may be necessary here to mention that the kingdom of Meath was formed in the first century of the Christian Era by the King of Ireland, Tuathal Teachtmar, who took from each of the existing four provinces a portion of territory which, put together, formed Meath. The newly-formed kingdom henceforth was to belong to the Ard Righ, or Head King, as his special patrimony. Tuathal Teachtmar, after a long and prosperous reign, fell in a battle in County Antrim, and his grave is still pointed out (a Kistvaen), the King of Ireland's grave on a hill side lying between the village of Ballynure and Ballyeaston in this county. Meath comprised the greater part of the English Pale; was the seat of Anglo-

Norman power, as it had previously been of Irish. This unique and lovely vale, so dear to students of Irish history and archæology, is now most accessible from evey part of the British Isles. Travellers from Belfast or the North proceed to Drogheda, from whence, in the summer months, there are public conveyances provided by the Great Northern Railway Company. The distance from Drogheda to Navan is seventeen miles, Slane being about midway, and a convenient resting place; Navan to Trim is twelve miles, and from thence to Clonard fourteen miles, which covers all the points of greatest interest. The River Blackwater, the ancient Sele, joins the Boyne at Navan, and in its course of twenty miles from Lough Ramor, in County Cavan, passes several places of great historic interest. In sylvan beauty, rare monuments of past ages, and historic interest, the valleys of the Boyne and Blackwater stand in the foremost rank of Irish river valleys. Scattered along the Valley of the Boyne are relics of every age, from the Belgae or Firbolgs, 1,000 B.C., down to the present century—a period of about 3,000 years. These consist of cairns, cromleachs, chambered pyramids, pillar stones, kistvæns, souterraines, raths, duns, lisses, and all classes of earthen forts. Of the early Christian period, Celtic churches and hermitages, dating from almost the time of Saint Patrick; round towers, sculptured crosses, and moasteries; Anglo-Norman castles in great numbers, dating from the end of the twelfth century, and other relics of early Norman power. The Boyne rises at Trinity Well, close by the village of Carbury, in County Kildare, four miles from the town of Edenderry. It flows through King's County for a few miles, next becomes the boundary between Meath and Kildare, then enters Meath, through which it flows until it empties into the sea four miles east of Drogheda, as already stated, a total distance of seventy miles. It receives several rivers in its course, the principal one being the Blackwater, already mentioned. Many remarkable events have occurred in the Boyne Valley, not the least of which was the arrival of St. Patrick to preach the Gospel to the King and nobles and others at the Royal residence of Tara, for he rightly judged if he converted the chiefs the people would certainly follow. He came up the Boyne in a coracle similar, I have no doubt, to those still peculiar to that river. When he reached Slane, being Easter Eve, he ascended the hill which is the highest ground in Meath, and lighted his fire, which was distinctly visible from Tara. The ruins of a monastery now stand on that hill, and from the top of the church tower a view may be obtained from the yellow steeple in Trim to the maiden tower at Drogheda, a view of fully five-and-twenty miles as the crow flies. Every spot in this extended view is historic ground, trodden for centuries by kings, and lords, and saintly men, as well as by all the race of invaders already mentioned. In the early ages of our era, Con, the hundred fighter, and his grandson, Cormac, the son of Art, that chivalrous and wise king and law-giver, the greatest who reigned at Tara up to his time, and to whom we shall again refer ; Nial, also of the hostages, the conqueror of Alba and of Britain, trod this soil, and was finally assassinated in Gaul, whilst invading that country. In reviewing this remote age, there arises before our mental vision Leary, son of Niall, Ard Righ, or High King, when Patrick came, and, though his chief druid and principal nobles embraced the new faith, Leary, like a stout Pagan which he was, died as he had lived, and was buried in the rampart of his own fort on Tara Hill, in a standing posture, with his great war spear in his hand and his face towards Leinster, the territory of his hereditary enemies. A few centuries later bands of Northern foreigners might be seen pillaging this same district. The Annals relate that the caves of Knowth, Dowth, and New Grange were pillaged by Amlaff, Imar, and Ansilie, three of the leaders of the Danes of Dublin. We can contemplate another and a more peaceful scene, one hundred years after King Leary had been interred. Up the Valley of the Boyne, at Clonard, in the year 520, St. Finnan established a school for the youth of Erin, which became the most celebrated seat of learning in the island. He had for pupils men such as St. Columba, St.

Kieran, of Clonmacnois, and St. Brendan, of Clonfert. Columba, after founding innumerable churches and monasteries, became the apostle of the Northern Picts ; St. Brendan, it is believed, preached the Gospel as far as Iceland, and St. Kieran founded the famous school of Clonmacnois in the centre of the island, near Athlone. From this period and several centuries later Ireland was known as the Island of Saints. So famous was the great school of Clonard, and so celebrated for its learning, that pupils flocked to it from Britain, Alba, Gaul, and Germany, until their numbers, it is said, reached 3,000. The village of Clonard, the site of this ancient seat of learning, is the first historic place of importance coming down the river from its source. A Round Tower formerly stood here, but it is recorded in the Annals that in the year 1039 the steeple of Clonard fell. A great loss, not alone to Clonard, but to the entire country, was the destruction by fire in 1143 of the library of the monastery, in which a great number of manuscripts were consumed. Clonard passed through many vicissitudes of fortune. Dermot MacMorrough and his English allies plundered it in the year 1170. When the Anglo-Normans took possession they superseded the Irish monks by countrymen of their own. Simon de Rochford assumed the title of Bishop of Meath, and removed the Episcopal chair from Clonard to Newton, near Trim, where he founded the great Augustinian abbey dedicated to St. Peter and St. Paul, the ruins of which form a notable picture there to the present day. The great monasteries of this period were so constructed that they could be used for purposes of defence, and were loopholed for bowmen. The Abbey of St. Peter and St. Paul, at Newton, is remarkable in this respect. Ath Truim (Ford of the Alder Trees), now called Trim, is the next great historical place down the river from Clonard. It is one of the most interesting towns in Ireland for the antiquarian, containing ruins of several monasteries and castles. The view approaching by the Dublin road, seen under favourable circumstances, will never be forgotten. This view includes all the ruins of Newtown and

Trim, with the Boyne flowing beneath them; the Priory of Saint John, the old bridge and its protecting tower, and the great Abbey of Peter and Paul are in the foreground. In the distance rises up King John's Castle, a splendid ruin; next the Yellow Steeple, rising to a height of 125 feet, close by which is one of the ancient gates of Trim, known as the Sheep Gate, whilst still further off stands the square and massive tower of the Parish Church, built by Richard Duke of York, father of Edward the Fourth, in the year 1449. In Anglo-Norman Trim there was the Grey Friary of Observantines and the Black Friary of the Dominicans, the latter founded by Geoffry de Joinville, Lord of Meath, in A.D. 1263. There was also Saint Mary's Abbey, of which the Yellow Steeple is the only surviving relic. It is stated that Oliver Cromwell battered down this abbey in consequence of a number of men holding it against him. Henry the Second granted the entire Kingdom of Meath to Hugh de Lacy for the service of fifty knights, and he fixed on Trim as his residence, and built King John's Castle. It covers an area of two acres or more on the sloping bank of the Boyne. The river flows on one side, and on the other has a broad and deep fosse, filled with water from the river, which isolated it completely, and rendered it almost impregnable before the invention of artillery. King John lodged in Trim in July, 1210; Parliaments were held in it, and there was a mint for coining money; in fact it was the capital in the early Anglo-Norman period. Henry the Fith, the hero of Agincourt, was left here when a youth, confined in one of the towers of the castle, by Richard the Second. The Duke of Wellington received his early education in Trim in a schoolhouse still occupied, and he represented it when he was twenty-one years of age in the Irish Parliament. A monument stands in the town, erected to the Iron Duke, as the hero of Waterloo. About six miles further down the river from Trim are the ruins of Bective Abbey, situated on the northern bank of the Boyne. It was founded in 1146 by O'Melaghlin, King of Meath, for monks of the Cistercian Order. It was richly endowed, the demesne consisting of 245 acres, with a mill and fishing weir on the river. The Abbott of Bective sat as a Lord of Parliament, and it was the only house of the Order in Meath. Bective Abbey being built before the arrival of the Anglo Normans, possesses more interest for Irish archæologists. The cloisters are very fine and fairly well preserved. The great tower above the porch is quite perfect, and was evidently intended for defensive warfare, in fact, for the Church militant, as its battlements and loopholes testify. We now reach Navan, where the Blackwater forms a junction with the Boyne. The ancient moat is the principal object of interest to the antiquarian at Navan. Tara can be readily reached, either from Bective or Navan ; the distance from the former is about five miles and the latter six to the ancient seat of the kings of Ireland. The drive lies through a beautiful and well-wooded country, with some very pretty views of the river. The Hill of Tara was the seat of Irish sovereignty for ages ; it was there the laws were promulgated and there the great assemblies of the nobles and people were held. The hill, which is about 550 feet high, has a commanding view, extending over several counties. It has always been kept in grass, and the outlines of the ancient raths and forts have been well preserved ; also the earthworks which outlive the great banqueting hall celebrated in poems and story called Miodh-Chuarta, or the middle house of the Palace of Tara. The buildings were constructed of timber and protected by earth works ; the former have perished years ago, whilst the latter have remained to the present day. Standing on a mound in one of the raths is the Lia Fail, or stone of destiny, on which it is recorded the kings of Ireland were inaugurated. The glory of Tara was brought to an untimely end. The annals of Clonmacnois relate that in the year 563 the hill was deserted in consequence of a curse pronounced against King Dermot by Saint Ruadhan, because of the king's determination to punish Hugh Guarry, his relative, for killing one of the king's officers. Having examined the raths and forts of Tara, as well as the very ancient church on the hill, we may return to Navan ; and before proceeding to Drogheda a visit should be made to Kells and the valley of the Blackwater, where there are some most interesting places well worthy of a visit. The ruins of Saint Kieran's Church and the Holy Well, situated under a wide-spreading ash tree, and the Termon Crosses should all be seen ; they are situated three miles from Kells. One of the most celebrated places in the ancient ecclesiastical history of Ireland is Kells. Amongst the antiquities still remaining is a round tower and a beautifully sculptured cross close by it, a handsome shaft of another cross in the churchyard, and the great Cross of Kells standing in the Market Square. In addition to these, there is the ancient house or church of Saint Columba, stone roofed, having stood the battle and the breeze for more than one thousand years. The Book of Kells was kept in the monastery here for ages, and, as everyone knows, is the most valued treasure in the great library of Trinity College, Dublin. Kells was burned and sacked many times by Danes and Normans, as well as by Edward Bruce in the year 1315, and it is wonderful that so many remains of such extreme antiquity should have survived. Telltown, the ancient Tailtean which, next to Tara, was one of the greatest Royal residences in ancient times, is situated midway between Kells and Navan on the banks of the Blackwater. There still may be seen the remains of three great raths close by the river. Here the great National Assembly or Aenach was held once a year, commencing on the first day of August and lasting for a week. Games and athletic contests somewhat similar to the Olympian games were held here. It was established by King Lugh Lamhfhada about 600 years B.C. in memory of his foster mother, and continued till the 12th century A.D. ; the last fair being held in the reign of Roderic O'Connor last Ard Righ of Ireland. Proceeding from Navan towards Drogheda, the Boyne is much increased in volume by the junctions of the Blackwater. The beauties of the river and the most lovely scenery is situated between Navan and Slane. A canal has been made from Navan to Drogheda, and the tow-path of the canal is a very convenient way from which to view the beauties of the river. About $1\frac{1}{2}$ miles from Navan stands the round tower and ancient church of Donaghmore ; a little further down the river we see the Castle of Dunmoe on our left and the ancient church of Ardmulchan on our right. We next reach Slane, to which we have already referred in connection with the coming of Saint Patrick. The river is very beautiful between Beauparc and Slane, and the hill on which it stands commands the most extended view in the county. Close by the monastery on the top of the hill is a great tumulus or mound, probably the burial-place of King Slanius, after whom the town was probably named. The burial-place of King Cormac Mac Art, who died in 266, and was buried at Rossnaree, is about two miles from Slane, further down the river. The burial mound is within a stone's throw of the Boyne. On the opposite side, on a hill, is the great tumultus of Knowth. King Cormac's burial has been made famous by Sir Samuel Ferguson in his splendid poem, and the exact place of interment has been handed down for over 1,600 years, and never lost sight of by his countrymen. The lecturer next described the three great sepulchral pyramids of Knowth, Dowth, and Newgrange, the most ancient and most remarkable monuments in Western Europe. The lecturer next referred to the Abbey of Mellifont, founded in 1142 by O'Carroll, Prince of Oriel, at the suggestion of St. Malachy, Primate of Ireland, for monks of the Cistercian Order. The monks were brought from Clairvaux, and were principally French. It was here the faithless Dearvorgail, wife of O'Rorke of Breffney, who had eloped with M'Murrough, ended her days in penitence. It was here also, towards the close of the sixteenth century, that Hugh O'Neill, Earl of Tyrone, submitted to Mountjoy, in the House of Garrett Moore, ancestor to to the Marquis of Drogheda. Monasterboice Round Tower and sculptured crosses were next referred to. There was an Irish monastery founded here in the year 522. The only ruins of this ancient foundation now remaining are the round tower and sculptured crosses, the monastic buildings and ancient church having disappeared. The next and last place of interest on the river is the very ancient town of Drogheda, which would be an ample text for an entire lecture. The great tumulus now called Millmount is similar in type to those already referred to, and is probably chambered in the interior. From the time of Saint Patrick in 432 to 1649, when it was stormed by Cromwell, and in 1690, when it was occupied by James II., its history can be traced all through the ages. Turgesius, the Danish king, occupied and fortified it early in the 9th century, and King John visited it in year 1210 and gave it a charter. Parliaments were held in Drogheda, and the law known as Poynings Law was passed there. King Richard II. received the Irish chiefs in St. Mary's Abbey when they came to make their submission. The learned primate, James Ussher, lived in Drogheda near to St. Lawrence's gate. He it was who secured the Book of Kells for the library of Trinity College. Phelim Roe O'Neill in 1641 besieged Drogheda, when it was successfully defended by Sir Henry Tichbourn. Few towns in Ireland can boast of so many famous men having visited it. St. Patrick first, next Tingesius, the Danish King, King John, Hugh De Lacy, Richard II. and the northern princes who came to pay their respects to him, Red Hugh O'Donnell, and the great Earl of Tyrone, Phelm Roe O'Neill, Oliver Cromwell, James II., and William III. St. Lawrence's gate still stands in a good state of preservation, as well as some portions of the ancient walls. The Magdalene steeple is the only remains of the Dominican Monastery of Saint Mary Magdalene. In the cemetery attached to the Parish Church of St. Peter's there are many curious tombstones. Of modern buildings there are two extremely fine Roman Catholic Churches just completed ; also the great railway viaduct, the finest in Ireland. At the Inver or mouth of the river stands the Maiden Tower, a Pharos or lighthouse, erected in the time of Queen Elizabeth. This brings us to the end of the river and the end of our subject also. We have now surveyed the Boyne from its source to the sea at Drogheda, attempted to picture and describe some of its antiquities and scenery, and I must confess that I do not know any portion of Ireland that offers such attractions to the student of Irish history, the archæologist, the lover of the beauties of nature, as well as the huntsman and the angler, as this lovely Irish valley along the banks of the Boyne.

One hundred specially prepared lantern slides were shown of the Boyne Valley, illustrating the scenery and antiquities.

Mr. Walter H. Wilson proposed a vote of thanks to Mr. Milligan for his instructive lecture. Personally, he thought no prettier bit of river scenery could be wished for than that from Navan to Slane. There was no doubt that Irish scenery was not properly known; and if the result of the lecture, which Mr. Milligan had delivered that night, was to encourage people to visit that historic district, it would be a God-send to that sadly-neglected part of the country.

The resolution was seconded by Mr. William Gray, and was passed with acclamation.

The Lord Mayor, in conveying the vote, said that not only as citizens, but as Irishmen—in which he took the liberty of including himself—they felt obliged to Mr. Milligan for his instructive and interesting lecture. He was pleased to hear Mr. Milligan refer to technical instruction as having been in force in Ireland at an early date. In the Queen's speech that day reference was made to the Agriculture and Industries Bill for Ireland, and he hoped that when that Bill was passed Ireland would prosper more and more, and he further hoped that Belfast would get a liberal slice of whatever grant Parliament would give to Ireland.

Mr. Milligan suitably replied.

Professor Redfern proposed a vote of thanks to the Lord Mayor for presiding.

Professor Fitzgerald seconded the motion, which was enthusiastically passed.

The LORD MAYOR, in acknowledging the compliment, said it gave him great pleasure to be present there that night, and he could assure them that he would not spare himself in attending as far as he could to the many duties devolving upon him as Lord Mayor, of which position he was proud.

14th March, 1899.

Mr. Thomas Workman, J.P., President, in the Chair.

PATHOGENIC BACTERIA WITH SPECIAL REFERENCE TO THE TYPHOID BACILLUS.

By J. Lorrain Smith, M.A., M.D.

(*Abstract.*)

The natural processes for which bacteria are responsible are very numerous, but a rough classification of these may be made by dividing them into three groups—viz., fermentation, putrefaction, and the production of disease.

In regard to fermentation, suggestive conclusions were established in the first instance, showing that the ferment producer is a living organism which has in suitable conditions the power of indefinite self-multiplication, and that in unsuitable conditions it dies out and cannot be revived except by the introduction anew of living organisms of the same kind. Subsequent study revealed many characters whereby the different organisms could be recognised, and also the conditions, which were most favourable to their activity. The same methods of study applied to disease have shown that many acute infectious fevers and allied conditions are due to microbes, and it is to this branch of the science of bacteriology that I wish now to refer.

A short introduction in regard to general principles will be of service.

We have, in the first place, to devise means for giving to the microbes we wish to cultivate the most suitable conditions for their growth, and for this purpose various ingenious methods have been adopted. The food which the microbe requires is obtained by preparing a fluid or solid substance in which are present the same constituents as exist in the fluids in which the microbe naturally dwells. We have, accordingly, various extracts of meat in common use as the so-called media. The extract is, in the first place, in the form of a clear fluid broth, and this may be solidified without losing its clearness by gelatine and other substances.

If we take such a substance and inject it under the skin of an animal in a moderate dose, it has no harmful effect. If, however, we allow a pathogenic or disease-causing microbe to grow in it for some time before we make the inoculation, we find that the harmless broth has become more or less poisonous. The poisonous effect varies with the form of the microbe, and this difference corresponds with the difference in the diseases with which the microbe is associated. We can therefore produce disease in two ways. Either we can inject the microbe which multiplies in the tissues of the body, and so causes the disease, or we can obtain the poison outside the body by growing the microbe and cause the disease, or a condition closely akin to it, by injecting the poison. The microbe flourishing in the tissues of the body produces disease, because it manufactures poisons as it grows, and from the action of these poisons the effects arise. It is of the utmost importance, therefore, for the understanding of the nature of disease to understand the nature of the poisons which are produced in this way, and to ascertain their effects on the animal body. The study of these poisons or toxines, as they are often called, has given great definiteness to the study of infectious disease.

One aspect of disease in particular, to the explanation of which this study has made important contributions, is that form of resistance to attack which is known as immunity. A man is said to be immune to a disease when he, after exposure to infection, fails to contract the disease. When this power of resistance is an original attribute of the man it is called natural immunity. If, however, by some artificial process, this power has been contributed to the man, he is then said to have acquired immunity.

In the study of the action of bacterial poisons it was found that, when a dose is injected insufficient to cause death, and yet such as to lead to more or less disturbance of the bodily functions, there results finally an immunity to the disease on the part of the animal so inoculated. In such investigations the method is to inject a small dose in the first instance and to increase the dose subsequently until a dose is reached which, without the preliminary inoculations, would certainly have been fatal. The nature of the change which this series of inoculations induces so as to establish the state of immunity is very imperfectly understood. One result, however, of great practical importance is, that the serum of the blood is charged with immunising power, and that this power can be conveyed to a second animal by injecting into that animal some of the serum of the first. This is the principle on which the modern treatment of diphtheria is based. A horse is made immune to the poison of the diphtheria bacillus, and when this is successfully carried out the immunity which the horse acquires enables it to resist the effects of enormous doses of diphtheria poison. The serum of its blood is then obtained and prepared for injection into the tissues of children who have been attacked by the disease. The child in this way gets at once the advantage of the tedious process of acquiring the immunity to which the horse has been submitted. Such a serum is called an antitoxic serum.

In regard to the bacteriology of Typhoid Fever one or two general points of interest may be noted. The avenue of infection by which the microbe reaches the body is the alimentary canal. Here also occur some of the structural changes which characterise the disease. The bacillus is discovered in the tissues of various abdominal organs—viz., the lymph glands, the spleen, and the liver.

The bacillus has no very clear character by which it can be at once distinguished from all other bacilli. It is very closely allied to the other groups of bacilli, and from these it is a matter of no small difficulty to distinguish it. The obscurity which naturally results from this circumstance is increased by the fact that it has been found impossible to produce the disease in animals. It is possible to inoculate animals and to find that they die, but such cases do not show the characters of the disease as it occurs in the human subject.

Such difficulties, however, do not gainsay the evidence which we otherwise possess of the connection of the typhoid bacillus with the disease. Since the place of the disease is in the intestine, the rule which is observed in public health is to regard any contamination of food or water used for drinking, with intestinal excreta as a possible source of typhoid infection.

The lecture was illustrated by actual specimens and by lantern views. Mr. Mayne manipulated the lantern, and the slides, which were referred to by the Lecturer as in every way suitable for his purpose and generally approved of, were specially prepared by Mr. J. J. Andrew.

Professor REDFERN moved, and Dr. SHELDON seconded, a hearty vote of thanks to Professor Smith for his very instructive lecture.

The CHAIRMAN, in putting the motion to the meeting, said they owed a great deal to such men as Dr. Smith, who put forth such praiseworthy efforts in order to alleviate suffering.

The motion was warmly passed.

Subsequently an interesting exhibition of bacteria under the microscope took place in the Library of the Museum.

April 11th, 1899.

Mr. T. Workman, J.P., President, in the Chair.

ELECTRIC DISCHARGES IN RAREFIED GASES, WITH EXPERIMENTS AND LANTERN SLIDES.

By J. Finnegan, B.A., B.Sc.

The experiments on this subject have attracted the attention of numerous observers, not only because of their beauty and and variety, but also from the widespread belief that this is the most promising field in which to discover the relationships between electricity and matter.

Consider the discharges in electrodeless tubes. Take a coil of wire, of which one end is connected to the inside coating and the other end through a spark gap to the outside coating of a Leyden jar, charged by an induction coil. When the jar is discharged enormous and very rapid alternating currents flow through the coil, sufficient by their induction to produce bright discharges in bulbs placed in the coil. If the bulb is connected to pump and exhausted, when the pressure is high no discharge appears, but when the pressure is about 1mm. of mercury a thin red line runs round the bulb in the plane of the coil; continuing the exhaustion, the colour changes to white, the ring gets thicker, and the brightness becomes a maximum; it then diminishes, and when we have a very good vacuum the discharge no longer passes. If a metallic diaphragm crosses the bulb there are produced two separate bright rings, just as with a non-conducting diaphragm.

There is always considerable difficulty in producing the first discharge in rarefied gases. The gas first breaks down along the line of maximum E.M.F. intensity, and a small discharge takes place, producing a supply of dissociated molecules, along which the succeeding discharges can more easily pass.

Observe discharge with electrodes. When the pressure is about ½ millimetre of mercury, we see that the cathode is irregularly covered with a velvety light, its distribution depending on the pressure and quantity of current; then comes Crookes' dark space, after this a luminous column, the negative glow, independent of the position of the electrode, its size depends on the shape of the vessel near the cathode; next, the Farady dark space, of variable length; lastly, the luminous column extending to the anode, very regularly striated, and beautiful. Attempts have been made to explain the striae on the hypothesis that the discharge through an exhausted tube is not continuous but intermittent.

Plücher first investigated the fluorescence on the walls of the tube near the cathode. Hittorf next discovered that the surface of the electrode is the origin of a motion spreading uniformly through the gas. Goldstein showed that a pointed cathode produces a well-defined shadow on the walls of the tube of a body in front of it, while a cathode of large surface produces a clear but not very sharp shadow, thus proving that the cathode rays, as he called them, came off nearly normally from the cathode, and not like light in all directions.

In 1879 Crookes wrote his first papers on this subject, and his experiments became popular in this country. The most striking property of cathode rays is their power of producing fluorescence, not only in the gas through which they pass, but also in many substances on which they fall. To show these effects most strikingly we use "solid solutions," which are formed when two salts are simultaneously precipitated from a solution. They are then particularly sensitive to the rays coming from an electric discharge.

Goldstein discovered that if there are two adjacent cathodes the rays from one are deflected by the other.

Again, using a tube with the cathode in the centre, the anode at one end, the cathode being pierced with one or more small holes, Goldstein found that the front side of the cathode shows the usual cathode light. From the back of the cathode rise high columns of reddish-yellow light, the blue rays being entirely absent. These were called "Canal Rays." It seems to me proved that they are identical with the luminous glow on the front of the cathode, and that both are produced by positive ions travelling from the anode to the cathode, and, if the cathode is pierced, some pass through and produce the canal rays. Wien showed that they carried with them a positive charge. An object, placed in the dark space in front of the cathode, throws a shadow on the cathode, as if it protected the cathode from the impact of particles striking it normally. If holes are pierced in the cathode in this shadow no canal rays appear there. Metals placed in the path of the rays become oxidised, so that if an object be placed in the dark space in front of a cathode, consisting of wire gauze and a polished metal plate placed behind it, we have on the plate an image produced of the object placed in front of the cathode. If now a luminous screen be placed in front of the cathode, we have a shadow of the object again produced, which is larger than the object if this latter is inside the cathode dark space, and about the same size if outside, so that cathode rays only come from the parts struck by these anode ions.

In the simple case of the discharge passing as a thin line of reddish light, we may describe the effect of a magnet by saying that the displacement of the discharge is like that of a perfectly flexible wire carrying a current. "If a magnet be applied to a striated column, each striae is subjected to a rotation or deformation, as if the striae marked the termination of flexible currents radiating from the bright head of the striae behind it, and terminating in the hazy inner surface of the striae in question."

The negative glow behaves in a magnetic field, like a magnetic substance without weight, and perfectly free to move. The magnetic effect on the cathode rays may be expressed by stating that the negative rays mark the path of a sheaf of charged particles, and therefore in general it is a spiral in a uniform field. A sheaf of rays normal to a pole of a magnet forms loops and nodes, as shown by Poincaré.

Crookes' theory regards the cathode rays as streams of negatively electrified particles driven with great speed away from the cathode. The heating effects are explained by supposing that the kinetic energy of the particles is partly transformed by impact.

A rapidly moving particle acts like an electric current, and produces round it a magnetic field ; when the particle is stopped the field is destroyed. This rapid change in the field produces rapidly changing electro-magnetic forces, analogous on the electro-magnetic theory to the conditions which accompany ultra-violet light, and therefore phosphoresence.

The phenomena of the discharge have led us to believe that the molecules are broken up, and that chemical actions essentially accompany the passage of electricity through gas.

We can readily admit that the molecules of gases, which consist of two atoms, can be broken up by the current ; but there is a difficulty in the case of mercury vapour, which must be regarded as mon-atomic.

If, then, the dissociation theory is correct, we must, as Warburg pointed out, suppose that the mon-atomic mercury vapour may also be further analysed, and, by electric discharges, carriers of electricity are produced, which are small in comparison with the ordinary atom or molecule.

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Scott, Conway, C.E., Annaville, Windsor Avenue,	do.
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Tate, Alexander, C.E., Rantalard, Whitehouse,	do.
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Turpin, James, Waring Street,	do.

Report and Proceedings

OF THE

BELFAST NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1899-1900.

BELFAST:
PRINTED BY ALEXR. MAYNE & BOYD, 2 CORPORATION STREET
(PRINTERS TO QUEEN'S COLLEGE.)

1900.

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Belfast Natural History and Philosophical Society.

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ESTABLISHED 1821.

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SHAREHOLDERS.

1 Share in the Society costs £7.		
2 Shares	,,	cost £14.
3 Shares	,,	cost £21.

The Proprietor of 1 Share pays 10s. per annum; the proprietor of 2 Shares pays 5s. per annum; the proprietor of 3 or more Shares stands exempt from further payment.

Shareholders are only eligible for election on the Council of Management

MEMBERS.

There are two classes—Ordinary Members, who are expected to read Papers, and Visiting Members who, by joining under the latter title, are understood to intimate that they do not wish to read Papers. The Session for Lectures extends from November in one year till May in succeeding one. Members, Ordinary or Visiting, pay £1 1s. per annum, due 1st November in each year.

Each Shareholder and Member has the right of personal attendance at all meetings of the Society, and of admitting a friend thereto; also of access to the Museum and Library for himself and family, with the privilege of granting admission orders for inspecting the collections for any friend not residing in Belfast.

Any further information can be obtained by application to the Secretary. It is requested that all accounts due by the Society be sent to the Treasurer.

The Museum, College Square North, is open daily from 10 till 4 o'clock. Admission for Strangers, 6d. each. The Curator is in constant attendance, and will take charge of any Donation kindly left for the Museum or Library.

Belfast Natural History and Philosophical Society.

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ANNUAL REPORT, 1899.

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THE Annual Meeting of Shareholders of the Society was held on 14th June, in the Museum, College Square North. On the motion of Mr. Robert Young, C.E., J.P., seconded by Dr. MacCormac, the chair was taken by Mr. John Brown, and there were also present Rev. Dr. Hamilton (President of Queen's College), Professor Fitzgerald. B.A., M.I.M.E.; R. L. Patterson, D.L., F.L.S.; T. F. Shillington, J.P., James O'Neill, M.A.; Joseph Wright, F.G.S.; J. H. Davies, John M'Knight, J. Horner, M.I.M.E.; Wm. Faren, J. E. Magill, Isaac Ward, Conway Scott, C.E.; R. Patterson, M.B.O.U.; Robert M. Young, J.P. (honorary secretary); and W. H. F. Patterson (honorary treasurer).

Mr. R. M. Young, Hon. Secretary, having read the notice convening the meeting, presented the report of the Council, as follows:—

The Council of the Belfast Natural History and Philosophical Society desire to submit to the Shareholders their report of the working of the Society during the past year.

The Winter Session was opened on 7th November, 1899, when the President of the Society, Mr. Thomas Workman, J.P., delivered an address, subject: "Incentives to the study of Natural History," with lime-light illustrations.

The Second Meeting was held on 5th December, 1899, at which a lecture was given by Mr. Robert A. Mitchell, LL.B, subject: "Personal Impressions of the Transvaal, Natal, and

Cape Colony," illustrated by a large series of lime-light views from photographs taken by the lecturer recently in South Africa.

The Third Meeting took place on 2nd January, 1900, when Mr. Seaton F. Milligan, M.R.I.A., lectured on "Ireland and the Scottish Isles: Ancient Connections and Intercourse," illustrated by a large series of specially prepared lantern views.

The Fourth Meeting was arranged for 6th February, when Mr. Conway Scott read a paper, subject: "Some thoughts on Rome." Afterwards, Mr. W. H. Patterson described the "Growth of the Ink Blot," with illustrations.

The Fifth Meeting, on 6th March, was devoted to the consideration of technical instruction in Belfast, when Mr. W. Gray read a paper on "The position of Belfast in relation to Technical Instruction under the Agricultural and Technical Instruction Act." This was followed by an interesting discussion.

The Closing Meeting was held on 3rd April, when a paper was given by Prof. Fitzgerald, B.A., A.M.I.C.E., subject: "Some of the Work Done by Committees of the British Association."

These meetings were well attended, particularly those devoted to Technical Instruction.

The Gilchrist Course of Lectures mentioned in the last Annual Report were very successful, and a moiety of the balance remaining after all expenses were paid was handed to your council by the Committee, with the recommendation that artizans should be admitted by ticket on certain days. The number of kindred societies holding their meeetings in the Museum exhibits no reduction. At the Easter holidays the attendance of the public was similar to last year, although no special attractions were on view. The ordinary days admissions vary little of late years. As will be seen by the Hon. Treasurer's Statement of Accounts, a substantial balance in favour of the Society still continues to be shown after payment of all liabilities.

A list of donations to the Museum and of the publications received in exchange from home and foreign societies will be printed with the present Report.

Such donations as were received during the year have been incorporated with the Museum collections and exhibited in their proper place in the several cabinets. Amongst the specimens given may be mentioned Mr. R Welch's land and fresh water shells, some of which are rare species, and some only recently added to the Irish fauna. Owing to evaporation many specimens in jars require attention ; some of these have been renewed, and others must shortly be dealt with. Further additions to the herbarium have been selected, mounted, and placed in their systematic order, and several cases of birds have been cleaned and renovated. The curator and his assistant have been fully occupied with the work, in addition to the usual attention and oversight of the entire collections during the session. Your council have to deplore the loss of their president, the late Mr. Thomas Workman, J.P., who died after a short illness at St. Paul's, Minnesota, on 11th May last. He had been for many years an active and valued member of our society, and of the council, in which he was a vice-president and librarian. During the two years in which he held the office of president he was most zealous for the interests of the society, and in last September he was chosen to voice at the Dover meeting the city's invitation to the British Association. He took the chair at our March meeting, and had made arrangements to be home in time for our annual meeting, and that to be held for the renewal of the invitation to the British Association. Your council also received with much regret the announcement of the death of Professor John F. Hodges, M.D., a former president of the society, and of Mr. Jas. Thompson, J.P., one of the oldest and most valued members, whose brother William died while president in 1852. Captain Robert Campbell, the donor of many valuable specimens in the museum, has also passed away, much regretted.

Mr. W. H. F. Patterson submitted the financial statement, which showed a substantial balance in favour of the society, though the subscriptions had slightly decreased.

The President of Queen's College, in moving the adoption of the report and statement of accounts, said that the Belfast Natural History and Philosophical Society was one of the few old things that our comparatively modern city had, and was one of the most useful and most interesting of all the societies that Belfast could boast of. He hoped the day was far distant when it would cease to perform its very excellent functions in the midst of this busy community.

The report reminded them that during the year the society had lost four very valued and old friends, all of whom he knew, and all of whom the society had good reasons to prize. The death of Mr. Thomas Workman was specially sad. He was the second president who had died during his term of office, the first being their eminent and well known Belfast naturalist, Mr. William Thompson, whose death occurred in 1852. Mr. Workman, as they all knew, was a man of very varied and large scientific attainments. He was one of the type of men who helped long ago to earn for Belfast the appellation of the Athens of the North, and who at the present day enabled it to still lay claim to some extent to that name. Another death chronicled in the report was that of Professor Hodges. They in Queen's College had already in their own way taken note of that death, which deprived them of the last of the old staff of original professors. He had occupied a chair in the college for fifty years, and he (the President) was glad to say that in a short time a portrait of him, subscribed for by his friends in the college and city, would be hung on the walls of the Examination Hall. In the Natural History Society the late professor occupied a very prominent place, and in its working he took a large share. In connection with his name it ought to be said that very long ago he took steps in his own private capacity to do, in of course a small way, what this very year was being carried out by the Government through the operation of the Agriculture and Technical Schools Act. He established, many years since, a little farm of his own not far from the College, for experimenting with seeds, plants, and manures, and from that time up to his death he was continually endeavouring to infuse a spirit of science into the agriculture of the North of Ireland. They who knew him best in his latter days deplored the loss of a valued friend, whose genial conversation and sage experience made intercourse with him peculiarly valuable and pleasant. He was undoubtedly one of the best types of the fine old Irish gentleman.

Mr. James Thompson did not latterly take a very prominent part in the working of the Society, but he belonged to a family which gave to Belfast one of the most eminent men of whom the city could boast, namely, the late Mr. William Thompson. As to Captain Campbell, he (the President) had known him from boyhood, and a finer or braver fellow never trod the quarter-deck of a British ship. It could be wished that many more of their seafaring men would use their opportunities abroad in collecting rare specimens for that Museum.

Those were the sad points referred to in the report, but there was a bright side, and it might be summed up in a single sentence, that the Society continued to do good and useful work for the objects for which it was instituted. It had had a busy and useful year. Many of its members had taken a lively interest in its work, and he could only express the hope that as the old members passed away new ones might be found to come in to fill their places, so that the Society might be continued, not only in unimpaired, but, if possible, increased efficiency, and handed down to future generations of Belfast men as they had received it from the Belfast of long ago.

Mr. R. L. Patterson, in seconding, mentioned that at a town meeting on Wednesday last it was decided to invite the British Association to meet in Belfast in 1902—that would be fifty years after their first meeting in 1852. On that occasion that society took a leading part in the issuing of invitations, while many of its members took an active part in the reception of that distinguished body both individually and collectively. He had no doubt that, as he hoped and expected the association would accept the invitation, the present members of the society would do their best to make the gathering a distinct and striking success. He regretted to hear that the subscriptions showed a slight falling off. He did not exactly know that they could increase the number of their shareholders, but occasionally a little effort might get them recruits in the way of annual subscribers, and thus they would increase the usefulness of the society. In connection with their active membership there was one point he should like to mention. On the list of shareholders there figured the names of a good many deceased shareholders, or rather the representatives of so and so deceased. President Hamilton had suggested to him that they might try and get Lord Shaftesbury to join the Society and he thought the suggestion a good one.

The resolution was adopted.

The following five members, who retired by rotation, were re-elected on the Council :—Sir Otto Jaffé, J.P.; President Hamilton, D.D., L.L.D., Professor Fitzgerald, Mr. T. F. Shillington, J.P. ; and Mr. R. M. Young, J.P.

Mr. R. M. Young announced that Mr. J. H. Davies, a member of the Council, had recently discovered in County Antrim three species new to the Irish moss flora—namely, *Tortula marginata*, *Amblystegium Juratzkanum* and *Amblystegium varium*—specimens of which would be placed in the Museum Herbarium.

Mr. R. Young gave an interesting description of some rare specimens of worked flints (Wadi el Sheikh, Egypt), received from the Free Museum, Liverpool, in accordance with the system of duplicate exchange recently adopted.

The following Officers were elected :—President, John Brown; Vice-Presidents, President Hamilton, William Swanston, F.G.S.; Robert Young, C.E., J.P.; R. L. Patterson, D.L., F.L.S. Honorary Treasurer, W. H. F. Patterson ; Honorary Librarian, J. H. Davies ; Honorary Secretary, Robert M. Young, B.A., J.P., M.R.I.A.

A vote of thanks to the Chairman, proposed by Dr. MacCormac and seconded by Mr. Isaac Ward, concluded the proceedings.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict. ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended 30th April, 1900.

Dr. **Cr.**

CHARGE.

To Balance as per last Account		£76 1 2
,, Amount of Donations, Bequests, and other Endowments, received in the year ended 30th April, 1900		14 8 6
,, Amount of Subscriptions received in the year ended 30th April, 1900		112 0 0
,, Amount of Dividends received in the year ended 30th April, 1900		17 8 0
,, Amount of Rents received in the year ended 30th April, 1900		51 11 6
,, Amount of Fees received in the year ended 30th April, 1900		0 4 6
,, Amount realized by Sales in the year ended 30th April, 1900		0 2 0
,, Amount of Miscellaneous Receipts in the year ended 30th April, 1900 (not included in the foregoing), viz.:—		
Entrance Fees at door at Easter	£17 0 6	
,, ,, ,, for rest of year ..	21 18 9	
		38 19 3
Total, ...		£310 14 11

DISCHARGE.

By Amount of Payments made in the year ended 30th April, 1900, under the following headings:—		
Maintenance of Premises, &c. ..	£21 12 4	
Rent & Taxes, &c., ...	27 11 0	
Salaries, ...	94 5 6	
		143 8 10
Other Payments, viz:—		
S. A. Stewart, Grant for Nat. Hist. Research	5 0 0	
Auditor's Fee	1 1 0	
Insurance, £2 12s 6d, £1 19s 9d, £1 19s 9d ..	6 12 0	
Commission on Cheque..	0 0 6	
Stamping 12 Transfer Forms	0 6 0	
Subscription Egypt Exploration Fund .	2 2 0	
,, *Irish Naturalist*	3 0 0	
Purchase of Shares	3 10 0	
Hire of Lantern	1 18 0	
Printing Report	16 8 9	
Expenses at Easter	5 12 3	
Printing and Stationery	8 5 5	
Advertising	11 14 7	
Postage and Carriage	6 16 1	
Gas and Fuel	15 16 3	
		88 2 10
Total Payment		231 11 8
,, Balance in favour of this Account as on the 30th April, 1900		79 3 3
Total		£310 14 11

N.B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., 4½ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.

W. H F. PATTERSON, Accounting Officer.

Dated this 19th day of May, 1900.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.
15th day of May, 1900.

DONATIONS TO THE MUSEUM, 1899-1900.

From Mr. John Fisher, Kilkeel.

Transverse section of a yew tree from Kilkeel, Co. Down, the trunk was 20 feet long.

From Mr. W. H. M'Laughlin.

Specimen of goat moth (*Cossus lignaperda*), and its cocoon embedded in a block of ash wood.

From The City of London.

Medal struck by the City in commemoration of the 60th year of the reign of Her Majesty Queen Victoria.

From Mr. I. A. Richardson.

A flint lock musquet of a Broomhedge yeoman.

From Mr. Osborne Grimshaw.

Specimens of the submerged forest at Portrush.

From Mr. Robert Welch.

A large number of the rarer Irish land and fresh water shells.

ADDITIONS TO THE LIBRARY, 1ST MAY, 1899, TILL 1ST MAY, 1900.

ADELAIDE.—Memoirs of the Royal Society of South Australia. Vol. 1, part 1, and Transactions, vol. 23, parts 1 and 2—1899. *The Society.*

ALBANY.—Forty-ninth and Fiftieth Reports of the New York State Museum, 1895 and 1896.
The University of the State of New York.

AUSTIN.—Transactions of Texas Academy of Science. Vol. 2, no. 2, 1899. *The Academy.*

BELFAST.—Report and Proceedings of Belfast Naturalists' Field Club. Series 2, vol. 4, part 6, 1899.
The Club.

BERGEN.—Bergens Museums Aarbog, 1899 ; also Crustacea of Norway. Vol. 2, parts 13 and 14, 1899; and vol. 3, parts 1—4, 1899-1900.
Bergen Museum.

BERLIN.--Verhandlungen der Gesellschaft für Erdkunde. Vol. 26, nos. 4—10, 1899; and vol. 27, nos. 1—3, 1900. *The Society.*

BOSTON.—Memoirs of Boston Society of Natural History. Vol. 5, nos. 4 and 5, 1899; also Proceedings, vol. 28, nos. 13—16, 1899; and vol. 29, nos. 1—8, 1899. *The Society.*

BREMEN.—Abhandlungen Herausgegeben vom Naturwissenschaftlichen Verein zu Bremen. Vol. 16, part 2, 1899. *The Society.*

BRESLAU—Zeitschrift für Entomologie Herausgegeben vom Verein für Schlessiche Insektenkunde zu Breslau. Part 24, 1899. *The Society.*

BRIGHTON.—Annual Report and Abstract of Papers of Brighton and Sussex Natural History and Philosophical Society for the year 1898-99. *The Society.*

BRUSSELS.—Bulletin de la Société Royale de Botanique de Belgique. Vol. 37, 1898; and Vol. 39, 1899.
The Society.

„ Annales de la Société Entomologique de Belgique. Vol. 43, 1899. *The Society.*

„ Annales de la Société Royale Malacologique de Belgique. Vols. 21—23, 1896-98; also Bulletins des Seances. *The Society.*

BUENOS AYRES.—Annales del Museo Nacional de Buenos Aires. Series 2, vol. 6, 1899; and Comunicaciones, vol. 1, nos. 3—5, 1899. *The Director.*

BUFFALO.—Bulletin of Buffalo Society of Natural Sciences. Vol. 6, nos. 2—4, 1899. *The Society.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 28, part 1, 1898. Palæontologia Indica. Series 15, vol. 1, part 2, 1899; and new series, vol. 1, parts 1 and 2, 1899; also General Report of the Survey for year 1898-99.
The Director of the Survey.

CAMBRIDGE.—Proceedings of Cambridge Philosophical Society. Vol. 10, part 2, 1899; and parts 3 and 4, 1900.
The Society.

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Zoology. Vol. 32, no. 10; vols. 33 and 34; and vol. 35, nos. 1—7, 1899. *The Curator.*

CARDIFF.—Report and Transactions of Cardiff Naturalists' Society. Vol. 30, 1899; and vol. 31, 1900.
The Society.

CASSEL.—Abhandlungen and Bericht (44) des Vereins für Naturkunde zu Kassel, 1899. *The Society.*

CHICAGO.—Fortieth Annual Report and Bulletin of Chicago Academy of Sciences, No. 2, 1897.
The Academy.

„ Occasional Memoirs of Chicago Entomological Society. Vol. 1, No. 1, 1900.
The Society.

CHRISTIANIA—Christiania Videnskabs Selskabs Forhandlinger. No. 1, 1899.
The Royal Norske Frederiks University.

EDINBURGH.—Proceedings of the Botanical Society of Edinburgh. Vol. 31, part 1, 1897; part 2, 1898; and part 3, 1899. *The Society.*

„ Proceedings of the Royal Physical Society, Session 1897-98 and 1898-99. *The Society.*

ELBERFELD.—Jahresbericht der Naturwissenschaftlichen Vereins in Elberfeld. Part 9, 1899. *The Society.*

EMDEN.—Eighty-third and eighty-fourth Jahresbericht der Naturforschenden Gesellschaft in Emden, 1898-99. *The Society.*

GENOA.—Giornale della Società di Letture e Conversazione Scientifiche di Genova. Anno 20, fasc. 2—4, 1899, also Rivista Ligure; anno. 22, fasc. 1, 1900. *The Society.*

GIESSEN.—Thirty-fourth Bericht des Oberhessichen Gesellschaft für Natur and Heilkunde, 1897-98-99.
The Society.

GLASGOW.—Transactions of the Natural History Society of Glasgow. New ser. vol. 5, No. 3, 1900.
The Society.

„ Proceedings of the Philosophical Society of Glasgow. Vol. 30, 1899. *The Society.*

GOTHENBERG.—Goteborg's Kungl. Vetenskaps och Vitterhets Samhälles Handlingar, 1899. *The Society.*

HALIFAX.—Proceedings and Transactions of the Nova Scotian Institute of Science, Vol. 9, part 4, 1898.
The Institute.

IGLO.—Jahrbuch des Ungarischen Karpathen Vereines, 26th year, 1899. *The Society.*

LAUSANNE.—Bulletin de la Société Vandoise des Sciences, Naturelles. Vol. 35, n s. 131-133, 1899.
The Society.

LAWRENCE.—Kansas University Quarterly. Vol. 8, nos. 2 and 3, 1899. *The Kansas University.*

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig, 1898, and Wissenschaftliche Veroffentlichungen. Vol. 4, 1899. *The Society.*

" Sitzungberichte der Naturforschenden Gesellschaft zu Leipzig, 24th and 25th years, 1897-98. *The Society.*

LONDON.—Memoirs of the Royal Astronomical Society. Vols. 52 and 53, 1896-1899. *The Society.*

" Report of the 69th Meeting of the British Association; Dover, 1899. *The Association.*

" Fifteenth Memoir of the Egypt Exploration Fund of the Egypt Exploration Fund (Deshasheh), 1898, Sixteenth Memoir (Deir el Bahari), 1898, and Seventeenth Memoir (Dendereh), 1900. *The Committee of this Fund.*

" Quarterly Journal of the Geological Society of London. Vol. 55, parts 1—3, 1899. Vol. 56, part 1, 1900; also Geological Literature added to the Library during 1898, and List of Fellows of the Society. *The Society.*

" Journal of the Royal Microscopical Society, Nos. 129—133, 1899, and Nos. 134 and 135, 1900. *The Society.*

" Proceedings of the Zoological Society of London, parts 1—4, 1899, and Transactions, Vol. 15, parts 2—4, 1899; also List of Fellows of the Society. *The Society.*

MADISON.—Transactions of Wisconsin Academy of Sciences, Arts, and Letters, Vol. 12, 1898. *The Academy.*

MADRAS.—Bulletin of Madras Government Museum. Vol. 2, No. 3, 1899, and Administration Report for 1898-'99. *The Superintendent.*

MANCHESTER.—Journal of Manchester Geographical Society. Vol. 14, nos. 7—12, 1898, and Vol. 15, Nos 1—9, 1899. *The Society.*

" Transactions of Manchester Geological Society, Vol. 26, parts 4—9, 1899, and part 13, 1900. *The Society*

MARSEILLES.—Annales de la Faculte des Sciences de Marseille. Vol. 9, fasc., 1—5, 1899. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. New ser., Vol. 11, part 2, 1899. *The Society.*

MEXICO.—Boletin del Instituto Geologico de Mexico. No. 11, 1898, and 12 and 13, 1899. *The Institute.*

" Boletin Mensual del Observatorio Meteorologico Central de Mexico. No. for December, 1898, and Nos. for January—September, 1899. *The Director.*

" Boletin del Observatorio Astronomico Nacional de Tacubaya. Vol. 2, No. 5, 1899; also Observaciones Meteorologicos, 1897, and Anuario 20, for year 1900. *The Director.*

MILWAUKEE.—Bulletin of Wisconsin Natural History Society. New series, vol. 1, no. 1, 1900; also 16th Annual Report of Milwaukee Public Museum. *The Society.*

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Vol. 2, fasc. 11 and 12, 1899. *The Director.*

MOSCOW.—Bulletin of the Society of Naturalists' of Moscow. No. 4, 1898; and no. 1, 1899; also Memoirs. Vol. 15, part 7, 1898; vol. 16, part 1, 1898; and part 2, 1899. *The Society.*

NANTES.—Bulletin de la Société des Sciences Naturelles de l' Ouest de France. Vol. 9, parts 1—3, 1899. *The Society.*

NEW YORK.—Annals of New York Academy of Sciences. Vol. 11, part 3, 1898; and vol. 12, part 1, 1899; also Constitution, Bye-Laws, and List of Members, 1899. *The Academy.*

" Bulletin of American Geographical Society. Vol. 31, nos. 2—5, 1899; and vol. 32, no. 1, 1900. *The Society.*

ODESSA.—Memoirs of the Society of Naturalists of New Russia. Vol. 22, part 2, 1898; also Memoirs of the Mathematic Section. Vols. 16 and 19, 1899. *The Society.*

OPORTO.—Annaes de Sciencias Naturaes. Vol. 5, no. 4, 1898. *The Editor.*

OSNABRUCK.—Jahresbericht des Naturwissenschaftlichen Vereins zu Osnabruck for year 1898. *The Society.*

OTTAWA.—Annual Report of the Geological Survey of Canada. New series, vol. 10, 1897; and Maps to accompany Report; also Contributions to Canadian Palæontology. Vol. 1, part 5, 1890; and vol. 4, part 1, 1899. *The Director of the Survey.*

PADÚA.—Bullettino della Società Veneto-Trentina di Scienze Naturali. Vol. 6, no. 4, 1899; and Atti; series 2, vol. 4, fasc. 1, 1900. *The Society.*

PHILADELPHIA.—Proceedings of the Academy of Natural Sciences. Parts 1 and 2, 1899. *The Academy.*

" Proceedings of the American Philosophical Society. Vol. 38, no. 159, 1899. *The Society.*

" Transactions of Wagner Free Institute of Science. Vol. 6, 1899. *The Institute.*

" Report of the Philadelphia Commercial Museum; also Monograph on the State of Nicaragua, and Monograph on Costa Rica, 1898. *The Museum.*

PISA.—Atti della Società Toscana di Scienze Naturali. Vol. 11, January to July, 1899; and Processi Verbali. Vol. 12, Nov. 1899. *The Society.*

REIGATE.—Proceedings of Holmesdale Natural History Club, 1899. *The Club.*

ROME.—Atti della Reale Academia dei Lincei. Series 5, vol. 8, semestre 1, fasc. 7—12. Semestre 2, fasc. 1—12, 1899; vol. 9, semestre 1, fasc. 1—7, 1900; also Rendiconto dell' Adunanza Solenne, June, 1899. *The Academy.*

SAN FRANCISCO.—Proceedings of California Academy of Sciences. Series 3, vol. 1, nos. 5, 6, 11, 12, 1899; and Occasional Papers, no. 6, 1899. *The Academy.*

ST. LOUIS.—Tenth Annual Report of Missouri Botanical Garden, 1899. *The Director.*

STAVANGER.—Stavanger Museums Aarsberetning for 1898. *The Museum Trustees.*

STIRLING.—Transactions of Stirling Natural History and Archæological Society for year 1898-99. *The Society.*

STOCKHOLM. — Kongliga Svenska Vetenskaps Akademiens Handlingar, Vol. 31, 1898-99. Bihang, vol. 24, parts 1—4, 1899; and Ofversigt, vol. 55. 1898. *The Academy.*

SYDNEY.—Science of Man. New series, vol. 2, nos. 3, 5, 10 and 12, 1899; and vol. 3, no. 1, 1900. *The Editor.*

TOKYO.—Mittheilungen der Deutschen Gesellschaft für Natur und Volkerkunde Ostasiens. Vol. 7, parts 2 and 3, 1899. *The Society.*

TOPEKA.—Transactions of Kansas Academy of Science. Vol. 16, 1899. *The Academy.*

TORONTO.—Proceedings of the Canadian Institute. New ser. Vol. 2 parts, 1899. *The Institute.*

UPSALA.—Bulletin of the Geological Institution of the University of Upsala. Vol. 4, part 1, No. 7, 1898.
The University.

VIENNA.—Verhandlungen der Kaiserlich Koniglischen Reichsanstalt. Nos. 5—18, 1899, and Nos. 1 and 2, 1900. *The Society.*

„ Verhandlungen der Kaiserlich Konglichen Zoologisch-Botanischen Gelleschaft. Vol. 49, 1899.
The Society.

WASHINGTON.—Year Book of United States Department of Agriculture, 1899, and Bulletins, Nos. 14 and 15, 1899. *The Secretary of the Department.*

„ United States Geological Survey Reports—18th Annual Report, parts 1—5 and 5 continued, 1897-98; 19th Annual Report, part 1 1898, part 2, 1899, part 4, 1899, part 6, 1898, and part 6 continued, 1898; 20th Annual Report, part 6, and part 6 continued, 1899; also Monographs, Vols. 29, 31, and 35, and Atlas to Vol. 31, 1898. *The Director.*

„ Proceedings of the United States National Museum, Vol. 20, 1898, and Vol. 21, 1899; also Bulletin, No 47, parts 2 and 3, 1898, and Annual Report for 1899; Annual Report of the Smithsonian Institution, 1898; Miscellaneous Collections, Nos. 1,171 and 1,173, 1898.
The Smithsonian Institution.

YORK.—Annual Report of Yorkshire Philosophical Society, 1899. *The Society.*

ZURICH.—Vierteljahresschrift der Naturfor chenden Gesellschaft in Zurich, 44th year, parts 1—4, 1899.
The Society.

From MR. VICTOR COATES, D.L.—The Zoologist, Vol. 5, 1847. Vol. 6 of ser. 3, 1882, and Vol 7, 1883.

From MR. R. LLOYD-PATTERSON, J.P., F.L.S.—Journal of the Linnean Society (Botany.) Vol. 26, No. 178, and Vol. 33, Nos. 237—239, 1899.

From MR. THOMAS WORKMAN, J.P.—Malaysian spiders. Vol. 2, parts 1—4, 1899.

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

SESSION 1899-1900.

7th November, 1899.

ADDRESS BY THE PRESIDENT,

MR. THOMAS WORKMAN, J.P.

INCENTIVES TO THE STUDY OF NATURAL HISTORY.

(*Abstract.*)

IT has no doubt been the privilege of many of you to ascend the St Gothard valley by the wonderful railway that has been so skilfully engineered up it. At one moment the traveller is carried in a straight line towards the snow crested alps at the summit, as if no obstacle stood in the path, but that lasts only for a little way. In another moment, with a shrieking whistle, you enter into a darksome cavern of a tunnel, and the traveller knows not whether his course is away from or towards the object of his aspiration. However, when you again emerge into the sunlight you find, though you have taken an enormous spiral, you are still going onwards and upwards, and you can see far below you the road you formerly traversed, and that even your backward course was an onward one.

Such, it appears to me, is scientific progress; we seem never for any time on the straight course to perfect knowledge, but ever on a spiral one if we follow after truth.

We cannot follow absolute truth, but only truth as it appears to us at every moment of our progress. Our path must necessarily be on the line of the least resistance.

Too many incline to the line of no resistance, and taking the river as their guide become the creatures of circumstance. Like Tennyson's Lotus Eaters, they say—

> Let us alone. What is it that will last?
> All things are taken from us and become
> Portions and parcels of the dreadful Past.
> Let us alone. What pleasure can we have
> To war with evil? Is there any peace
> In ever climbing up the climbing wave?
> All things have rest, and ripen towards the grave
> In silence; ripen, fall and cease:
> Give us long rest or death, dark death or dreamful ease."

But your presence here to night assures me that you are not of those, but that you are ever willing to struggle on towards the light. Now though the nineteenth century has still a few months to run, this is the last session of the Belfast Natural History and Philosophical Society which will use the numbers eighteen hundred to mark its date, and as I think the study of Natural History has, after the tremendous development when Darwin published in 1859 his epoch making book on the Origin of Species, entered somewhat one of these dark tunnels, or at least shady places where we are inclined to ask are we making any progress, or what is the good of it all. Believing thus, I think I cannot do better in my opening address of this session, 1899-1900, after thanking you for the honour you have shown me by again electing me as your President, than by continuing my former address, "Incentives to the Study of Natural History"; treating on this occasion the ways, colours, and instincts of Animals.

It had not been my intention to urge as an incentive, the good we may do by the study of Natural History, but an important instance has just been brought before the public to which I think it right to refer.

All persons who have lived or had friends living in tropical or other hot countries must have heard something of the ravages of malarial fever or ague. The cause of the fever has long been a mystery but at last it is to be hoped that naturalists will be able to solve the mystery and that we are on the track of the fell destroyer. It would appear that the cause is a living organism which gets into the blood and there sets up a disturbance of the system that brings on the fever. This organism has been found to be not only carried to the victim by a species of mosquito but actually the organism goes through a change or metamorphosis in the body of the mosquito. It is hoped, therefore, that if we can destroy the mosquito we will be able to annihilate the disease.

In Rome, where malarial fever never originates but only in the Campagna around the city, some of these mosquitos have been allowed to suck the blood from a patient suffering from malarial fever and after a few days allowed to eject their poison into another human being and it was found that he was inoculated with the fever. If the mosquito is at once allowed to attack the subject it can do no harm as the metamorphosis is not completed and the organism is not in a fit state to live in the human system.

The eggs of this mosquito are eagerly sought after and devoured by fish, so that they have no chance of coming to maturity if laid in deep water where fish are, and thus they can only come to maturity in puddles or shallow surface water where fish cannot live. Their larvæ also float along the surface of the water, getting the oxygen necessary for their life from the air, so they can easily be destroyed by pouring a little paraffin oil on the surface of the water which, spreading out, cuts them off from the air. Of course better surface drainage will also have the effect of destroying them.

If these statements should prove true, as we have every reason to expect they will, we have very direct evidence of the good of this ennobling study.

It has always been most interesting to the student of Natural History to investigate the similarity in structure existing between animals from separate parts of the globe, and if possible to discover if these similarities are the result of a connection in former times. For such an investigation a knowledge of the forms that lived during the past history of the earth is imperative.

Unfortunately it is most difficult to get the remains of invertebrates well preserved in geological strata, owing to their perishable nature, but there is one substance in which we have them well preserved, even better than the larger animals. That substance is amber. Great numbers of spiders, as well as other articulata are found embedded in the amber which is copiously cast up on the southern shores of the Baltic, many in a complete state of preservation. The principal work by Koch and Berendt, on the subject of these remains describes these amber spiders, three of which are remarkable for their strangely elevated heads, and are grouped in one genus *Archaea*. Type, *Archaea paradoxa*.

Koch considered this genus not to be related to any known spiders, while the late Professor Menge of Danzig, believed them at first to have most affinity with *Tetragnatha*, but afterwards refers *Archaea* to the *Laterigrades*. However within the last few years living spiders have been discovered closely related to *Archaea*, but strange to sa y, in widely separated parts of the world.

The first of these sent by me to the Rev. O. Pickard-Cambridge and described by him under the name of *Eriauchenius* *Workmani* was found in Madagascar. He said " It is of great interest, not only on account of its singularly elevated caput, but because the elevation is of a type quite distinct from anything I have ever before met with."

Some specimens of *Walckenaera* have the upper part of the caput elevated to a great height, and the eyes are (some or all) carried up with it; but in the present spider not only the eyes but the falces are carried up, necessitating the extraordinary development of the latter to enable them to meet and cooperate with the other parts of the mouth. These parts would otherwise have been left open and exposed and the spider itself would have been in danger of starvation since the anterior extremities of the falces, with their fangs and teeth, are the main instruments for holding and compressing the spider's prey, the juices of which flow thence into the mouth itself.

Another of these curious spiders came from Landana on the river Congo on the west coast of Africa and has been described by M. Eugene Simon and he has named it *Landana Petiti* after the discoverer M. L. Petit.

M. Simon has not only described a third living species under the name of *Mecysmauchenius segmentatus* but also another fossil species, *Archaea pougneti* found embedded in amber from the shores of the Baltic.

M. Simon in his splendid work on spiders, just being issued, says, that he can see no difference between *Archaea* and *Eriauchenius*, and therefore does away with the latter genus. He also says of these spiders, "The geographical distribution of the *Archaeidae* is not less curious than the details of their strange structure. Although during the Tertiary epoch the genus *Archaea* inhabited the North of Europe, the genera actually living, which we must suppose to be its descendants, are relegated to the most southern parts of the Old and New world. The genus *Archaea* is found in Madagascar, the genus *Landana* in the Congo districts, while the genus *Mecysmauchenius* comes from Cape Horn. The first two genera Simon considers to be allied to the *Argiopae*, of which our common or garden spider *Araneus diadematus* belongs. *Landana* he has placed in the *Therididae*. It would be of great importance to know what sort of webs they make.

The Lung-fishes, living representatives of the *Dipnoi*, an order of fish that goes back to the Devonian period, has also a similar distribution, represented by the *Protopterus* in Africa, the *Lepidosiren* in South America, and the *Ceratodus* in only one or two rivers in Queensland.

In the skunk (*Mephitis sufficans*) we have a curious instance of a mammal protected by warning colours, and a disagreeable smell. The skunk goes about freely with its white tail erect as a danger signal, fearing neither man or beast.

In 1881, when crossing the Pampas of Uruguay, between the Brazilian frontier and the city of Monte Video, in a diligence, with a party of Spaniards, I had a personal interview with a skunk in a state of nature, and can therefore speak from experience of its defensive or rather offensive armature. While stopping to change horses I wandered a little way from the station, searching for spiders. While in the act of catching some red ones in a crevice among rocks, I heard a curious sound like that emitted by a large moth or butterfly flapping its wings. I peered down into the opening, expecting to see some insect trying to get out, but instead, I saw a funny little pig like nose and two bright eyes looking up at me with a very comical expression. This explained where the hist! hist! hist! came from. But what was the thing. At first I thought it was a young pig, but a pig does not make that noise, nor is it armed with long claws as this animal was. It then began to show signs of attack, and not liking the look of the long claws I kept my distance and hallooed for the others, who soon came running down to see what was wanted. When they came near they did not seem to like the look of the creature.

Some of the party would not go within yards of the rock where it was, but no one explained the nature of the beast and why they feared it, except that it would not bite. Seeing they were really in earnest that it would not bite I felt quite anxious to capture it alive. So taking great precautions I slipped my hand down the cleft until I got firm hold of the animal by the back of the neck and, with difficulty, dragging it out, I began to carry it to the diligence, congratulating myself on the handsome capture I had made, for it looked very nice and mild with its black body and long bushy tail.

My companions seemed strangely elated and laughed immoderately. Indeed if I had not been such a self-satisfied tenderfoot their strange behaviour would have aroused my suspicions and I would have smelt a rat. The creature now began to show signs of dissatisfaction as if it thought the joke had gone far enough and being afraid it was making round to bite my hand I let it drop to the ground, expecting it immediately to bolt off. But such a thought seemed never to have entered its mind. It apparently thought itself master of the situation and when I poked my hat at it, it acted very much like a playful kitten, sitting up on its hind legs and jumping at the hat as if in fun. I got more than ever pleased with my new-found pet and proceeded to re-capture it. When suddenly it turned tail . . whew ! ! ! The murder was out, the laughter explained ; for feeling a most horrible effluvium in my nose and smarting in my eyes I needed no one to tell me what I had captured. A skunk, a beast I had smelt before but never seen and handled and don't want to again.

I am sure I cannot better close my lecture than in the noble words in which Professor Charles Richet, of Paris, opened that address on Nerve Waves which entranced the British Association at Dover last September.

"If, owing to the stupid prejudices and barbarian hate, nations are still separated by divisions which may lead them into fratricidal war, it falls to the men of science at least to set the example of concord, in order that by their teaching, based on reason, they may bring to all peace, sweet peace—the chimera of the past, the reality of to-morrow." "To this end nothing can be more effective than the great example of the British Association and the Association Française, who, within the space of a few days, are to meet twice as partners in their fertile work : to-morrow on English soil, in this hospitable town of Dover ; five days later on the soil of France, on the shores you can see from here, where you will find the same courteous and cordial welcome as our countrymen will receive on this side." "Yet, after these words of peace must come words of war—nay, its open declaration."

"Men of science have not the right to stay within the closed gates of their tower of ivory ; it behoves them also to wrestle, and to wrestle unceasingly for justice, to turn the united forces of all generous minds against the common foe, the worst enemy of mankind, and this is ignorance.

"We must not value unduly the admirable conquests won by science in this century. Admirable as they are, they are yet nothing as compared to the great mystery beyond. Newton compared our science to that of a child, who should pick up a pebble on the seashore, and think he has penetrated the secrets of ocean."

"After all our searching and all our efforts, we to-day can hardly say more. The shades that surround us are as deep as in the time of Newton; and in this universe, vast and obscure, at most, scattered glimmers of light, few and far between, reach our straining eyes. We need all the co-operation of all men of science, of all nations, to dispel some of these shades."

"What madness it would be not to unite, not to walk hand in hand, but to strive apart! The reward of this union will be above all price; the conquest of truth, the control of brute matter, the gift of a life less precarious and less painful to man, feeble man."

Also his closing words,

"Vast as is the world, mighty as are the fires of the infinite stars, the intelligence of man is of a higher order than these; and I would fain exclaim with the great philosopher Immanuel Kant: 'More than the starry heaven above my head, one thing fills me with admiration: the moral law in the heart of man.'"

Dr. Charles Sheldon in proposing a vote of thanks to the lecturer, said that the President was not the least notable among the members of the Workman family, who had done so much in various forms to increase research in Belfast. They had been delighted with the manner in which he had revealed to them the results of his own investigation, and he (Dr. Sheldon) hoped that the President's desire might be gratified that the British Association would visit them at a future date.

Mr. G. W. Ferguson seconded and Mr. W. Gray supported the motion, which was passed by acclamation.

The President thanked the mover of the vote of thanks and the other gentlemen who had spoken for their kind remarks, and said he could promise the British association a very warm welcome indeed if they visited Belfast in 1902.

5th December, 1899.

MR. THOMAS WORKMAN, J.P., President, in the Chair.

PERSONAL IMPRESSIONS OF THE TRANSVAAL, NATAL, AND CAPE COLONY.

BY ROBERT A. MITCHELL, LL.B.

(*Abstract.*)

SOUTH AFRICA has attracted a great deal of public attention of late years, especially since the important episode of the Jameson Raid, and the dénouement now taking place had not been altogether unexpected by those who really knew. It has been said that South Africa was the "grave of the reputations of prominent men," but it has also produced its successes, among whom are Cecil Rhodes and Sir Alfred Milner. To Mr. Rhodes Great Britain owes her predominance in South Africa to-day, and to him is due the fact that we have a vast empire in that part of the world. Sir Alfred Milner is a star which has shot into brilliancy at a later date, but his conduct of affairs during the crisis has marked him as a coming man.

South Africa is at present in a transition state, and we can only guess at what its future will be. Unlike some of our other colonies, which are entirely white men's country, South Africa has its great native question always present, and always will have it, for Great Britain has stopped the cruel and bloody wars by which thousands formerly lost their lives, and has taken measures to keep down epidemic diseases, such as smallpox, which claimed its thousands of victims also. This is characteristic of us as a colonising power, for whenever Britain puts her shoulder to the wheel, ignorance, cruelty, and injustice vanish. Great Britain alone has made a thorough success of colonising, and we await with interest the advent of a new colonising power across the Atlantic which may sometime equal, but never eclipse us. Wherever Great Britain goes, unlike the other nations of the world, she holds her possessions in trust for mankind ; that is at once the keynote and the invisible strength of her Empire.

South Africa is politically divided into many spheres, but the principal divisions are Cape Colony, Natal, Rhodesia, Orange Free State, and the South African Republic or Transvaal. Germany and Portugal hold territories on the borders of these, but one possession in the hands of the latter power I hope will now become British, I refer to Delagoa Bay. Cape Colony is the oldest and most important of the places just named. Its length is about 440 miles, its breadth 600, and its area 199,950 square miles (more than twice that of Great Britain), but including dependencies it has an area of 355,171 square miles. To this vast area must be added that of Bechuanaland, Chartered Company, Mashonaland, and Matabeleland, which is 963,000 square miles, and Natal and Zululand, or a grand total of 1,352,821 square miles owned by Great Britain in South Africa. The population of Cape Colony and dependencies is 410,000 whites and 1,500,000 blacks.

Natal and Zululand have an area of 34,650 square miles and a population of 50,000 whites and 700,000 blacks.

The area of the South African Republic is 113,700 square miles, and the population 204,000 whites and 645,000 blacks.

The Orange Free State has an area of 43,000 square miles and a population of 95,000 whites and 130,000 blacks.

From Capetown to the Zambezi is about 1,200 miles, and from the Atlantic to the Indian Ocean is ab ut 1,300, and when we assimilate the Orange Free State and the South African Republic our empire in South Africa will be a gigantic one in point of area, but this vast country is peopled by but 720,000 whites and 4,000,000 blacks, the two added together not much more than the population of Ireland and the total white population is only about twice that of Belfast.

As regards the nature of her population, it is made up of Cape Dutch, Britishers, Negroes, Malays and Indians. The Cape Dutch are a mixed race, being descendants through intermarriage of the original Dutch settlers and the French Huguenots who came to the country in the 17th century. Their language is not pure Dutch, but a patois called the "Taal." The lead in social improvement and the amassing of wealth is taken by the British, and their superiority is due to their greater application to habits of industry. The native races comprise Kaffirs, Bechuanas, Hottentots, Fingoes, Zulus, Mashonas and Matabele. The Zulu is the first type of the coloured people of South Africa—he is at once a warrior and a gentleman, and until Cetewayo was crushed in 1879 he never soiled his fingers with work, as his women folk did all that for him. Each native man who is not a Christian is entitled to as many wives as he can buy, and his ideal number is four. The price of wives when I was there last being 10 cows, and a commission of one to the prospective mother-in-law.

The Malays who inhabit chiefly Cape Colony were brought there from the East Indian Islands by the Dutch as slaves, and are very energetic and industrious. Another element of the population, and a serious one, is the Indian element. Natives were brought from India to work in Natal, and are to a very appreciable extent supplanting the white man in that colony, and so causing a burning question that will have some day to be settled by the Home Government. Broadly speaking Cape Colony is more Dutch than British ; Natal has only a sprinkling of Dutch inhabitants ; in the Orange Free State there are five Dutch to one Britisher, and in the Transvaal almost two Uitlanders to one Boer.

As may be observed in the several views at this stage thrown on the screen, Cape town and Table Bay present a magnificent sight to the visitor. Towns up country, however, are hardly worth being called towns, they are small collections of houses and at best what we would call villages, but as such they look large in the estimation of the population unused to anything greater. Places like Colesberg and De Aar, lately come into prominence, are very small. The other important seaports of Cape Colony are Port Eilzabeth and East London. Some of the finest buildings in South Africa are in Capetown, which is so much in advance of Belfast that it possesses an electric tram service. Simonstown is the British Naval station for the Cape and it was here that the naval brigade, which had won so much fame for itself in recent battles had been organised, and it was here that the bulk of the Boer prisoners were detained.

There are two ways to choose from for the traveller on his way to Johannesburg, one is by train direct from Capetown a hot and weary journey of 62 hours, and the other way via Natal, first by sea and then by rail, which is preferable to the long train journey from Capetown, but which gives travellers a good chance of seeing Cape Colony scenery. The greater part of Cape Colony consists of Karoo. Any one seeing it for the first time would imagine himself to be in a desert and the very look of the place would drive a County Down Farmer to madness, and yet vast herds of cattle and flocks of sheep manage to exist there. Port Elizabeth is the most English town in the colony. Its chief export is wool. One remarkable feature of Cape Colony scenery is the want of trees. What trees did grow are not more than 20 feet high except the blue gum tree which has been brought from Australia, and which reaches a good height, and which are always planted near the farm house for the shade. Almost all South African trees bear flowers.

Natal was first settled in 1820, and differs considerably from Cape Colony as it is more fertile and is called the "Garden Colony" in consequence. The Natal natives are for the greater part of the Zulu stock ; they live in Kraals and are governed by their own chiefs. The Colony of Natal is essentially British, much more so than Cape Colony. Natal slopes upwards from the coast to the great Central African tableland at a rapid angle, and so causes an astonishing variety of climate from tropical to quite cool in the neighbourhood of Langs Nek, about 5,500 feet above sea level. Pietermaritzburg is the prettiest town in South Africa, and the railway which connects it with Johannesburg is a great feat of engineering skill, having been brought round mountains and alongside precipices with wonderful engineering skill in negotiating the several thousand feet between the sea coast and Johannesburg. Travelling, apart from railways, is rather rough and attended with considerabie danger. There are few bridges across rivers and streams, and these have therefore to be crossed by drifts or fords, which is a difficult matter in time of rain. Ladysmith, when I visited it, was a very small place with very miserable hotel accommodation. It stood on a plain, surrounded by hills on two sides.

Crossing into the Transvaal we may glance at its past history, and the causes that led up to the present war. The Boers who ruled it had formerly peopled Cape Co ony, had gone north rather than live under the flag of the most liberty-loving nation in the world. In 1877 the Transvaal was annexed by the British in order to save it from extinction by the natives, but through the weakness of the Government then in power, when the Boers rebelled in 1881, it was again allowed its independence. Conventions were entered into between the Imperial Government and the Transvaal in 1881 and 1884. Almost every provision of each of these conventions has been systematically and deliberately broken by the Boer government since they were signed. The result has been the present war. The Transvaal has a very fine climate which is almost perfect for consumptives, being dry and bracing. All the land is covered with grass and there is plenty of water, and so it is most suitable for stock farming. Rolling grassy plains with blue gum trees here and there round the farms and distant hills are the characteristic features of the Transvaal landscape Johannesburg is about 5,000 feet above sea level and in the winter is quite cold. The mineral resources of the country are not yet fully known, but from what is known it is one of the richest places in the world and has a great future before it. Johannesburg has been built up within the last 14 years by the industry and skill of the Uitlander. It is a very fine city and a credit to our fellow-countrymen. So oppressive, however, was the Boer Government that the guns of the fort were kept constantly trained upon it. Johannesburg was founded in 1886, and in 1897 it had a population of 100,000, one-half white. Mr. Bryce, the historian, says, "Johannesburg with its mining environs has nearly all the industry and wealth and half the whole white population of the Transvaal, a country, be it rememberd, as large as Great Britain, Pretoria and the lonely country to the north, east, and west has the rest of the population and all the power."

Considering the political situation before the war and the grievances of the Uitlanders, instances of which I met with in Johannesburg, it seemed to me clear that the war was inevitable, and was directly brought about by the Boer government for its own ends. The Boer does not care for hard work, but has no objection to enjoy the fruits of others labours. This explains in a great measure their attitude towards the Uitlanders, and their barbarity to the Natives.

The South African Republic was only a Republic in name, and was really a corrupt oligarchy, almost all the members of the government and most of the public men being known to accept bribes freely, and President Kruger has pushed into public and well paid offices as many of his 108 grandchildren as he could, whether they had the necessary qualifications or not. The fact is that the Boers are far behind the times; they are ignorant, taciturn, and suspicious—their ideas in dealing with others is to be "slim," *i.e.*, crafty. The Uitlanders had many grievances to complain of; it had been in trying to bring about a redress of those grievances that the present war originated. It is to be hoped that the issue will be on the side of right and justice.

In showing some slides of Pretoria, I may explain that

Pretoria is quite unlike Johannesburg, and presents a great contrast to it, being a quiet little country town, rather pretty, and surrounded by hills—upon the summit of each a fort. The only fine building in Pretoria is the Raad Zaal or Parliament House which cost £200,000.

The Orange Free State is almost entirely a stock raising country. Farming and shop-keeping are the only industries. Bloemfontein is a small country town, with nothing to claim attention. The climate of the Orange Free State, like that of the Transvaal, is almost perfect for consumptives. It is, however, like the rest of South Africa, subject to violent thunderstorms. While travelling in the Orange Free State I experienced one of the most tremendous thunderstorms it is possible to imagine, which raged for many hours. About 6 p.m. the sky clouded over, the rain fell in torrents and for hours the thunder rolled and the lightning flashed. Forked lightning, sheet lightning, and balls of fire followed each other in quick succession so that the illumination of the landscape was practically continuous. My friends and myself endeavoured to count the flashes per minute, but as they were coming in all directions we had to fall back on an estimate of 30 or 40 flashes.

In concluding, may I express the pleasure I have had in helping any one to-night to understand, even if faintly, the main features of our future Great Dominion in South Africa and the conditions which, until recently, obtained in one portion of it more particularly.

2nd January, 1900.

Mr. Thomas Workman, J.P., President, in the Chair.

IRELAND AND THE SCOTTISH ISLES; ANCIENT CONNEXIONS AND INTERCOURSE.

By S. F. Milligan, M.R.I.A.

(*Abstract.*)

I have been led to think of this subject in consequence of being one of a large party who visited these islands in the month of June last. On the occasion referred to two of the leading archæological societies—viz., the Royal Society of Antiquaries of Ireland and the Cambrian Archæological Association—chartered a fine steamer, and paid a visit to the Inner and Outer Hebrides, as well as several islands lying outside the track of tourists and ordinary steamers. I was much impressed with the similarity of the surroundings, physical appearance, and social conditions of the islanders as compared with our own people in Mayo, Galway, and islands on the Western Atlantic seaboard. In most of the islands Gaelic was still spoken, and was easily understood by Irish-speaking people. Their intercourse with Ireland was much greater three or four hundred years ago than it is now, due to the fact that in the early ages of Christianity and for many centuries afterwards Irishmen had a great disposition for roaming all over Western Europe, either as teachers, missionaries, or soldiers. About the year 560 A.D. Saint Columba formed the idea of going to Scotland to attempt the conversion of the Picts to Christianity, and, if successful, he hoped it would alleviate the condition of his countrymen who had settled in the Scottish Dalriada. Columba by his grandmother was related to the Dalriada Kings of Scotland, and his sympathies were drawn out towards his kinsmen who were so harassed by the Picts. He had spent the first forty years of his life in Ireland, founding churches and monasteries, and, as an itinerant missionary, preaching all over Ireland. He started from Derry, founded by himself, where stood his favourite monastery. He proceeded, accompanied by twelve of his followers, along the beautiful shores of Lough Foyle to Innishowen Head, where the little bay is still shown from which his curragh sailed to the Scottish Isles. It was about the year 563 he left Ireland, and, as he was born in 521, he was then forty-two years of age. He was full of energy and zeal, and had vast experience of mission work, when he made this new departure. Monasticism was taking a firm hold in Ireland about this time, and the more zealous of the Irish clerics were founding monasteries in the islands around the Irish coast as well as in the islands on the larger lakes. Islands were the favourite spots where these institutions first flourished. It is supposed that monasticism originated in Egypt in the third century, and rapidly spread over the then Christian world. What was for their safety and security at first—that is, their isolated position—ultimately during the Danish period led to their destruction. Columba stopped at several islands on his way. He called at Oronsay with the idea of remaining, but as he could see the summits of the mountains of Ireland from it he proceeded on to I, or Hy, now known as Iona, where he got a grant of land, and founded his famous monastery. For two years he never left the island, getting the little community into order, building his monastery, and tilling the ground. By his holy life, example, and conversation he impressed most favourably all who came in contact with him. His little colony was like an oa-is in the desert of that wild country. He was entirely successful in his mission to Brude, the Pictish King, who became a convert to the Christian faith. The leading nobles followed, and for years afterwards his labours amongst the Pictish nation never flagged until the whole nation embraced Christianity. The result he anticipated followed, and the mellowing influence of the Gospel caused a marked improvement in the relations between the Picts and the Scots, and led to their ultimate union into one Scottish kingdom. The monastery of Iona became celebrated over Western Europe, and for centuries afterwards shone as a bright beacon of Christianity in this far-off isle of the sea. In the burial-ground known as the Relig Oran there are buried 48 Scottish kings, 4 Irish kings, 8 Norwegian kings, and Egfrid, a king of Northumbria, also many great Highland chiefs and lords of the isles, so that very few spots on earth contain more remains of illustrious dead than does Iona. It was the parent of many monasteries not alone in Scotland and the Isles, but in Ireland and the North of England. Columba returned to Ireland at the close of his life to attend a great national convention held at Drumceatt, near to where Limavady now stands.

The Macdonnells became connected with Antrim, and formed an Irish family, the head of which is the Earl of Antrim. John Mor Macdonnell, son of Eion of Islay, and grandson by his mother of King Robert II., came to Antrim for a wife. He came over to seek the hand of Margery Bysett, a handsome woman, and heiress to all the lands included in the Glens of Antrim. The Bysetts were a noble Scotch family, who about the year 1242 were outlawed from Scotland for the supposed murder of the Earl of Athol, which charge was never proved. Leaving Scotland with all their means, they acquired the territory included in the Glens. Margery's father had married a daughter of The O'Neill, and, having no other child, the property fell to her. John Macdonnell was married in 1399 to Margery Bysett at Glenarm, where her family had a castle. They resided afterwards in Cantire, and occasionally at Glenarm. From the period of their marriage a greater number of the islanders settled in the Glens, which continued a favourite resort and hiding-place when any trouble arose in Scotland. The intercourse between Antrim and the Isles, particularly Islay and Cantire, from this time became very close. There was constant going to and from the Isles, and occasional forays were made as far as Castlereagh, when large preys of cattle would be driven back to the Glens, and thence to Rathlin, to be taken afterwards to Islay at their convenience. In the year 1551 a feud existed between the O'Neills of Castlereagh and the Macdonnells, and the latter made an incursion into Clannaboy, from which a great prey of cattle and other valuables were lifted and removed to Rathlin. The Macdonnells were able to strike a blow at England more easily through the North of Ireland than any other quarter, and the Government in Dublin made up their mind to put them down. This was in 1551, when Elizabeth was Queen. Four ships were fitted out, and a large number of soldiers placed on board to proceed to Rathlin, and, if possible, carry off the plunder that was supposed to be stored there. The ships, on their arrival, proceeded to land an armed force of three hundred men, part gunners and part archers. The Macdonnells awaited them on the shore, prepared to give them a warm reception. By a sudden upheavel of the sea or a great Atlantic roller the boats were driven high on the rocks, and before they could recover themselves the Macdonnells attacked and slew every man except the two captains. These were retained as hostages, and afterwards exchanged for the younger brother of the chief, the afterwards celebrated Sorley Boy, who was then a prisoner in Dublin Castle. The Macdonnells at this time owned Dunluce Castle, which they had taken from the MacQuillans, also Kenbane Castle and Dunanynie Castle, built on a cliff near the sea at Ballycastle, which was the favourite residence of Sorley Boy. Ballycastle was previously called Port Brittas, and was the place principally used for landing or embarking for Cantire. It was also from here that Fergus was supposed to have embarked when he and his brothers founded the Scottish kingdom. A little to the east of Ballycastle is Port Usnach, from where Naysi and Derdrie sailed to Alba.

There were frequent intermarriages between the Macdonnells and the leading families in the North of Ireland. The Macdonnells succeeded in holding a large portion of their

Irish property, whilst they lost Islay and Cantire. We have tried to show that an ancient and intimate connection existed between Ireland and the Scottish isles ; that they were of the same race and language ; and that hundreds of years ago there was a close and intimate union existing. They retain the name that we have lost—that is, Scots, whilst we are called Irish. When in Dunvegan Castle we were shown a drinking cup made in the North of Ireland 400 years ago. Maguire, of Fermanagh, in the fifteenth century married a lady from Skye, Catherine Magrannal, and this cup was made at her expense and forwarded as a present to her relatives there. The high crosses of Ireland were reproduced in Scotland and the isles, and the island monasteries of Ireland and Scotland were similar in both architecture and discipline. The ruins we examined on the Flannan Islands and North Rona have their counterparts in Innismurray, Arran, and the Skelligs. If you would understand the social condition and the mode of life in Ireland in the Tudor period. you may study it at present in the Island of Lewis and other islands, where the mode of living has altered very little for hundreds of years. Fynes Morrison, who was secretary to the Lord Deputy, and who visited the Scottish islands, writes in 1598 that the West of Scotland carried on trade with Ireland in red and pickled herring, sea coal, and aquavitæ, in exchange for yarn and cow hides. The Scottish Parliament passed an Act to promote temperance and stop the importation of wine to the islanders. The large landowners, however, were permitted to import wine, and the quantity was fixed in proportion to their property. MacLeod, of Dunvegan, might purchase 876 dozen bottles, smaller proprietors 220 dozens. Claret was the wine in most demand.

The Scottish people have done a great deal to attract tourists to their country. Besides providing extremely cheap railway and steamboat travelling, they have availed themselves of the halo of romance that Scott has shed on so many spots in Scotland in his poems and stories, and they continue to keep them well to the front as an additional attraction to their fine scenery. We might do a little more in this way in Ireland. Our country is not devoid of places possessing great historical interest. All around our Antrim coast, no further back than three hundred years ago, was bristling with stirring events. Even two hundred years ago matters of the first importance took place in our immediate neighbourhood—the landing of William III. at Carrickfergus, and his march to Belfast on his way to the Boyne. The old town of Carrickfergus, which took its name from the Dalriadan King, has a history of very great interest all through the Anglo-Norman times. What varied people trod its streets—the great De Courcey, King John, and many a gallant Norman knight ; Irish chiefs and gallowglasses, the Chichesters, lord deputies, and others who lived there or came to visit this stronghold of English power. We can almost fancy we can hear the clash of swords when Sir James Macdonnell attacked Sir John Chichester when returning after collecting taxes over the glens. The battle took place a little on the Larne side of Carrickfergus, and resulted in Sir John being slain and his army of Englishmen being defeated. The old ruin of Olderfleet at Larne marks the spot where Edward Bruce landed with 10,oco Scots in the year 1315 for the conquest of Ireland. As we proceed around the coast we reach Glenarm, where the castle of the Bysetts stood on the south side of the river, opposite to where Glenarm Castle now stands. Near Waterfoot stand the ruins of Red Bay Castle, which was repaired and lived in by the Sir James to whom we have now referred. Further round near Cushendun Shane O'Neill, the great chieftain of Tyrone, fell, slain at a banquet by the Macdonnells in revenge for the death of their chief James, whom O'Neill kept prisoner till his death. Shane's head was cut off and taken by an Englishman to Dublin Castle, where it was placed on a spike over the gateway. Further along the coast we reach Ballycastle, the ancient Port Brittas, where the Scots landed and embarked on their journey to and from Cantire. Here still stands the ruins of Sorley Boy's Castle of Dunanynie, his favourite abode in life, and where he died. A little distance outside Ballycastle along the base of Knocklayde there was fought one of the fiercest and most sanguinary battles of that time. Shane O'Neill, without any justifiable reason, attacked unexpectedly and treacherously the Macdonnells before the latter could collect their full forces. The army of the Scots was almost exterminated, and the chief and his brother—Sorley Boy—were taken prisoners. James was sent to a castle of O'Neill's at Carrick, in Tyrone, and all ransom refused, while his brother Sorley Boy was sent to Dublin Castle. We cannot omit a reference to Dunluce Castle, which all through the Elizabethan age held an important position in Irish history. Here the eldest son of Sorley Boy—the brave Alexander—defended the castle most heroically against Perrott, the Lord Deputy. Between the Causeway and Ballycastle is the ancient castle of Dunseverick, much older than any we have mentioned, which brings us back to Cormal Cearnach, a Red Branch knight, who resided there. On a hill near to Cushendall is pointed out the grave of Ossian, the great Irish bard and poet. These few references, taken hurriedly, may suffice in the direction I have indicated, and point to the course that should be taken to popularise travel in Ireland, which, added to its scenic beauties, should make our country the favourite resort of travellers.

The lecture was illustrated by upwards of eighty specially-prepared lantern slides of both Pagan and Christian antiquities and scenery taken during the visit already referred to by Mr. Milligan.

The cordial thanks of the meeting was accorded to Mr. Milligan on the motion of Dr. Moran, seconded by Mr. Wm. Gray, M.R.I.A.

6th February, 1900.

Mr. Thomas Workman, J.P., President, in the Chair.

SOME THOUGHTS ON ROME.

By Conway Scott, C.E.

(*Abstract.*)

At the outset the reader surveyed the early history of the city on the Palatine hills, and inquired into the causes contributing to the greatness of the Roman power. But walking through the streets of the Rome of to-day, with the mind full of memories of the past, one could hardly realise that it was Rome, the once mighty mistress of the civilised world. Everything became so modernised that little remained of the old Pagan city on the Tiber. The ancient architectural magnifice ce of Rome was dealt with, and a minute description given of the present state of the ruins of those monuments of former greatness. He considered that one of the causes of the fall of Rome was the extent of her possessions, which more or less extinguished her early spirit of patriotism. Another cause was her opposition to Christianity, which in the end won its triumph, and subdued a far vaster realm than ever was held sway over by Roman dictator or Emperor. But the Roman civilisation formed a splendid basis for the Christian civilisation, and to day the once capital city of the world was as famous for sending out the soldiers of the cross to conquer the world for Christ, as ever it was for sending out its legions to win earthly dominions.

THE GROWTH OF THE INK BLOT.

By W. H. Patterson, M.R.I.A.

(*Abstract.*)

The author described some experiments on the markings produced by the application of various coloured inks to blotting paper and exhibited some remarkably brilliant "blots" which he had made, or rather which had made themselves by the methods described below. Some of them bore a wonderful resemblance to the pictures that have been produced of the corona during an eclipse of the sun, others looked like paintings of botanical subjects, but all possessed a strange kind of constructive beauty and harmonious blending of colour. Very frankly Mr. Patterson admitted that the "blots," so far as he knew, were of no practical use further than to illustrate in a pleasing manner the principal of capillary attraction.

In forming the blot, the materials or appliances required are some ink, some white blotting paper, and a piece of cotton cord to serve as a wick. The most convenient way of causing the blots to grow is by placing a wick in a bottle of ink so that the ink can freely rise to the upper point of the wick. The lower side of a sheet of blotting paper is then brought in contact with the point of wick, and supported there in any convenient manner, for instance, on the edge of a bowl or basin, inside which the bottle of ink may stand.

The ink immediately commences to rise through the wick into the paper, and quickly or slowly, according to the nature of the ink, spreads into a blot of more or less circular form, until it reaches the edge of the paper, but it is not well to let it go quite so far if one wishes to have a pretty well shaped blot. By transferring the blotting paper from an ink of one colour, say red, to a bottle containing a different coloured ink, say green, and letting the paper take up more or less of the various colours, a great variety of very remarkable and unexpected results will be obtained. Very soft and pretty blots can be made if some clear water is fed with a camel's hair brush to the upper side of the blotting paper, while the lower side is still receiving a supply of ink from the wick. The character of the blot can in this way be varied in an almost endless manner.

In the case of black or blue black inks, it is a curious fact that nearly every different make of ink forms a different kind of blot, more especially as regards the edge, which is sometimes beautifully branched or scalloped. There are also remarkable differences as to the rates at which different inks will flow or travel through the paper while the blots are growing.

6th March, 1900.

Mr. Thomas Workman, J.P., President, in the Chair.

"THE POSITION OF BELFAST IN RELATION TO TECHNICAL INSTRUCTION UNDER THE AGRICULTURE AND TECHNICAL INSTRUCTION ACT."

By William Gray, M.R.I.A.

Mr. Gray said that the time had arrived when it became necessary to readjust our arrangements for imparting technical instruction in Belfast, and that he proposed to discuss the merits of that portion of the Agriculture and Technical Instruction Act of last Session that applied more particularly to technical instruction in County Boroughs. He would briefly indicate the lines along which our present system of industrial education has been developed. In the middle of last century the first institutions were founded in England, Scotland, and Ireland for the promotion of technical instruction, or for the practical application of Art and Science to industries. Mr. Gray related the history of the first agencies founded in Great Britain and Ireland for the practical application of Art and Science to industries. The Board of Trustees in Scotland, founded in 1727, the Dublin Society, incorporated by Royal Charter in 1749, and the Society of Arts, London, founded in 1754. He referred particularly to the original School of Design established in London in 1837, and its result, the founding of what we now know as "The Department of Science and Art." In Ireland the Dublin Society originated the Botanic Gardens, the Industrial Museum, School of Art and Library, which in 1877 were transferred from the Royal Dublin Society, a voluntary agency, to the care of the Science and Art Department, under the Crown.

Reference having been made to the schools established by its agency and to the opposition with which the Government arrangements were met before the desired aims were accomplished, Mr. Gray went on to say that it was this spirit of independence that must govern our action in dealing with the Agriculture and Technical Instruction Act, which should assist, but not supersede voluntary effort.

In the first quarter of this century the industrious and progressive artisans began to feel the necessity for some form of technical intstruction, and under the skilful leadership of Dr. Birkbeck mechanics' institutes were founded in most manufacturing localities. At that period Belfast was not behind; indeed, it was then foremost among the towns in the kingdom in the cultivation of literature, art, and science. This educational work was in fact the foundation of that measure of material prosperity Belfast has enjoyed in modern days. A meeting was held in 1807 to receive "The report of the committee appointed to arrange a plan for the Government of the Belfast Academical Institution." That plan embraced technical instruction in Chemistry, Botany, and Agriculture, and such subjects as may be "conducive to the improvement of the agriculture, arts, and manufactures of the country." What a clear vision those old Belfast folk had of what is now about to be unfolded possibly on their own premises?*

Mr. Gray then proceeded to explain how the old "Schools of Design" originated with the Select Committee of the House of Commons appointed in 1835 "to inquire into the best means of extending a knowledge of the arts and the principles of design among the people, especially the manufacturing population." As the first School of Design founded in Somerset House was not quite a success, because of its limited sphere

* Since the lecture was delivered the County Borough Council has taken a site for the proposed Technical College on the grounds of the Royal Academical Institution.

of action, the Government in 1841 determined to further the creation of schools of design in certain manufacturing centres and to provide teachers for this purpose. Under this arrangement the School of Design was established in Belfast, subsequent changes in the conditions under which aid was given to local schools, caused the Belfast school to be given up although it had contributed works to the first exhibition of students' works ever held in London. The Belfast School of Art, which suceeded the old school of design after some years, was opened in 1870, had made steady progress, and in the School of Science, established two years later in connection with the Working men's Institute, pupils had taken high positions in the annual national competitive examinations. The labours of the Royal Commission on Technical Instruction during 1882 and 1883 gave a powerful stimulus to local efforts for the promotion of technical instruction, and while the Commission was sitting Belfast was stirred up to establish the Hastings Street School, which has steadily maintained a precarious existence ever since, under most discouraging circumstances. The fact, then, that we have struggling for existence a school of art, a science school, and a certain form of Technical school demonstrated the desirability and possibility of having a good combined central Technical school if sufficient funds were forthcoming. Belfast has always for its voluntary educational agencies but limited means, and divided interests hindered their effective operation, as in the case of the scheme formulated in 1887. Having noted the want of co-operation among the various agencies engaged in technical instruction in Belfast, and the evil consequences arising therefrom, Mr. Gray drew attention to the fact that by the Technical instruction Act of 1889 city councils were enabled to aid local effort to provide technical instruction to the extent of 1d in the £1. The Act was welcomed throughout the kingdom, and new schools were everywhere established under its provisions. In Belfast, although every effort had been made by public appeal, deputations, and personal application to induce our City Council to follow the lead of the chief cities and towns of the kingdom, up to the present the County Borough Council of the city only granted from the rates the sum of £800 per annum, which is distributed in an arbitrary way between our four industrial schools, that for many years have been hampered by straightened financial difficulties, to the serious disadvantage of the technical educational prospects of the city. Mr. Gray referred very fully to the effect of the Customs and Excise Act of 1890, under which large sums are rendered available for technical instruction in England, Wales, and Scotland, and the establishment of the City and Guilds of London Institute, which in 1878 founded a central and other colleges in London, in which technical instruction was carried on to an advanced stage. Mr. Gray clearly pointed out how Ireland was handicapped by having no advantage under the Customs and Excise Act for the promotion of Technical Instruction, and that owing to the apathy of our City Council, the Technical Instruction Act of 1889 was not put into operation.

Mr. Gray said that, amid the chaos and confusion that prevailed in the political atmosphere of Ireland in 1895, a far-seeing intellect perceived and followed up an opening that gave some prospect of securing a substantial advantage for Ireland in favour of the agricultural and industrial classes of the country. The steps taken in the formation of the Recess Committee by the Right Hon. Horace Plunkett, M.P., and the important report of the Committee's labours laid before the Chief Secretary in August, 1896, was the origin of the Agriculture Act introduced into Parliament in 1897. Fortunately this as then drafted was not passed, owing to pressure of other business, but it was reintroduced in an amended and much-improved form, and and, without any help from the Belfast municipal authorities, was passed into law last year under the title of "The Agriculture and Technical Instruction Act." Under the provisions of this most welcome Act Belfast and other county boroughs in Ireland will be enabled to readjust the local arrangements for technical instruction, and if Belfast County Council would but do its duty and try to make up for past delay it would be enabled to formulate and carry out such a scheme as would equal that of any city in the kingdom, and be worthy of our educational and industrial traditions and advancement. The Act provides for the establishment of a Department of Agriculture and other Industries and Technical Instruction, with the Chief Secretary as President, and a Vice-President appointed by the Crown. Mr. Gray mentioned that the technical instruction branch referred more particularly to Belfast, and noted several matters of importance connected with the duties of the Board of Technical Instruction and the consultative Committee. The funds at the disposal of the department, in addition to the cost of administration, will be about £166,000 per annum, or including departmental expenses, a total of £200,000 per annum. Of this amount a sum of £55,000 per annum will be allocated exclusively to technical instruction in Ireland, not depending on an annual Parliamentary vote, but conferred by direct endowment. It is not only possible, but it would be desirable, for the county councils, say of Antrim and Down, to work in unison with Belfast County Borough Council in the working out of their respective schemes. All educational efforts should be co-operative, and for this purpose scholarships may be founded connected with National and other country and town schools to enable students to pass on to the more important central school in Belfast. All educational agencies should be considered in the scheme, so as to avoid friction or overlapping. For this reason no really effective scheme can be formulated unless with the co-operation of all our educational agencies. The actual amount to which Belfast may be entitled will depend upon the division to be made of the £55,000 by the department with the concurrence of the Board of Technical Instruction. Assuming that the division will be in equal parts, then Belfast, in proportion to its population, would receive a little over £10,000 a year from this source of income, exclusive of the income from the penny rate under the Act of 1889, and the additional penny rate under the act of last year. The purposes on which the money is to be expended will be determined by the Department and not by the City Council. As the powers and duties of the Science and Art Department in Ireland and the administration of grants for teaching art and science will be transferred to the new department, the usual result fees and grants hitherto paid are still available, from which we may calculate upon an increase of £1,000, and, if the local contribution from the rates is only 1d in the £1, a total income of £15,000 a year may be calculated upon, exclusive of pupils' fees, provided that the £55,000 is divided into two equal portions by the department.* Attention was called to the fact that the "department will not approve of any scheme that is not assisted from money provided by local authorities or from local sources," and that the financial aid under the Act will not be limited to any one institution, and the amount to be given to the Central School will depend upon how far it will be conducted in harmony with all the other local educational agencies.

Mr. Gray strongly advocated the immediate formation of a composite managing committee, and said that it was shown by the records of Europe and America that when the agencies employed for the management and maintenance of educational institutions are limited to municipal control such institutions are rarely successful, but similar institutions become living realities when they command the liberality and active exertions of individual citizens in their private personal capacity, untrammelled by the formalities of office. Hence it will be very desirable that a good Composite Committee should be formed to draft the scheme and carry it into execution, as has been found to work well in all the chief towns of the kingdom, and in the County Council. The appointment of a composite executive committe in Belfast was recommended by the Chief

*The Department has for the present apportioned £20,000 to the County Boroughs, £20,000 to the Rural districts, and keep in reserve £15,000.

Secretary and Mr. Horace Plunkett. Assuming that it was formed, Mr. Gray expressed the opinion that it could not set before it a higher or better aim than to fully realise that form of a technical instruction institute suggested by the composite committee that met during the Mayoralty of Sir James Haslett, M.P., in 1887, which proposed to establish "a central institution for the teaching in a combined form of art, science, and technology, as applied to the trade and manufacturers of the district, utilising and combining so far as possible for this purpose the school of art, schools of science and technology, and the technical school." A full definition of what was meant by the expression "technical instruction" was given, and the views of many well-known authorities quoted. Proceeding, Mr. Gray said they could not do better than to provide without delay a central institution in which our present excellent Art, Science, and Technological classes may be properly and comfortably housed, with ample space, class-rooms, laboratories, and lecture-rooms, equipped with all necessary fittings and appliances of the most approved kinds, and conducted by a staff of specially qualified teachers for each department of the work, capable of rendering teaching assistance or advice to any school or class in the city. Thus appointed, together with bright, cheerful, and attractive surroundings, they might fairly calculate that the 1,500 pupils now receiving instruction in their local art, science, and technological classes would be increased to not less than 3,000 in the near future, with a promise of proportionate advantage to our local industries. Enlisting into their educational scheme every available auxiliary, they should extend and should complete the intended Technical Museum and Art Gallery connected with the Public Library, and every function connected with that institution should be subordinated to the purposes of technical instruction in its widest and most liberal aspects, and placed under the management of the composite technical committee, and conducted by them as part of the Technical Instruction Scheme for the city.*

*The County Borough Council have joined the Library Committee and the Technical Instruction Committee into one Committee.

Although elementary teaching will be excluded from the proposed technical institution, the elementary schools under the National Education Commissioners must not be altogether overlooked in our technical scheme. When the national education scheme was drafted in 1838 it was far in advance of an educational system in Britain, and it was intended to be technical in its character, but sectarian conflicts eliminated that important element from our national system of industrial education. This form of technical instruction should be restored. The late Commission had recommended its renewal, and in future technical instruction would be encouraged so as to prepare the young pupils for the next step in the technical institutions of the county boroughs, our National schools would then be helpful auxiliaries to the central institution; their students at entrance to the Technical College would no doubt be tested by examination, and classed accordingly. Scholarships may be founded for competition among the National school pupils preparing to enter the Technical Institute, and also scholarships to enable advanced pupils of the Technical Institute to go forward to the technical branch of the Queen's College, the Royal University, and the Royal College of Science in Dublin.

Evening continuation classesshouldbe promoted in connection with our National schools, and to this end, as well as to supply the necessary school accommodation now required for Belfast, Mr. Gray advocated the opening of four National schools in Belfast under the Technical Committee to become models for their respective localities, if not for the whole country. These would be evening as well as day schools, and they may be further used as branch Libraries. These should be properly equipped, and officered by a staff of qualified teachers enabled to discharge their professional duties untrammelled by clerical obligations. Mr. Gray in conclusion referred to the fosterage laws of ancient Ireland that provided for certain forms of technical instruction, then the native Irish were disposed to industry, and skilled in workmanship, qualities that may be revived with great advantage to our industrial progress. The opportunity is given Belfast to-day to help to revive the best forms of our national skill open up new fields of industry, and by a well considered scheme of technical instruction set an example for all Ireland, and justify anew the imputed title of Belfast as the industrial metropolis of Ireland.

Professor Fitzgerald, in opening the discussion, said he wished to emphasise what Mr. Gray had said as to what the old Belfast people were in the beginning of the century, compared with what they were at the present time. What Mr. Gray had said was a most interesting lesson, and showed that Belfast was fifty years behind the place where it was fifty years ago. Could they conceive that the old Belfast people, who were willing to allow a little money out of their pockets to build such institutions as that in which they were met—could they conceive that they would allow such an important place as the Victoria Institute to break down in the way it had been allowed to go?

With regard to the necessity of breadth of the local scheme touched upon by Mr. Gray, he might say the Corporation had got a peculiarity of never saying anything about anything that they could help. They appointed a mixed Committee, who drew up a scheme which was fairly broad, and as he was on that Committee he could give them some idea of the plan. The general notion was that the Corporation Technical Committee should co-opt a number of outsiders, not exceeding one-half of the members of the Corporation, to form a mixed Committee for working the technical education scheme in Belfast, and that the immediate working of schools should be regulated by a board of heads of departments of schools. The departments of the school were not precisely finally settled, there was a list made by the Committee, but it would be liable to alteration from time to time. Among the departments of the school it was intended to comprise a set of preparatory evening classes for youths, some of whom were serving their apprenticeship at the present time. It has been found that this was necessary in other large towns. In order that boys should not be debarred from taking advantage of the superior classes of the technical schools it was necessary to have preparatory classes. The schools were to be built exactly opposite the building in which they were assembled. and pupils would not be admitted to the regular technical classes who were not properly prepared. A subject which had not been mentioned by the lecturer, but which he (Professor Fitzgerald) hoped would be included, was cookery. It was an historical fact that the ancient Irish never seemed to mind what they ate. He himself thought the preparatory classes should be held in various parts of the city, but he believed they were to be held only in the central institute. With regard to the breadth of the scheme, he did not know whether those present in the Y.M.C.A. when Mr. Balfour was there paid sufficient attention to the strong reference that was made to the necessity in Ireland within the next few years of training a large number of teachers. That appeared one of the primary difficulties with technical instruction. In the scheme special provision was made both for the agricultural and technical instruction teachers. The agricultural teachers, he thought, meant nothing more than teachers in technical schools outside the county boroughs. He had noticed in the papers that a considerable number of national school teachers were wanting to be trained in manual instruction, and existing teachers, with few exceptions, had no training in work of that kind ; but to that he would not refer. The agricultural teachers would be paid out of the grant which would go to the agricultural division out of the £55,000 to which reference had been made.

Mr. Stevenson was of opinion that the apathy with which technical instruction was regarded in Belfast was decidedly disheartening to all interested in the subject. It would seem as if Belfast manufacturers had a poor opinion of their fellows when it came to anything affecting the arts or sciences. He believed a great number of the young people in Belfast who used their hands might increase their comfort and usefulness very much if they could add a little brainwork to their labours.

The new institution would assist such, and no doubt there would be a great improvement in the prosperity of the city after its establishment. He had had recently several hundred designs sent him from various parts of the country, and, while the senders no doubt were well educated, the results from an artistic point of view would have been laughable had one not felt some sadness in looking at them. In conclusion, he wished to express the pleasure he felt at listening to Mr. Gray's paper, and his entire confidence in the far-reaching effect which the establishment of this institution would have in their midst.

Mr. Milligan said everyone had been delighted with Mr. Gray's admirable paper. One of the most intelligent and cultured audiences he had ever seen in the hall he looked upon that night, and it was a great pity the members of the Council did not come there for information—the information which they needed very much. They had made a move as to site for the new building, but he would have preferred it at Marcus Ward's, because it would have saved them £1,000 a year. However, money was of no importance to the Council, and it was better to have the present site than none. He hoped that Mr. Gray's Lecture would be printed, and that the members of the Town Council would read it, for he felt assured it contained information they would get in no other place. Though late, they were not too late to do well. The future prosperity of the city depended largely upon the interest taken in the matter, and he hoped the technical school would be pushed forward as quickly as possible.

Mr. W. Armstrong regarded the subject from two points of view—the cosmopolitan and the patriotic. He expressed the opinion that they were bound to go on with it, because other nations were making progress, and if they would simply sit still and pat each other on the back they would soon find themselves fifty years behind the times.

Mr. Shaw thought the great linen manufacturers of Belfast might have established a school of design for their own purposes, and that the great shipbuilding concerns might have done something similar for their respective places of business. Nothing, however, had ever been done. He spoke in favour of drawing and the teaching of the chemistry of common things, and said that without some practical work even the elementary teaching of chemistry would be useless. There might be a danger of the cry of technical schools supplanting the proper work of other schools.

Mr. Wheeler asked on what principle Mr. Gray had arrived at the figures representing the two divisions of the £55,000 grant.

Mr. May inquired what class of people would be benefited by the teaching in the school regarding woodcarving.

Mr. Gray in replying said there would be a prescribed course for pupils, with an examination, and after two years they would be put to practical work. The Technical instruction given in the Central School would be limited as much as possible to those practising it in the way of trade. No encouragement should be given to mere amateur aims after educational embellishments. All must be practical, and calculated to promote our local industries. Replying to a question, Mr. Gray said that the amount available was clearly given in the Act, and included not only aid to the Central School, but was available also for any other educational effort. It was a mistake to think that all the funds provided by the Act will be devoted to the Central College. In replying to Professor Fitzgerald, he might say it was an extraordinary thing that after ten years waiting we had no official knowledge of what the Town Council proposed to do. If the project was to be successful it must be kept in touch with the public, and the people should know what the members of the Council were doing.* Of all the sites best adopted for the purposes of a technical school, he thought the one chosen in 1887, immediately behind the Public Library, was the best, because in that place they could have had all their schools to-

* Up to the time of going to press no acceptable scheme has been devised. No composite committee has been formed, and the persons most interested in Technical instruction have not been consulted.

gether. We do not object to the site selected on the grounds of the Royal Academical Institute, only for its cost, which must come out of the ratepayers pocket, and not out of the funds available under the provisions of the Technical Instruction Act. The Council should go in for a building for educational purposes, and not for a building to simply decorate the city.

3rd April, 1900

MR. ROBERT YOUNG, C.E., J.P., Vice-President in the Chair.

SOME OF THE WORK DONE BY COMMITTEES OF THE BRITISH ASSOCIATION.

BY PROFESSOR MAURICE F. FITZGERALD, B.A., M.I.M.E.

THE Lecturer began by remarking that many people, including some who might have attended meetings of the British Association, had little, if any, conception that that society was more than an organisation for carrying out annually a sort of scientific picnic. The Association, like many other societies, had a yearly meeting or conference, held usually in the end of summer or beginning of autumn, which lasted for a week, and which constituted, to the outsider, the most obvious and apparently important part of the work of the Association. This impression was natural enough, and was encouraged by the large attendance of scientific and other notabilities, and by the immense number of papers read and discussed, during this annual meeting, the Association being divided into sections (now numbering nine) which have separate meeting rooms, so that a large number of papers are read, or subjects discussed every day simultaneously. As an example taken at random, the Bristol meeting of 1898 might be instanced, when the number of items in the sectional proceedings was 304. It was pointed out, that however large the amount of work represented by the labour undergone in listening to the maximum possible number of these communications, by any person attending the meeting, such work was not itself of any particular scientific value, and that the real importance of the Association was liable to be more or less masked by the "fuss" attached to the Annual meeting. It was remarked that, as in other societies holding periodical meetings or conferences, a great part of the really valuable work of the British Association was done by committees appointed to investigate particular matters, and to report on them to the annual meetings. The committees pursued their work all the year round, sometimes for many years in succession, and were aided by money grants from the Association. The total sum so granted since the formation of the Association in 1832 up to the present time amounted to about £66,700. In the Report of the meeting of British Association at Bristol in 1898, above referred to, 723 pages were occupied by Reports of Committees and 303 by transactions of the Sections at the Bristol meeting itself, the total number of Reports of Committees being nearly fifty, and a good many of these were interim reports of Committees, some of which have been at work for over thirty years. The Lecturer proceeded to remark on the character and influence of the work of various committees of the Association, beginning with reports by Fairbairn and Hodgkinson, so far back as 1837, on Hot and Cold Blast Iron, whose relative merits were at that time a matter of considerable importance, in consequence of the then just beginning development of railways, and the free use of cast iron in bridges and girders. Ultimately, as we now see, improvements in the manufacture of wrought iron and steel and the consequent reduction in the cost of bridges constructed of these materials, compared with the cost of cast iron, coupled with the relative disadvantages of the latter, had led to the abandonment of cast iron as a material for bridge structures of any size, but until well on in the fifties cast iron was an important part of the structure of many bridges, and its properties formed the subject of investigation by the Association. These investigations were of material use and assistance to the Commissioners on Railway structures, whose report, made in 1848, forms the basis of the present Board of Trade regulations for Railway Bridges and similar works.

During the period from 1830 to 1860 a vast increase in the use of steam power for manufacturing purposes took place, and steamships came into existence capable of making long sea voyages. Among the matters of importance on which information was deficient at the time, not the least was the provision of adequate strength in boilers, since the problems arising from increase of steam pressure have always been prominent, and steam pressure has steadily risen since the days of Watt. Accordingly there were found in the records of the Association the investigations of Fairbairn on the effects of temperature on the strength of wrought iron in 1856, and on the collapse of circular flues in 1857. This latter may be described as forming the foundation for the design of all furnace flues since, and is still the ruling authority in this matter, its conclusions having been early embodied in the rules for the strength of circular marine boiler furnaces adopted by the Board of Trade, as well as in the principles of design used by all the leading manufacturers of land boilers of the Cornish and Lancashire types. About 1860 another matter connected with the strength of iron and steel came into greater prominence than before, namely, the effects on the material of repeated loadings and unloadings, reversal of stress from tension to compression and *vice versâ* at short intervals, and of vibration. Again here we find the most important part of the early work reported on by the British Association, beginning about 1860. This work was, some seven or eight years later, taken up by the Prussian Government in a more thorough and complete manner than could have been effected with the resources of the Association, and has been continued at Government expense ever since. It is of a kind which must unavoidably take up much time to carry out.

Another matter which occupied much attention for a good many years was the performance of steamships in respect of the relations of power and speed. Up to about 1865 little real progress was made owing largely to false impressions as to the importance of details of form, and the consequent controversies as to the merits of "wave line" forms, "hollow" versus "full" lines, and the like. The Association, however, got together a committee of men, including Mr. Froude, Professor Rankine, Robert Napier, and others, who really did understand what they were about, and, after a few years, placed the question on a proper basis. In about ten years, that is in 1874, the Admiralty became so impressed with the importance of this work that they established their experimental tank at Torquay for the testing of ship's models, and the German and U.S. Admiralties or Navy Boards have since followed suit. It may seem strange that a body so difficult to move in any new direction as the British Admiralty is commonly assumed to be, should have taken up this matter before any private shipbuilder or foreign government did, but apart from the fact that government departments occasionally have the sense to act rightly, the difficulties of predicting, even roughly, the speed and horse-power of new ships always pressed much more severely on the Navy designers than on others, partly on account of the proportions of the ships they dealt with diverging, as a rule, much more from the ordinary types of cargo or passenger steamer than these do from one another, and partly from the wide differences between different ships of the Navy itself, specially accentuated at the time referred to, by the then recent introduction of ironclads. Besides this, the Admiralty had received a very severe lesson on the unwisdom of neglecting good advice from sensible people, it having been made abundantly manifest that, if they had attended to reports on the stability of ships which had been pressed on their attention by the British Association about 1863, and carried out very simple tests fully explained therein, but which the Admiralty officials stated were not practical, the "Captain" would have been ascertained to be unfit for being sailed in the way which led to her capsizing. After the accident of course, it was found that the tests of stability proposed were quite easy to carry out, and they have been ever since made on every new ship in the Navy.

The enormous strides made by the electrical industries in the last twenty five years were referred to by the lecturer, and it was shown that, until the matter was taken up by the British Association, the commercially necessary means of measuring electric quantities were so deficient as to be, for most practical purposes, altogether wanting. For telegraphic purposes—or at least most telegraphic purposes—the actual amount of electric energy required to be supplied was too small to call for any particularly accurate measurement, nor did the apparatus involve, as a rule, any very close regulation of voltage or current. Consequently although the scientific principles on which the measurement of electric quantities is made had been laid down, and some standards of measurement, corresponding, in matters electrical, to the standard yard and pound in matters of ordinary measurement, had been made or proposed to be made, still the whole subject of dealing with electricity on an industrial scale was practically as much in a state of chaos as the buying and selling of coal would be if the mines all sold it by the truck load, but every mine had a different sized truck, whose capacity had never been measured, to shippers who dealt in it by the shipload, every man according to his ship, but the tonnage of the ships was not ascertained, and the consumer received it by the cartload, every dealer pleasing himself as to the size of his cart, and building new carts when the old ones were worn out, as near the former size as he could judge by the eye.

About thirty eight years ago the Association set itself to rectify this state of things, and for that purpose appointed a committee on Electrical Standards, with a view to providing means for doing with electricity what corresponds to providing foot rules, weighing machines, and pounds or other weights to measure the coal trucks, ship loads, and cart loads, in the case of the coal. The Committee rightly judged the matter to be one of international importance, and began by collecting advice on the system of measurement to be employed, as well as all other information relating to existing standards from foreign as well as British sources. It very soon appeared that even among scientific workers, methods of measurement were often used which were (comparatively speaking) not much more accurate for the purpose in hand than measuring off lengths of cloth by the reach from finger tip to shoulder are, and that one of the very first steps to be taken was to find out accurate methods in measurement, and to construct accurate instruments. The trouble occasioned by these things may be realised when it is found that it took about seven years to produce a really reliable standard resistance. Everything about it was ill understood at first. The most suitable material was unknown ; wires which were supposed to be exactly alike in constitution were found, on exact testing, to differ materially: alloys supposed to be permanent were found to alter irregularly in time. Different experimental methods for arriving at the same result were found to give discordant results, and the apparently small and obscure causes of the discrepancies had to be searched out and corrected. The result has been that electricity can now be dealt in for industrial purposes as easily and accurately as any other commodity, and in some respects more easily, since the fundamental system of weights and measures used is international, both in actual value and names of the quantities, so that pressure in volts, current in amperes, and power in kilowatts mean the same things all the world over.

It is probably not too much to say that no authority except the British Association could have been brought about this result. No other body possessed the scientific weight and insight required to initiate the system, no other body could have enlisted such able assistance, and no other body could so effectually insure the universal adoption by the world of the system of measures and nomenclature brought forward by it, and have led up to the international conferences required for that adoption to be officially ratified. The Lecturer adverted to the small cost at which the work of the Association's Committees was done, for though the sum total of the grants for scientific purposes already referred to (£66,700), expended since 1832, might seem pretty large, it really represented but a fraction of what would have been paid if the same investigators had been employed to do the work as part of their regular paid professional or commercial work. Many eminent professional men, whose fees when called in for advice might sometimes be reckoned at pounds a minute, or men, like Sir W. Fairbairn and others, who gave the use of their works, materials, and the assistance of their staff, carried out lengthy and troublesome investigations without charge. It would be but fair to say that the £66,700 would have been expanded into probably a quarter of a million, if all the work done had been paid for in the commercial sense, as the Railway Commissioners, the Board of Trade, the Admiralty, and others would have had to do if they had not had the British Association to do so much for them as it had done.

The Lecturer desired to draw attention to the many valuable Reports made to the Association on educational subjects; it would, however occupy too much time to enter into any any review of these. Some were statistical and were mainly valuable as an index of the progress or otherwise made in introducing scientific and technical subjects into the courses of various schools. Others contained reports from various authorities, scholastic and otherwise, on their experience as to the effectiveness of particular methods of teaching, and the value of particular subjects as expanders of the general faculties of the pupils. Others again dealt with such matters as the proper fitting up and uses of museums and collections, and the necessary provision in the way of demonstrator and apparatus required to render these most useful. This matter was especially worthy of attention, and was one in which most museums were specially deficient, insomuch that the great majority of the persons to whom museums or trade collections should be useful were, partly from want of training, and partly from want of assistance, quite unable to take any practical value out of the collections of objects before them.

The Lecturer was obliged to omit reference to the immense value of the great mass of the British Association reports on purely scientific subjects. There were in Belfast many persons fully competent to appreciate, and infinitely better qualified than himself to discuss, the reports on subjects connected with Natural History. In pure science, the computation of tables of the values of special mathematical functions, the bibliography of particular scientific information, and the like, did not lend themselves to exposition before a popular audience without previous explanation at considerable length of how and why the matters on which so much trouble was spent were of importance, so that a whole evening would, in many cases, have to be devoted to a single Report, but the Lecturer hoped that some of those able to do so would endeavour to make this society and the public realise the value and magnitude of the work of the British Association in relation to Natural History and kindred subjects.

AN ANCIENT BOMBSHELL.

By Robert M. Young, B.A., M.R.I.A.

(*Honorary Secretary.*)

This ancient bombshell, which is exhibited by the courtesy of Mr. E. G. MacGeorge, J.P., was found at a depth of 8 feet in estuarine clay adjacent to the Scottish Provident Buildings. It weighs about 1 cwt., is 10 inches in diameter, and 2 inches thick, of cast iron. There is a fuse hole in which a wood plug 4 inches long and 1½ thick was found. Small handles of iron rod are inserted at each side. The discovery of the bomb was made when Mr. Robert Corry, contractor for the additional buildings of the Scottish Provident Institution, was excavating on the ground adjoining their present block. By reference to old maps of Belfast it would seem that this site lay outside of the old town rampart, one of whose bastions was erected on the side of Donegall Square North, near Fountain Street. The ground seems to have been marshy, and drained by the Malone ditch, which is shown as extending to Sandy Row about 1790. Since no artillery of heavy calibre is mentioned in the various accounts of Belfast as regards 17th century struggles, the missile in question may be probably referred to the next century, when the volunteer movement originated. The Mall passed the spot, and many of the military displays took place in its vicinity. Howitzers of 6-inch calibre were used in some of the reviews. Notably in 1781, when 5,300 men were under arms. On this occasion it is stated that shells were discharged of such a composition as to afford the appearance of real shells without the danger.

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Report and Proceedings

OF THE

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1900-1901.

BELFAST:
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1901.

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3 Shares	,,	costs £21.

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There are two classes—Ordinary Members, who are expected to read Papers, and Visiting Members who, by joining under the latter title, are understood to intimate that they do not wish to read Papers. The Session for Lectures extends from November in one year till May in succeeding one. Members, Ordinary or Visiting, pay £1 1s. per annum, due 1st November in each year.

Each Shareholder and Member has the right of personal attendance at all meetings of the Society, and of admitting a friend thereto; also of access to the Museum and Library for himself and family, with the privilege of granting admission orders for inspecting the collections for any friend not residing in Belfast.

Any further information can be obtained by application to the Secretary. It is requested that all accounts due by the Society be sent to the Treasurer.

The Museum, College Square North, is open daily from 10 till 4 o'clock Admission for Strangers, 6d. each. The Curator is in constant attendance, and will take charge of any Donation kindly left for the Museum or Library.

Belfast Natural History and Philosophical Society.

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ANNUAL REPORT, 1901.

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The Annual Meeting of Shareholders of the Society was held on the 16th July, in the Museum, College Square North. Mr. John Brown, President, occupied the chair, and the attendance included—Messrs. R. Lloyd-Patterson, D.L., J.P.; W. H. Patterson, M.R.I.A.; T. F. Shillington, J.P.; R. Young, J.P., C.E.; Andrew Gibson, George Kidd, J.P.; R. M. Young, J.P.; Henry Musgrave, Davys Bowman, A. J. Jackson, W. Armstrong, R. Patterson, M.R.I.A.; Isaac Ward, James O'Neill, M.A.; W. F. Faren, and W. H. F. Patterson. Letters of apology regretting their inability to be present were announced as having been received from Sir James Henderson, D.L.; and Mr. Seaton F. Milligan, M.R.I.A.

Mr. R. M. Young, Hon. Secretary, having read the notice convening the meeting, submitted the report of the Council, as follows :—

The Council of the Belfast Natural History and Philosophical Society desire to submit their report of the working of the Society during the past year.

The Winter Session was opened in the Museum on the 6th November, 1900, when the President of the Society (Mr. John Brown) delivered an inaugural address; subject—"Some Matters Electric," with lantern and experimental illustrations.

The Second Meeting was held on the 11th December, when the following papers were read :—1, Mr. John H. Davies, on "The Botany of the Shores of Lough Neagh;" 2, Mr. W. H. Patterson, M.R.I A., "Some Account of the Objects Comprised in Lord Deramore's Recent Donation, Principally Antiquarian;" 3, Mr. W. Swanston, F.G.S., "Notes on Some Clay Concretions from the Connecticut Valley, U.S.A."

The Third Meeting was held on the 20th December, when a lecture was kindly given by Rev. A. R. Crawford, M.A., Kirin, Manchuria ; subject, "Some Sidelights on the China Question," illustrated by special limelight views.

At the Fourth Meeting, held on 8th January, 1901, two papers were read :—1, The President, subject, "Report as Delegate of the Society to the British Association Meeting at Bradford ;" 2, Mr. Lyndon Macassey, C.E., B.A., LL.B., subject, "Irish Railways and the State," followed by a discussion.

The Fifth Meeting was held on 5th February, when a lecture was kindly given by Professor Morton, M.A. ; subject, "Colour," with experimental illustrations.

Mr. Seaton F. Milligan, M.R.I.A., gave the sixth lecture, on 5th March ; subject, "Scenery and Antiquities of Sligo, Connemara, and Clare," illustrated by a series of 150 lantern slides. The chair was taken by Sir James Henderson, D.L., in the unavoidable absence of the President.

The Seventh Meeting was held on 2nd April, when a lecture was kindly delivered by Mr. George Coffey, M.R.I.A., keeper of the Irish antiquities, National Museum, Dublin ; subject, "The Antiquity of Man and the Dawn of Art," illustrated by a special series of lantern slides of palæolithic implements.

The attendance at the meetings was well maintained, and several were inconveniently crowded.

The number of allied societies holding their meetings in the Museum shows no reduction. This was also the case with the ordinary admissions of visitors to the Museum, which have been above the average, and many who took an interest in some of the subjects illustrated expressed their gratification with what they saw in the collections. At Easter the Museum was thrown open, as usual, at a nominal charge, and full advantage of this opportunity was taken by the public, particularly children. No damage was done to any part of the collections. As will be seen by the Hon. Treasurer's Statement of Accounts, duly audited by the Local Government Board, a slight diminution is shown by the balance in hand, but this is fully accounted for by the large sum spent on necessary repairs to the building and the cases.

A list of donations to the Museum and of the numerous publications received in exchange from home and foreign societies will be presented with the present Report.

Amongst the donations, that of Lord Deramore is specially noteworthy, comprising as it does a large number of valuable Irish antiquities, and some Greek and Roman. The Irish bronzes have been arranged by themselves in the Benn Room, and the stone implements and some ethnological specimens have been incorporated with the general collections. A number of good fossils remain, for which there is no space available at present. Many valuable objects from the recent excavations at Abydos have been presented by the Egypt Exploration Fund, through the good offices of Mr. John Ward, J.P., F.S.A. Such other donations as have been received during the year have been placed in their proper cabinets. Your Council have under serious consideration the necessity of rearranging the contents of the Museum, and making as complete as possible the Irish natural history collections. In view of the meeting of the British Association next year in Belfast, they have also decided on having a loan collection of Irish antiquities, &c., following the precedent of their action when the first meeting was held here in 1852. The Council desire to express their best thanks to the local Press for their admirable reports of the Society's meetings. Five members of Council retire from office, of which four are eligible and offer themselves for re-election—viz., Messrs. R. Lloyd-Patterson, J. H. Davies, John Horner, and Robert Young.

The Hon. Treasurer (Mr. W. H. Patterson) submitted the Statement of Accounts, from which it appeared that the expenditure amounted to £252 10s. 2d., while the income was £315 14s. 6d., leaving a balance in hands of £63 4s. 4d.

Mr. Lloyd-Patterson moved the adoption of the Report. He much regretted he had not been present at the last meeting of the Council. There were two subjects he would like to draw the attention of the meeting to, first, their large and successful meetings, and, secondly, the rearrangement of their collections. The latter was a matter upon which he felt strongly, and he would not trust himself to speak as strongly on it as he felt. Many of the specimens were very old, and while every care had been taken of them that circumstances would permit, they were clearly worn out. For his part, he thought it would be better to have a small and perfect collection, as far as it went, than a large and faulty one. The financial report showed that the slight diminution in the balance-sheet is accounted for chiefly by expenditure on the building.

Dr. MacCormac, in seconding, regretted that he could not use the superlative degree when speaking of the monetary side of the question ; but, considering the admirable lectures they had had, he was bound to speak in the superlative degree. He was present at one, the most interesting he had ever had the opportunity of listening to, apart from its literary aspect, and he was sorry to see so few present. He might say if the Belfast public knew the merits of the lectures they had in that room they would always have the room filled, and filled to overflowing.

Mr. Henry Musgrave proposed a vote of thanks to Mr. Brown for having presided, and to Mr. Young, Secretary. He paid a high compliment to Mr. Brown's ability, and said he understood he had consented to occupy the presidency for another year. He (Mr. Musgrave) thought that very proper.

Mr. Davys Bowman seconded the motion, which was supported by Mr. William Armstrong, and carried by acclamation.

The Chairman briefly replied, after which the following were elected members of Council :—President, John Brown ; Vice-Presidents, President Rev. T. Hamilton, D.D., LL.D. ; R. L. Patterson, D.L., F.L.S. ; W. Swanston, F.G.S. ; Robert Young, C.E., J.P. ; Hon. Treasurer, W. H. F. Patterson ; Hon. Librarian, J. H. Davies ; Hon. Secretary, Robert M. Young, B.A., J.P., M.R.I.A.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict. ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year 30th April, 1901.

Dr. **Cr.**

CHARGE.

	£	s.	d.	£	s.	d.
To Balance as per last Account				£79	3	3
,, Amount of Donations, Bequests, and other Endowments, received in the year ended 30th April, 1901				17	10	0
,, Amount of Subscriptions received in the year ended 30th April, 1901				108	9	6
,, Amount of Dividends received in the year ended 30th April, 1901				17	3	6
,, Amount of Rents received in the year ended 30th April, 1901				50	9	6
,, Amount of Fees received in the year ended 30th April, 1901				0	11	6
,, Amount realized by Sales in the year ended 30th April, 1901				0	2	0
,, Amount of Miscellaneous Receipts in the year ended 30th April, 1901 (not included in the foregoing), viz:—						
Admission Fees at door at Easter	£20	5	4			
,, ,, ,, during rest of year ...	21	19	11			
				42	5	3
Total, ...				£315	14	6

DISCHARGE.

	£	s.	d.	£	s.	d.
By Amount of Payments made in the year ended 30th April, 1901, under the following headings:—						
Maintenance of Premises, &c.	53	3	2			
Rent and Taxes, &c.	27	11	0			
Salaries	98	10	10			
				179	5	0
Other Payments, viz.:—						
Printing and Stationery	6	11	2			
Advertising	9	2	7			
Postage and Carriage	3	12	10			
Fuel and Gas	14	18	0			
Commission on Cheques	0	1	0			
Cheque Book	0	4	2			
Insurance, £2 12s 6d, £1 19s 9d, £1 19s 9d ..	6	12	0			
Subscription Ulster Journal Archaeology ..	0	10	0			
,, *Irish Naturalist*	2	2	0			
Auditor's Fee	1	1	0			
Stamping Transfers	0	9	0			
Hire of Lantern	1	8	6			
Donation British Congress Tuberculosis ...	1	1	0			
,, for Old Shares	4	0	0			
Mr. Coffey's Expenses	1	15	0			
Expenses at Easter	5	10	11			
Printing Report	14	6	0			
				73	5	2
Total Payment				252	10	2
,, Balance in favour of this Account as on the 30th April, 1901				63	4	4
Total				£315	14	6

N B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., $4\frac{1}{2}$ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.

W. H. F. PATTERSON, Accounting Officer.

Dated this 20th day of May, 1901.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

30th day of May, 1901.

DONATIONS TO THE MUSEUM, 1900-1901.

From HEAD CONSTABLE JOHN RAYNOR.

A fresh specimen of *Palinurus vulgaris*, which is a cray fish known as the spring lobster. Caught at Portrush.

From MR. WALTER SMYTH, HOLYWOOD.

A specimen of the bittern (*Botaurus stellaris*).

From * * * *

A living specimen of a longicorn beetle (*Astyomus aedilus*) captured on Queen's Island, Belfast.

From MISS PERRY, WELLINGTON PLACE.

A snake's skin from West Africa.

From LORD DERAMORE.

A large number of bronze celts, swords, spearheads, rings, etc. Flint arrowheads, stone celts, fossils, minerals, classic pottery, Egyptian curios, leather water bottles, etc.

From EGYPT EXPLORATION FUND.

A number of specimens obtained in the recent excavations at Abydos.

From MR. R. M. YOUNG, J.P., M.R.I.A.

Portrait of R. Lloyd-Patterson, Esq., D.L., F.L.S., former President of the Society.

From MR. W. SWANSTON, F.G.S.

Clay concretions from the Connecticut Valley.

From MISS M. K. ANDREWS.

Rock specimen, showing granite intrusion in Silurian rocks of Mourne; also specimens of a number of local rocks.

From MR. A. S. OSWALD.

A beggar's badge, in brass, inscribed "St. Field, 25."

From MR. RICHARD HANNA.

Portion of the planking of a wooden ship perforated by the shipworm (*Teredo*). Found at Newcastle sandhills.

ADDITIONS TO THE LIBRARY, 1ST MAY, 1900, TILL 1ST MAY, 1901.

ADELAIDE. — Transactions of the Royal Society of South Australia. Vol. 24, parts 1 and 2, 1900, and Memoirs, vol. 1, part 2, 1900. *The Society.*

ALBANY.—Forty-ninth Annual Report of New York State Museum, vol. 3, 1895. Fiftieth Report, vol. 2, 1896, and Fifty-first Report, vols. 1 and 2, 1897. *The Regents of the University.*

BERGEN.—Bergens Museums Aarbog, 1899, part 2, and 1900, parts 1 and 2 ; also Aarsberetning for 1899 and 1900 ; and Crustacea of Norway. Vol. 3, parts 5—10, 1900. *Bergen Museum.*

BERLIN.—Verhandlungen der Gesellschaft für Erdkunde zu Berlin. Vol. 27, nos. 4—10, 1900; and vol. 28, Nos. 1—3, 1901. *The Society.*

BIRMINGHAM.—Proceedings of Birmingham Natural History and Philosophical Society. Vol. 10, part 1, 1896; and part 2—1897; and vol. 11, part 1, 1899; also Records of Meteorological Observations for 1896 and 1897. *The Society.*

BOLOGNA.—Rendèconto della R. Accademia delle Scienze dell' Istituto dé Bologna; new series, vol. 2, fasc. 1—4, 1898, and vol. 3, 1899. *The Academy.*

BOSTON.—Proceedings of the Boston Society of Natural History. Vol. 29, nos. 9—14, 1900. Memoirs, vol. 6, no. 6, 1900; and no. 7, 1901; also Occasional Papers, vol. 1, no. 4, 1900. *The Society.*

BREMEN.—Abhandlungen Herausgegeben vom Naturwissenschaftlichen Verein zu Bremen. Vol. 16, part 3, 1900. *The Society.*

BRESLAU—Zeitschrift für Entomologie Herausgegeben vom Verein für Schlesiche Insektenkunde zu Breslau. New series, part 25, 1900. *The Society.*

BRIGHTON.—Annual Report of Brighton and Hove Natural History and Philosophical Society for 1899-1900. *The Society.*

BRISBANE.—Annals of the Queensland Museum, no. 5, 1900. *The Director.*

BRUSSELS.—Bulletin de la Société Royale de Botanique de Belgique. Vol. 39, 1900. *The Society.*

,, Annales de la Société Entomologique de Belgique. Vol. 44, 1900. *The Society.*

,, Annales de la Société Royale de Malacologique de Belgique. Vol. 34 (part of), 1899. *The Society.*

BUENOS AYRES.—Comunicaciones del Museo Nacional de Buenos Aires. Vol. 1, Nos. 6 and 7, 1900. *The Director.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 28, part 2, 1900; vol. 29, 1899; vol. 30, parts 1 and 2, 1900; and vol. 33, part 1, 1901. Palæontologia Indica. Series 9, vol. 2, part 2, 1900; and vol. 3, part 1, 1900; also series 15, vol. 3, parts 1 and 2, 1899; and General Report of the Work of the Survey for 1899. *The Director of the Survey.*

CAMBRIDGE.—Proceedings of the Cambridge Philosophical Society. Vol. 10, parts 5—7; and vol. 11, parts 1 and 2, 1900-1901. *The Society.*

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Zoology. Vol. 35, no. 8, 1900; vol. 36, nos. 1—6, 1900; vol. 37, nos. 1 and 2, 1900; and vol. 38, nos. 2 and 3, 1901; also Annual Report for 1899-1900. *The Secretary, Alex. Agassiz.*

CARDIFF.—Report and Transactions of Cardiff Naturalists' Society. Vol. 32, 1901. *The Society.*

CASSEL.—Abhandlungen und Bericht (45) des Vereins für Naturkunde zu Kassel, 1900. *The Society.*

CHICAGO.—Bulletin of the Chicago Academy of Sciences, No. 3, 1898. *The Academy.*

CHRISTIANIA.—Christiania Videnskabs Forhandlinger. Nos. 2—4, 1899; and Oversigt for 1899; also Norway Official Publication for the Paris Exhibition in 1900.
The Royal Norske Frederiks University.

CINCINNATI. — Bulletin of the Lloyd Library of Botany, Pharmacy, and Materia Medica, No. 1, 1 .00.
The Messrs. Lloyd.

COLORADO SPRINGS.—Colorado College Studies. Vol. 8, 1899.
Colorado College Scientific Society.

DANTZIC.—Schriften der Naturforschenden Gesellschaft in Danzig. New series, vol. 10, part 1, 1899.
The Society.

DAVENPORT, IOWA.—Proceedings of the Davenport Academy of Natural Sciences. Vol. 7, 1900.
The Academy.

DUBLIN.—Scientific Transactions of the Royal Dublin Society. Series 2, vol. 7, parts 2 and 3, 1899; and parts 4—7, 1900. Scientific Proceedings. New series, vol. 9, part 1, 1899; and part 2, 1900. Economic Proceedings. Vol. 1, parts 1 and 2, 1899; and Index, 1899. *The Society.*

EDINBURGH.—Transactions and Proceedings of the Botanical Society of Edinburgh. Vol. 21, part 4, 1900.
The Society.

" Proceedings of the Royal Society of Edinburgh. Vol. 22, 1897-99. *The Society.*

" Transactions of the Scottish Natural History Society. Vol. 1, part 1, 1900. *The Society.*

GENOA.—Rivista Ligure di Scienze, Lettere ed Arti. Anno 22, fasc. 2, 4, 5, and 6, 1900; and fasc. 1, 1901.
The Society.

GLASGOW.—Proceedings of the Philosophical Society of Glasgow. Vol. 21, 1900. *The Society.*

HALIFAX, N.S.—Proceedings and Transactions of the Nova Scotian Institute of Science. Vol. 10, part 1, 1899; and part 2, 1900. *The Institute.*

HAMBURG.—Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg. Ser. 3, vol. 7, 1900; and Abhandlungen, vol. 16, part 1, 1900. *The Society.*

IGLO.—Jahrbuch des Ungarischen Karpathen Vereines, 27th year, 1900. *The Society.*

INDIANOPOLIS.—Proceedings of the Indiana Academy of Science for 1891 and 1899. *The Academy.*

KHARKOW.—Proceedings of the Society of Sciences, Physico-Chimiques, of the University of Kharkow. Part 24, 1898; and parts 25—27, 1900. *The Society.*

KIEW.—Memoirs of the Society of Naturalists' of Kiew. Vol. 16, part 1, 1899. *The Society.*

LAUSANNE.—Bulletin de la Société Vandoise des Sciences Naturelles. Ser. 4, no. 134, 1899; and nos. 135—137, 1900. *The Society.*

LAWRENCE.—The Kansas University Quarterly. Vol. 8, no. 4, 1899; and Bulletin of the University of Kansas. Vol. 1, nos. 2 and 3, 1900. *The University.*

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig, 1900. *The Society.*

LONDON.—Report of the Seventieth Meeting of the British Association: Bradford, 1900. *The Association.*

" Quarterly Journal of the Geological Society of London. Vol. 56, parts 2—4, 1900; and vol. 57, part 1, 1901; also Geological Literature for 1899; and List of Fellows, 190-. *The Society.*

" Journal of the Royal Microscopical Society, Nos. 136—139, 1900; and Nos. 140 and 141, 1901. *The Society.*

LONDON.—Proceedings of the Zoological Society of London, parts 1—4, 1900. Transactions, Vol. 15, parts 5—7, and vol. 16, part 1, 1900-1901; also List of Fellows, 1900. *The Society.*

MADISON.—Bulletin of the Geological and Natural History Survey of Wisconsin, Nos. 3 and 4, 1898, and Nos. 5 and 6, 1900. *The Director.*

,, Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 12, part 2, 1900. *The Academy.*

MADRAS.—Bulletin of Madras Government Museum. Vol. 3, Nos. 1 and 2, 1900; and Vol. 4, No. 1, 1901; also the Administration Report for 1899-1900. *The Superintendent.*

MANCHESTER. — Journal of the Manchester Geographical Society. Vol. 11, nos. 9—12, 1895; vol. 14, nos. 9—12, 1898; vol. 15, nos. 10—12, 1899; and vol. 16, nos. 1—9, 1900. *The Society.*

,, Transactions of the Manchester Geological Society. Vol. 26, parts 14—19, 1900. *The Society.*

MARSEILLES.—Annales de la Faculté des Sciences de Marseille. Vol. 10, preface and fasc. 1--6. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. New ser., vol. 12, part 2, 1900. *The Society.*

MEXICO.—Boletin Mensual del Observatorio Meteorologico. Central de Mexico. Oct.—Dec., 1899, and Jany.—June, 1900. *The Director.*

,, Boletin del Observatorio Astronomico Nacional de Tacubaya. Vol. 2, No. 6, 1900; also Anuario, Ano. 21, 1900, and El Clima de la Republica Mexicana, Ano. 2, 1900. *The Director.*

,, Boletin del Instituto Geologico de Mexico. No. 14, part 1, 1900. *The Institute.*

MILWAUKEE.—Bulletin of the Wisconsin Natural History Society. New ser., vol. 1, nos. 1 and 2, 1900.
The Society.

,, Seventeenth Annual Report of the Trustees of Milwaukee Public Museum, 1899.
The Trustees.

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Vol. 2, fasc. 15 and 16, 1900; fasc. 17, 1901; and vol. 3, fasc. 13, 14, and 18, 1900.
The Director.

MOSCOW.—Bulletin of the Society of Naturalists of Moscow. Nos. 2—4, 1899, and nos. 1 and 2, 1900.
The Society.

NANTES.—Bulletin de la Société des Sciences de l' Ouest de la France. Vol. 9, part 4, 1899, and vol. 10, parts 1 and 2, 1900. *The Society.*

NEW YORK.—Annals of the New York Academy of Sciences. Vol. 12, parts 2 and 3, and vol. 13, part 1, 1899 1900. Memoirs, vol. 2, part 1, 1899, and part 2, 1900. *The Academy.*

,, Bulletin of the American Geographical Society. Vol. 32, nos. 2—5, 1900, and vol. 33, no. 1, 1901. *The Society.*

NOTTINGHAM. — Report and Transactions of Nottingham Naturalists Society for 1899-1900.
The Society.

OPORTO.—Annaes de Sciencias Naturaes. Vol. 6, 1900.
The Editor.

OTTAWA.—Preliminary Report on Klondyke Goldfields of Yukon, Canada, and Geological Map; also Note on the Sydney Coal Field, Nova Scotia, and Maps 652-654, 1900.
The Director of the Survey.

PHILADELPHIA.—Proceedings of the Academy of Natural Sciences of Philadelphia. Part 3, 1899, and parts 1—3, 1900. *The Academy.*

PHILADELPHIA.—Proceedings of the American Philosophical Society, No. 160, 1899, and nos. 161—164, 1900.
The Society.

,, Transactions of the Wagner Free Institute of Science. Vol. 3, part 5, 1900.
The Institute.

PISA.—Atti della Società Toscana di Scienze Naturali, Processi Verbali, January, November, 1900.
The Society.

ROCHESTER.—Proceedings of Rochester Academy. Vol. 3, brochure 2, 1900. *The Academy.*

ROME.—Atti Reale Accademia dei Lincei. Vol. 8, semestre 1, fasc. 12, 1899. Vol. 9, semestre 1, fasc. 8, 9, 11, 12, 1900. Semestre 2, fasc. 1—3 and 7—12, 1900; vol. 10, semestre 1, fasc. 1—6, 1901; and Rendiconto dell' Adunanza Solenne del, 10th June, 1900. *The Academy.*

,, Journal of the British and American Archæological Society of Rome. Vol. 3, no. 2, 1900.
The Society.

,, Bollettino della Società Zoologica Italiana. Ser. 2, vol. 1, fasc. 2—4, 1900. *The Society.*

SAN FRANCISCO.—Proceedings of the Californian Academy of Sciences. Geology, vol. 1, nos. 7—9, 1900. Zoology, vol. 2, no. 1, 1899, and nos. 2, 4, and 6, 1900; also Occasional Papers, no. 7, 1900.
The Academy.

ST. LOUIS—Eleventh Annual Report of Missouri Botanical Garden, 1900. *The Director.*

STAVANGER.—Stavanger Museum Aarsberetning for 1899
The Museum Trustees.

STIRLING.—Transactions of Stirling Natural History and Archæological Society for 1899-1900.
The Society.

STOCKHOLM.—Handlingar of the Royal Swedish Academy. New ser., vol. 32, 1899. Ofversigt, no. 56, 1899, and Bihang, vol. 25, parts 1—4, 1900. *The Academy.*

SYDNEY.—Science of Man, new ser., vol. 3, nos. 3—12, 1900, and vol. 4, no. 1, 1901. *The Editor.*

TOKIO.—Mittheilungen der Deutschen Gesellschaft für Natur und Volkerunde Ostasiens. Vol. 8, part 2, 1900. *The Society.*

TORONTO.—Transactions of the Canadian Institute. Vol. 6, 1899. Proceedings, new ser. vol. 2, part 3, 1900, and part 4, 1901. *The Institute.*

UPSALA.—Bulletin of the Geological Institution of the University of Upsala. Vol. 4, part 2, 1899. *The University.*

VIENNA.—Verhandlungen der Kaiserlich-Koniglichen Geolo gischen Reichsanstalt. Nos. 3—18, 1900, and 1—3, 1901. *The Society.*

„ Verhandlungen der Kaiserlich-Koniglichen Zoologisch Botanischen Gesellschaft. Vol. 50, 1900. *The Society.*

WASHINGTON.—Year Book of the Department of Agriculture for 1899. Report of the Secretary for 1900. Bulletin of the Department, nos. 12—14, 1900, and North American Fauna, nos. 16—18, 1899-1900. *The Secretary of the Department.*

„ Seventeenth Annual Report of the American Bureau of Ethnology. Part 2, 1895-96. *The Director of the Bureau.*

„ Nineteenth Annual Report of the United States Geological Survey. Parts 3 and 5, with Atlas, 1897-98, and Twentieth Report, part 1, 1898-99; also Bulletins, nos. 151—156, 1898, and nos. 157—162, 1899. Monographs, vol. 32, part 2, vols. 33, 34, 36, 37, and 38, 1899. *The Director.*

WASHINGTON.—American Monthly Microscopical Journal. Vol. 21, nos. 1—12, 1900. *The Publisher.*

,, Annual Report of the Smithsonian Institution for 1898. Special Bulletin, part 1, 1900. Smithsonian Miscellaneous Collections, 1,253, 1901. Annual Report of the United States Museum, 1898. Bulletin of the U.S. Museum, no. 47, part 4, 1900.

The Smithsonian Institution.

XALAPA.—Boletin Mensual Meteorologico y Agricola del Observatorio Central del Estado Vera Cruz, four numbers, 1898 1900. *The Director.*

YORK.—Annual Report of the Yorkshire Philosophical Society, 1901. *The Society.*

ZURICH.—Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich, 44th year, parts 1 and 2, 1900.

The Society.

From MR. R. LLOYD-PATTERSON, D.L., F.L.S.—Journal of the Linnean Society (Botany). Nos. 240 and 241, 1900, and 242, 1901.

From JAMES GREEN, ESQ. (Massachusetts Bar), Worcester, Mass, U.S.A. Causes of the War in South Africa.

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

SESSION 1900-1901.

6th November, 1900.

ADDRESS BY THE PRESIDENT,
MR. J. BROWN.

SOME MATTERS ELECTRIC.

AT this opening meeting of our Session there is wanting a time honoured ceremony that usually graces the occasion. I allude to the introduction to you of your president elect by his outgoing predecessor.

For the second time in the history of the Society death has removed its President during his term of office. On the present occasion I feel the loss of one of my earliest Belfast friends, one who was always ready in sympathy whether of condolence and help in times of sorrow or of congratulation in times of success. One whose advice and counsel were freely available. One from whom I have received many kindnesses, and with whom I have spent many pleasant and profitable hours. I feel sure these sentiments find an echo in the hearts of all those who knew our late President.

In his death the Society has to deplore the loss of one who had its best interests at heart, whose shrewdness made him quick to discern these interests, and whose energy left no stone unturned in working for them. During my thirteen years official connexion with the working of the Society as its Honorary

Treasurer I had often occasion to observe the disinterested and completely unostentatious way in which Mr. Workman gave his mind to the good of the Society. Several important steps which turned out advantageously were initiated by him.

Mr. Workman's membership was an honour to us. He was one of the few business men in our city who found time for original scientific research. Mr. Workman not only spared time from his business for this purpose, but actually took advantage of his far business connexions to assist him in the successful study of that branch of natural history which he had made his own.

Memoirs published in our own proceedings and elsewhere bear witness to the success attending his researches—the discovery of new species and the more careful observation of the habits of others.

The volume of plates illustrating in detail so many of the Arachnida, which has been so carefully prepared by his own hands, assisted sometimes by his daughter, and of which a beautiful copy was presented by him to the Society bears witness to the interest with which he pursued his subject.

Offering to the memory of our late President this tribute of esteem and regret, I turn to my own duties unannounced.

In seeking a subject on which to address you, it seemed that either something pertaining historically to the Society, or something with which I myself was connected or interested, or some topic of new and general interest might be appropriate.

The first mentioned has been ably treated already. I have, therefore, thought it might not be amiss to take up a little of the two last.

I shall first deal as briefly as possible, with my own work on a subject of much scientific interest, though not perhaps of a very popular kind, "The Theory of Voltaic Action." It seems proper that some record of this should find a place in our proceedings, and this has not yet been the case. Afterwards I hope to describe experimentally some modern applications of electricity.

As my work on voltaic theory is on the main line of research, I would lead up to it by a brief reference to the history of the subject. The earliest experiment in this connexion was a very simple and now well-known one described by Sulzer[1], in 1760, in a paper on "The theory of agreeable and disagreeable sensations." The experiment consisted in placing under the tongue a plate of silver, and on top of the tongue a plate of lead or zinc or other suitable metal. In bringing the outer ends of these metals in contact a peculiar sensation is experienced in the tongue. That this is really due to the formation of an electric current passing through the tongue between the metals was not even guessed at the time of its observation, nor for many years afterwards. Yet its discoverer (if he had only known it) was the first to observe the current from a voltaic cell.

Science, however, does not progress by such co-ordinated observations of isolated effects, and the first step towards the discovery of the true character of the phenomenon was made by the observation and connexion of two almost accidental effects noted by Galvani,[2] professor of anatomy at Bologna.

In 1780 when investigating the nervous irritability of cold blooded animals he observed that the limbs of a recently killed frog, when hung by the crural nerve on a metal support near an electric machine, contracted convulsively at the occurrence of each spark drawn from the machine. Six years afterwards he observed the same contraction when a copper hook, on which the nerve hung, and the limb itself came simultaneously in contact with an iron railing—the copper hook, the iron railing, and the frog's leg forming thus a circuit of three bodies in contact. The similarity of the result pointed to the same cause—electricity. But how in this last mentioned case was the electricity produced?

This question has exercised the scientific world ever since.[3] Galvani thought it was produced in the animal tissues, and even went so far as to connect it with the spirit of the animal.

1. *Vide* Electrochemie, Ostwald, p. 41.

2. Ibid, p. 27. 3. Ibid, p. 45.

A year after the publications of his work, which naturally excited the greatest interest, it was criticised by his great compatriot, Alessandro Volta,[3] Professor of physics at Pavia. Galvani's attention had been devoted to the nerves and muscles of the frog. Volta's was directed upon the metallic matters in contact with them. He emphasised (what Galvani had already noticed) that strong muscular contractions were only obtained when the connecting arc is composed of two metals in contact, and he maintained that the electric current causing the muscular contractions was produced at the *contact* or *junction* of the metals ; and he describes this theory of his, without reticence or modesty, as a discovery of the highest order.

Had Volta's observations been made half a century later, when the splendid researches of Faraday emphasized the beginning of a more perfect knowledge, a truer view of science would doubtless have supported and intensified the leaning which he himself at first possessed towards the assumption that the source of the electric action was to be found in the chemical activities at the contact between the metals and the liquids of the fresh animal tissues.

That the electricity was produced by chemical action of these fluids on the metals was indeed suggested by Fabroni,[4] in 1792, and by Creve,[5] whose explanation of the action bears a quaint resemblance to that which a wider knowledge has brought forth in modern times.[6]

Volta, however, was carried away by the (merely apparent) simplicity of the metallic contact theory and by the result of a most ingenious form of experiment which seemed to preclude the possibility of any such chemical action on the metals. The apparatus used is represented by that on the table and is known as Volta's condenser. Here the two metals are in the form of plates, having plain surfaces, and mounted on insulating supports so as to be capable of being approached very closely to one another without touching. If when so approached the

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4. Wilkinson's Galvanism I, p. 313—15.

5. Ibid, p. 311. 6. Ibid, p. 104.

two plates be joined for a moment by a metallic wire and then separated, it is found that the zinc *appears to be* positively and the copper negatively electrified. I say *appears* advisedly.

If we neglect any possible actions of the atmosphere on the metals we are tied to Volta's view. It is surprising, considering the clear insight and the careful and persevering nature which Volta possessed, that he did neglect such atmospheric action, and continued to do so even after his brilliant invention of the Voltaic pile and cell in 1799, in which, notwithstanding, the obvious presence of chemical action, he still placed the seat of generation of the current at the contact of the two metals. I am inclined to think that the large acceptance which Volta's contact theory obtained subsequently was due in great measure to his impressive and self-confident style of writing, to the care he took to publish widely, and to the respect due to his undoubted genious rather than to any convincing characteristic in his experiments. For it is to be noticed that beginning with Fabroni and Creve and culminating with our own immortal Faraday, there was a succession of philosophers who maintained that in all cases the electric effect was due to chemical action upon the metals whether of the atmosphere on Volta's condenser plates or of liquid in his cell. In the cell indeed the presence of chemical action is evident, and the need of some such source of energy to produce the continuous current of the cell is more obvious.

To illustrate this, I have here two metallic plates, one of copper and one iron, placed in the necessary metallic contact through a wire which forms part of this galvanoscope. When placed in this jar of acidulated water the current generated immediately deflects the pointer of the instrument. If the experiment be continued for some hours, we find the iron has been dissolved by the acid while the copper remains unacted on. In Faraday's researches[7] on many varieties of such cells it was clear *inter alia* that contact of dissimilar metals was not necessary (one metal and two liquids being also active), also that

7. Experimental Researches in Electricity II., p. 18.

the direction of the current was always from the chemically active surface of metal through the liquid to the inactive one. A very remarkable experiment arises from this last-mentioned law.

You observed that when we dipped these metal plates in the acidulated water the pointer moved to the right, and I told you that in this case the iron was being attacked. We now place them in another solution, a solution of potassium sulphide which attacks the copper most, with the result that the current is reversed, and sends the pointer to the *left*. It now flows from the copper by liquid to iron. I point especially to this experiment with its reversal of current for a reason which follows later.

After Faraday's brilliant researches, men's minds seemed to have inclined towards belief in the chemical source of the current till about 1862, when Lord Kelvin (then Sir William Thomson) published what he described as a new proof of Volta's contact force,[8] which was really only a very elegant variation of Volta's fundamental experiment, and does not to my thinking throw any further light on the subject. Lord Kelvin, however, became himself convinced that the contact theory was the true one, and this seems very remarkable when we remember that it is to Lord Kelvin we owe the enunciation of the law (now known as Thomson's law) defining the intimate and exact connection between the electromotive force of the cell and the chemical actions in it. The great authority belonging to Lord Kelvin's high order of genius however swayed the scientific world towards what he accepted as true.

We have now come to the period when I was tempted to enter the lists. I found then two opposing camps, one led by the genius of Faraday holding that the Voltaic current and all Voltaic action was due to chemical action at the surface of the metal and liquid, the other maintaining that the seat of the force generating the current was at the contact of the two

8. Papers on Electrostatics and Magnetism, p. 317.

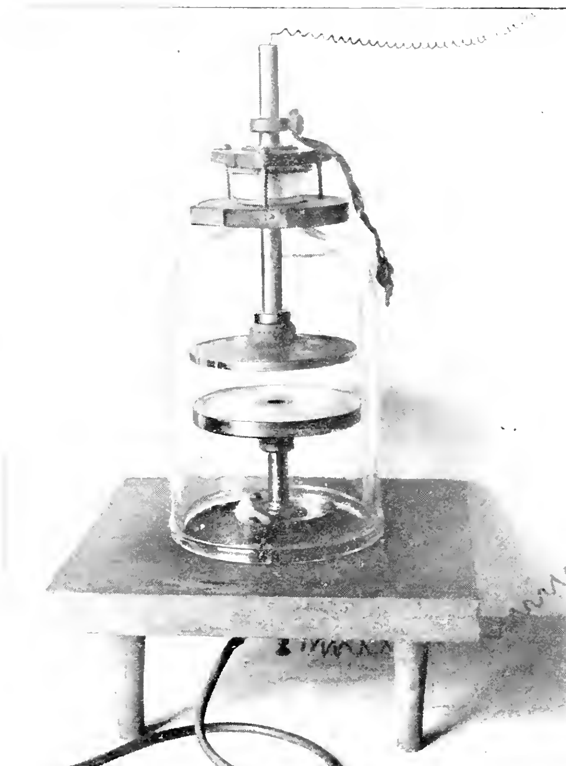

Fig. 1.

metals and pointing to the Volta condenser experiment as precluding the possibility of chemical action. They pointed out that this condenser experiment gave the same result *in vacuo* where they said no atmospheric action could take place. They omitted to consider, however, that there was no such thing as a vacuum attainable. After the best means of exhaustion known there is always amply sufficient gas left to cause the minute amount of chemical action required for this particular electric effect.

Since it seemed hopeless to attempt to nullify the electric effect by removing the atmosphere, it occurred to me to try if varying the chemical nature of the atmosphere would cause a corresponding variation of the electric effect.[9] In fact I considered that if with a Volta condenser we could arrange a change of the chemical activities of the atmosphere surrounding the plates analogous to the change of the chemical activities of the liquid in the cell which I have just described, we should find a reversal of the electric charges analogous to the reversal of current in the cell.

I chose the same metals as Faraday, copper and iron, and of these this small condenser Fig. 1 was made so as to be enclosed under a glass bell on insulating supports. When tested in ordinary atmosphere the chemical action of which is chiefly directed towards the oxidation of the iron, the usual Volta effect was produced. The iron plate communicated a positive charge to the electrometer. Then, without changing any of the metallic contacts, I passed into the glass bell a stream of hydrogen sulphide gas. The copper was actively attacked and tarnished by the gas and at once took, electrically speaking, the place of the iron in the first case, and a positive electrification was now obtained from it.

My satisfaction and indeed elation at finding my hypothesis so clearly verified was very great. Indeed I believed that this experiment would end the dispute between the contact and

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9. Phil. Mag. VI., p. 142, 1878.

chemical theories that had gone on for nearly a century.

Immediately afterwards I arranged the experiment in the form devised by Lord Kelvin where a metallic ring is formed—half of one metal here copper, and the other half of a different metal, here iron. Over the junction swings a delicately suspended needle capable of being electrified. Lord Kelvin showed that when positive the needle swings towards the copper attracted by a negative electrification, if negative towards the iron. I showed that these deflexions are reversed if the atmosphere be charged with hydrogen sulphide in this case as in that of the condenser method.

Using copper and nickel plates in air and in hydrochloric acid gas,[10] the electrification is also reversed following its analogous reversal in the corresponding cell. Finally, although the requisite conditions obtain with only a few metals and liquids, I was able to arrange five different experiments of an analogous kind, and in all these the hypothesis was amply and decidedly confirmed.[11]

An attempt to annul the Voltaic effect by a removal of all active chemical atmospheric matters from about the metals in a more thorough way than had hitherto been employed was made by sealing up in an exhausted glass tube this small Volta condenser, together with a quantity of potassium intended to absorb oxygen, etc.[12] Means were provided for testing the electric difference of potential. Lord Kelvin, I may mention, told me I should not succeed in annulling the difference of potential by these means.

In my first experiment, which lasted six months, it was reduced somewhat and increased on re-opening the tube. In a second experiment lasting 18 months, and in a third lasting seven years, there was no such effect observed. Lord Kelvin

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10. Phil. Mag. VII., p. 109, 1879.

11. Proc. Roy. Soc., XLI., p. 301, 1886.

12. Ibid., LXIV., p. 369, 1899.

was therefore correct in his prophecy. I attribute this negative result to the extreme difficulty of removing the chemically active matters from about the plates.

Several other forms of experiment were devised to obtain evidence on the question. In the result I can say that I have found nothing to definitely contradict and much to support the hypothesis I adopted originally.

In considering the true nature of the effect in Volta's fundamental experiment, I concluded that its explanation would be found in a modification of the theory originally put forth by De la Rive,[13] that the electrification was produced by electrolytic chemical action on the metallic surfaces, and that the electrolyte acting on these suıfaces was condensed on them in the form of a liquid film. In the ordinary atmosphere this film is doubtless chiefly water with oxygen, carbonic acid, etc., in solution. Its basis is doubtless in all cases water, while any gases present would dissolve in this aqueous film. In confirmation of this it was found that when by exceedingly careful and patient manipulation the plates of the zinc-copper Volta condenser were brought exceedingly close together, but not actually touching, the films on their surfaces came together and acted together as the liquid conductor of a cell, and a continuous current could be obtained from the cell so formed[14] sufficient to deflect a galvanometer connected to the condenser plates.

Such a theory explains the action of the Volta condenser and that of the cell as really the same, in so far as either can be explained. In so doing it has to admit that we know very little about either of them. I believe that is one of the attributes that characterises it as non-acceptable in comparison with theories which, based on large and ill-supported assumption, profess to explain everything.

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13. Traité d' Electrieité II., p. 776.

14. Proc. Roy. Soc., XLI., p. 307, 1886, also Repertorium der Physik, XXIII., p 732.

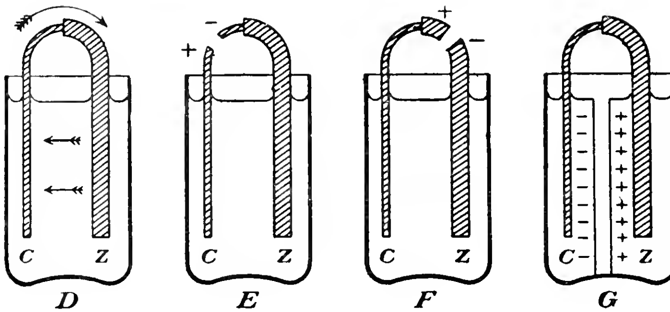

Fig. 2.

In Figure 2 D represents an ordinary Voltaic cell—a plate of copper and one of zinc connected and immersed in an oxidizing electrolyte. A current flows with the arrows, round the circuit copper, zinc, electrolyte, copper.

Now, if we cut this circuit at a point in the copper, as shown at E, we get a difference of potential between the copper ends at the division, positive in the part next the immersed portion of the copper, negative in the other end. Similarly if we cut the zinc as at F, we get the positive end above towards the contact, negative end below, and if we divide through the electrolyte as at G we have still the same effect, positive at the side in which the zinc is immersed, negative in that containing the copper. Now supposing we let this dividing diaphragm through the electrolyte be composed of air, and let it gradually increase so as to occupy so much of the space between two metal plates that only a mere film of the electrolyte is left on each metal surface, we have at once the whole effect as observed in the Volta condenser experiment or in the contact experiment of Lord Kelvin. I have shown this to be the case experimentally[15] and, further, if instead of merely dividing a single electrolyte, we use two electrolytes[16] such as a layer of copper sulphate solution on the copper, and zinc sulphate solution on the zinc,

15. Phil. Mag. VII., p. 110, 1879.
16. Proc. Roy. Soc., XLI., p. 306, 1886.

Fig. 3.

Fig. 5.

Fig 4.

we get the difference of potential equal to that of the Daniell cell analogous with this arrangement of films.

As touching the reception of my conclusions by the scientific world, it may be said that some accepted them fully, while others merely modified their definitions so as to save them from contradiction by my experiments. Professor Clerk Maxwell[17] was among the first to agree with me, and the interest taken in the experiments and acceptance of the conclusions drawn from them by one occupying a place so high in the scientific world doubtless led others to consider them.

Having now completed the more drily scientific part of my address, I shall ask your permission to describe a few applications of electric power arranged for the convenience of my own home, and afterwards to describe and exhibit experiments on the more important modern developments of electric art in wireless telegraphy and the Wehnelt interruptor.

At and about my home at Longhurst we employ, besides electric lighting eight electric motors and five pieces of apparatus in which electric heating is used. Fig. 3 represents an electrically driven gravel sifter. The motor is seen on the top driving the barrel screen which separates out the coarsest gravel, delivering it at the end into a barrow. Below the barrel screen is a sieve hung on springs and caused to vibrate and shake about by blows on its edge from the cams on the barrel screen. This delivers fine gravel into a second barrow and lets the sand fall through into a third. The economy over the usual method with two inclined flat screens is in the fact that only one shovelling is needed instead of say three or four for the two screenings, and the subsequent filling of the barrows with the product to be wheeled away.

The spiral shaped cam seen on the top is arranged to rise periodically with its supporting piece (which is hinged to the main frame) and fall suddenly as it is being rotated by contact with the revolving drum of the screen. The blow given by its fall shakes out any stones that may have become wedged between the rods of the screen.

17. Elementary Treatise on Electricity, p. 149.

Fig. 4 illustrates an electric motor arranged to drive either a mangle or an ice making machine.

At present it is connected by the strap to the mangle which it drives very agreeably on washing days. By changing the belt it may work the ice maker, the product of which was found acceptable in the hot weather. You simply enclose about a pint of water in the receptacle, switch on the current, and come back in twenty or thirty minutes for the ice. Water or wine can be iced in a very few minutes, and ice cream can be made.

Fig. 5 shows our electric motor car, or as a friend calls it the electric street boat. In it the motor and gearing are at the back over the driving wheels. The accumulator to carry the store of electricity needed for a 20 mile ride is under the middle of the car. The steering is effected by the wheel in front acting on the front wheels.

On the table is an electrically driven meat chopper, in which I have arranged a small motor simply coupled up to the usual hand chopping machine. The only disadvantage in introducing a machine of this kind into one's domestic arrangements is the continuous monotony of croquettes and rissoles which its handiness suggests to the housekeeper. By removing the chopping arrangements, and substituting egg beating apparatus, it is converted into a very efficient egg beater.

When this machine had been working for a year or so in my kitchen it occurred to me that the effect could be got more directly and simply. The magnetic pull which drives the rotary motor acts, like all other pulls, in straight lines and would produce the rectilinear motion required for meat chopping and egg beating, if we did not employ complicated means in the motor to produce rotary motion which we do not want, and are obliged to render rectilinear by further contrivances before we can use it.

It would be evidently simpler and better to allow the rectilinear pull to produce directly rectlinear motion. This is accomplished in the new form of apparatus Fig. 6 (here arranged as a meat chopper) in which the well known action of a solenoid on a soft iron core is employed.

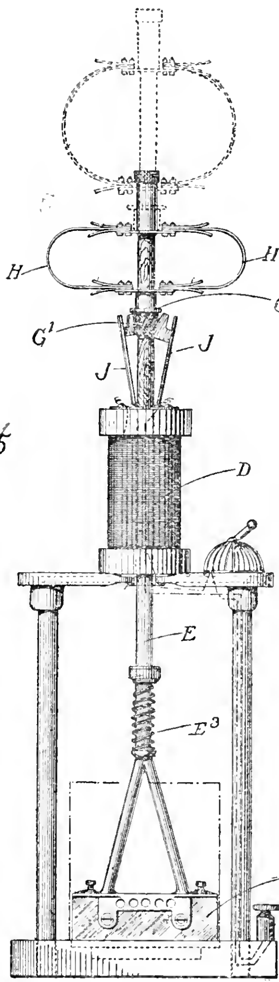

Fig 6

The current in passing round the coil attracts upwards the core E and its attachments, including the knife F^1, with a force of 3 to 4 lbs. In order to let it fall again it is only necessary to break the current, which is done by the sliding break or collar G. The current in entering the coil D passes through the two contact springs J J and the sliding collar G, making connexion between them, but as soon as the core in rising has stretched out the spring supports H H of the collar far enough to draw it up out of contact, the circuit is broken and the core falls by its own weight assisted by the resilience of a buffer spring E^3 under the coil. The sliding collar break follows it down and again completes the circuit, and so the reciprocating action continues. The material to be chopped is placed in a vessel with a wooden bottom as indicated in the figure by broken lines.

Besides this vertical motion it is necessary to rotate the knife F^1 so as to distribute its strokes over the whole of the meat. This rotation is effected by the inclined grooves G^1 in the collar break which engage with catches on the heads of the contact springs causing a turning movement each time the collar is drawn upwards.

A quick reciprocating motion of the kind we have here might be applied to many things such as hammering, rock drilling, etc. I have, as an experiment, fitted a hammer to this apparatus which can be controlled like a steam hammer. Again by turning the whole thing upside down and attaching to the cone a fret-saw or jig-saw with a spring take up, it has been made to saw also.

By substituting another core with a suitable plunger it is converted into an egg beater of great convenience and efficiency. The addition to this of an adjustable oil dropping arrangement gives it the power of making an excellent mayonnaise. Mayonnaise making, according to a high authority, requires "time, patience, and nicety." When these matters are arranged for in the machine one simply puts in the egg, oil, vinegar, and condiments, switches on the current, and in twenty or thirty minutes there is an excellent mayonnaise.

I now pass on to what is perhaps the most important electric invention of the last few years, namely, wireless telegraphy. In ordinary telegraphy the message is transmitted by means of electric currents in an insulated wire from the sender to the receiver, returning by the earth through earth plates, connected one to each end of the wire and buried in damp soil or in water. In returning through the earth the current does not confine itself to one path but spreads out through the earth. If we insert in the path of a portion of this earth current a second pair of earth plates and wire, we shall get a part of the earth returned current in a wire connecting these plates sufficient to affect a telephone, so that signals made by the current, in the first mentioned wire, can be heard in the telephone. Such a system is, I understand, in successful operation between Rathlin Island and the mainland at Ballycastle.

A method of much greater scientific interest as well as of later invention is that which has been recently perfected and brought into notice by Marconi. In this form of wireless telegraphy the message is carried by wave motions in the æther. In one sense it is not more wonderful than signalling by flashes of light; light waves being also wave motions in the æther, but with waves very much shorter than those used in telegraphy.

It will be interesting to recall briefly the history of the discovery of these electromagnetic æther waves.

In the year 1845 that greatest of all experimental philosophers Michael Faraday, tells us—"I have long held an opinion almost amounting to conviction, in common I believe with many other lovers of natural knowledge, that the various forms under which the forces of matter are made manifest have one common origin, or in other words are so directly related and mutually dependent that they are convertible as it were one into another and possess equivalents of power in their action. This strong persuasion extended to the powers of light and led to many exertions having for their object the discovery of the direct relation of light and electricity, but the results were negative. These ineffectual exertions could not remove my strong persuasion derived from philosophical considerations, and, therefore, I recently resumed the enquiry by experiment in a most strict and searching manner, and have at last succeeded in magnetizing and electrifying a ray of light."

We can imagine the great philosopher standing thus, as it were, on the farthest bound of knowledge, at the utmost point of discovery jutting out into the misty waters of the as yet dim unknown, gazing, examining into the depths of the infinitely possible, watching each dim foredawning of those gigantic truths, which that finest almost supernatural intuition with which he was endowed, convinced him existed there.

With this intuitive experimentalization of Faraday we contrast—but cannot compare—the brilliant deductions of Clerk Maxwell, who, in a later time, working on the experimental data of Faraday and others, and throwing on them the clear decisive light of mathematical deduction, concluded not only that there was a connection between light and electricity, but that light itself was really an electromagnetic phenomenon. He showed also that disturbances in the æther were produced by electric discharges, and that if such discharges were repeated with sufficient rapidity they would become the source of æther waves similar to light waves, but much longer, and having many surprising peculiarities. To such waves, for instance, certain opaque non-conducting substances such as pitch vulcanite and so forth would be found transparent. To these they would offer no more opaqueness than glass does to light. Metals would be opaque, but would have electric disturbance produced in them by the impact of these electromagnetic æther vibrations.

The experimental confirmation of these deductions was, however, still to be made. In 1883 Prof. George F. FitzGerald drew my attention to this, and pointed out that if we could produce electric discharges at the rate of 50 or 100 million per second we could verify Maxwell's prophesy. I could think of no current breaker which could work at such a rate. I mention this to show how narrowly one sometimes misses becoming famous. If we had only thought of the oscillatory discharge of an ordinary induction coil or leyden jar it would not have been left to Herz five years later to show that the oscillations of such discharges have the required frequency for radiating Maxwell's waves and to invent also means for detecting the radiations at a distance from their source.

In the working of such an induction coil as this now before you, at each spark there is an inconceivably rapid surging backwards and forwards of the current forming the spark, so that what looks like one spark is really a discharge oscillating in opposite directions between the brass knobs with extreme rapidity. By means of a suitable receiving instrument, telegraphy can be carried on by the usual code of short and long flashes. Such elementarv apparatus as I can show you here works very well across the lecture room as you see. Marconi has been able by more perfect arrangements to send messages over 40 miles.

If I have not wearied you too much I would now attempt to show two or three rather interesting experiments with another new electric invention. Wehnelt's electrolytic interrupter as applied to the induction coil.

The construction of the Wehnelt is very simple—merely a jar containing dilute sulphuric acid into which dips a lead plate forming the negative terminal of a supply at 100 volts or so. The other terminal is a platinum wire about the thickness of a darning needle enclosed in a glass tube so as to expose only half an inch or so to the liquid. When the current is switched on it passes by the platinum wire through the liquid to the lead plate. In doing so it heats the little platinum wire red hot. The heated wire electrolyses and also boils the acidulated water in contact with it, and surrounds itself with a layer of steam and electrolysed gas. Steam being a non-conductor the current cannot pass it, and so the needed interruption of the current occurs. The steam then promptly condenses thus allowing the dilute acid to come again in contact with the platinum wire. The current again flows, only to be interrupted again and so on at the rate of several hundred times per second, the rate of frequency depending on the make of the interrupter, and the self-induction of the coil employed. The result at the secondary terminals is a torrent of sparks succeeding each other so rapidly as to resemble a flame of fire. If the terminals be in the form of circles placed one over the other the discharge between them may be made to move round the circles by the proximity of a magnetic pole according to well known laws Again if the terminals be prolonged two or three feet in an upward direction, but diverging slightly as they rise, the discharge will form at the lower part, be carried up by the heated air formed in its track till it breaks at the top to reform below.

Sir Otto Jaffe, in moving a vote of thanks to the President, said it would be an impertinence on his part to attempt to criticise the lecture they had heard. He congratulated the President in that he had not only attempted but had been successful in scientific researches on one of the most difficult subjects of the present day.

Professor Purser, in seconding the motion, said he thought they would all agree with him in saying that they had seldom listened to a lecture so lucid and so well arranged. The experiments in wireless telegraphy had been wonderfully successful.

The motion having been passed by acclamation,

The President, in acknowledging the vote of thanks, said that after all, the success of an experimental lecture mainly depended not so much on the lecturer as on the care and efficiency of his assistants, and in this case their very best thanks were due to his friend Mr. MacWhirter, of Glasgow, who had come over specially and had given so much care and time to the preparation and carrying out of the experiments. They were also indebted to Mr. Mollan for his efficient assistance, to Professor Whitla for the use of the current from his house, to Mr. M'Cowan for making provision for this, and to Professor Morton, Mr. Finnegan, and Mr. Drennan for their kindness in lending apparatus.

11th December, 1900.

Mr. J. Brown, President, in the Chair.

THE BOTANY OF THE SHORES OF LOUGH NEAGH.

By John H. Davies.

(Abstract.)

Mr. Davies said that prior to the close of the seventeenth century there had been very little, if any, systematic investigation of the botanical productions of Lough Neagh. The first records were those supplied by the celebrated English botanist, Dr. William Sherard, who endowed the chair of Botany at Oxford, the distinguished Dillenius being the first Sherardian Professor. When visiting his friend, Sir Arthur Rawdon, at Moira, in 1692, Sherard spent some time in herborising along the lake shores. Following Sherard about the end of the next century, nearly 100 years later, came their townsman, John Templeton, than whom there had been no more zealous and devoted naturalist. In the course of his frequent visits to the lough and to Portmore, which are connected, he added much to the then meagre knowledge of its botanical history. In 1833 Dr. David Moore, when associated as botanist with General Portlock in the Ordnance Survey of Derry, had splendid opportunities which, at Lough Neagh, he used with the greatest advantage in the exercise of his love of botanical research. In more recent years their knowledge of the lake flora had been extended by not a few of the ardent and active botanists of the present time. Mr. Davies described the character of the rich and varied flora of the lough, and made allusion to the most noteworthy discoveries of those whose names he had mentioned. Some of the plants detected there by the earlier explorers, he said, were supposed to be now lost through the lowering of the level of the lake by the drainage works in the Lower Bann, but careful observation might probably result in the restoration of some of them to the list of Lough Neagh plants. One of the most important recent discoveries, by which the flora had been enriched, was that of a little sand-loving cress, *Teesdalia nudicaulis*, at Washing Bay, Co. Tyrone. It occurred in some abundance, but there was a question as to whether it might be indigenous. His own observations led him to believe that it had long been established there, and, though the ways in which a plant of the kind may be introduced were manifold, one was inclined to think it might be native. Recalling to mind, soon after it had been seen there, that the great bulk of the sand brought from the lough by canal to Lisburn and Belfast for building and filtration purposes is taken from the place where the plant is found, two of the spots along the canal where the sand is discharged were examined. In both, the plant was seen in quantity, with every appearance of having been there for some time, which was in support of the view that if not native at Lough Neagh, it was by no means a recent introduction.

Continuing, the lecturer said that the interest belonging to the occurrence of *Polygonum mite* at Lough Neagh, where he had the good fortune to meet with it very recently on both the County Antrim and County Armagh margins, consisted in its being a very rare plant in Ireland. There were, indeed, only two other stations for it. In England it was also a scarce plant, and it was not known in Scotland nor in Wales.

Sometimes one saw in the lake on the Antrim border considerable quantities of a very rare water crowfoot, *Ranunculus fluitans*, but on examination it was found to be floating loose in the water, not a single stem being attached. Were it not known that it occurred in the Sixmilewater, discovered there by his friend Mr. Stewart, some years ago, that river still remaining its only Irish station, it might possibly be mistaken as a lake plant. It was carried from the river to the lake in times of flood. Though producing abundant fruit, much of which must frequently find its way to the lough, the plant did not grow there. So nice was it in its choice of habitat that it occurred only in streams having a rapid current.

Proceeding, Mr. Davies said that notwithstanding the attention that had been given to the investigation of its flora by those to whom allusion had been made, it might not unreasonably be supposed that in the case of a lake having an area of over 150 square miles, there were some parts of its margins that had never been thoroughly explored. For a botanist he could conceive nothing more likely to afford profitable enjoyment than to spend a long summer holiday there, to examine its diversified shores, to visit its islands, and to dredge its waters for Characeæ and other hydrophytes. The student of nature who found pleasure in mingling with his pursuits matters of human interest would have opportunity. The hardy and intelligent fisherman you met by the way, or who invited you into his cottage for acceptable shelter from a passing thunder shower, would ask you about "them quare weeds," and impart his views on the affairs in which he took interest. If you fell in with him on the beach at his noontide meal of freshly-caught pollan, cooked on the embers of a wood fire, you were heartily welcome to a share, and he (Mr. Davies) could avouch that those same pollan, cooked after that fashion, and served to you on fresh, cool sycamore leaves, were fish most excellent that would not be lightly esteemed by the most fastidious epicure. He was, moreover, kindly and obliging in other ways, and would deem it no trouble to help you on your way by ferrying you over an intervening stream or inlet. But, however it may have been with him aforetime, he was now not much given to straying along the banks at the "clear, cold eve," or other time of day. His energies were devoted to the care of his nets and the baiting of his lines, to the capture of his pollan and trout and eels, and he was not overmuch concerned in searching for the submerged architectural structures of poetic fable. The old order changeth. Now-a-days he must take account of railroads, and his fish must be packed and despatched in time to catch the Liverpool steamer.

Continuing, Mr. Davies said that one of the most interesting features of the lough flora was the presence there of a small group of plants, some of which were not found inland elsewhere in Ireland, and others which seem never to have been seen inland throughout the British Isles. The main difference between some parts of the shores of their large lakes and the seaside consisted in one case of the absence, and in the other the presence, of salinity. In both, the degree of humidity was much the same, and in some other respects there was more or less similarity. In their island, save at the seaside and parts of their lake shores, they had very little, or none, of the loose shifting sands which influence the character of the flora. It was necessary to have some understanding of this before looking for or attempting to explain the presence inland of plants which are regarded as maritime. As was well known, there are species having a partiality for situations in close proximity to the sea, which occur on some of their highest mountains. Examples of some of these were given, the popular and scientific names of which sufficiently indicated their preference for the sea coast. In the high altitudes inland, in which they occur, it was to be assumed they found atmospheric conditions necessary for their growth and sustenance, their distribution not being solely influenced by salinity of soil Nevertheless, it is noteworthy that they had at Lough Neagh, and that only on the County Antrim shore, a number of plants usually regarded as maritime, which, in Ireland, had not been met with elsewhere in distinctly inland localities. The names of some of these were mentioned, and, in particular, allusion was made to the Sea Club-rush, *Scirpus maritimus*, which, so far as he knew, did not occur otherwhere inland in any part of the British Isles. A well-known botanist, Mr. Nathaniel

Colgan, knowing Mr. Davies' interest in the matter, had given him references to its continental range of distribution. There it was known to occur in the regions adjacent to the Jura Mountains. Yet, it remained that in this island it was restricted to the seaside, Lough Neagh, so far as he could ascertain, being the only exception. In the course of last summer he had seen there another plant, a sand spurrey, *Spergularia rupestris*, which held the same position. How came these plants? Not carried by sea-birds which visit the lake, since in that case they might be expected at the margins of other large lakes, also frequented by sea-birds. There were considerations which pointed to geological possibilities. One incident bearing on this he might mention. In 1874 the British Association met in Belfast under the presidency of Professor Tyndall. That meeting was most memorable, and of some of the discussions that then arose, and were for some time continued, there were those of them who retained a lively recollection. On that occasion a well-known geologist, Mr. Hardman, brought forward a paper on "The age and mode of formation of Lough Neagh." He sought to prove that the clays overlying the basalt were lacustrine deposits of Pleiocene age. Two years later, during a visit to Crumlin in company with Professor Hull, they found in the clay at that place fossil shells, the only fossils save those of plants previously known to occur in the Lough Neagh clays. They were considered to be fresh water shells, and their discovery was held to be in support of a theory that there was a former very large Lough Neagh, also fresh water, with an area probably twice as great as at present. This aroused so much interest that three of their members, his friends, Mr. W. Swanston, Mr. Stewart, and Mr. Wright, made a thorough investigation of the deposits, which led to widely different conclusions. The shells, which were in loose drift over-lying the boulder clay, were found to be, not fresh water shells, but those of the common mussel. It was found also that the deposit contained several species of microzoa now living along their sea coasts. These had lived and died, where their remains were now to be seen at Crumlin Waterfoot. The deposit in which they occur must have been formed by the action or within the influence of the sea. That being so, it seemed not very unlikely that at least some of the group of plants to which he had called their attention were survivals of a once littoral flora at Lough Neagh, when, through subsidence of the land in Pleistocene times, the country along the course of the Lower Bann was probably an arm of the sea.

Mr. Davies concluded by stating that he had been inviting their attention to the Lough Neagh flora, but he thought he might say that they in the North of Ireland, possessing the largest lake in the United Kingdom, were perhaps scarcely alive to the many debatable points in connection therewith. The physical problems as to the origin of the Lough itself would afford subjects for much discussion. Was it glacier formed, or was it due to some geological flexure? or, was the depression caused by a fracture of the strata at that place as suggested by Portlock's report? Then, the geological deposits surrounding it, its great bed of clay, with its petrified trees and its nodules of ironstone in which are preserved the fossilised leaves of a flora long since extinct in these regions, required more investigation. Zoology offered for research another field which had not yet been exhausted. The avifauna was most attractive, and a further study of its unusual fish and crustaceans would be instructive.

Mr. S. A. Stewart, in the course of some brief remarks, said he had listened with great pleasure to the paper which Mr. Davies had just read. The shores around Lough Neagh supported a rich and varied flora, and its waters yielded an abundance of aquatic plants, some being of considerable rarity. Lough Neagh was often resorted to by the botanist, and seldom failed to reward his research. Mr. Davies had just shown that it had not yet been exhausted, and no doubt the list of its plants will be still more extended when its western shores have been scanned by keen eyed Naturalists as well as the eastern had been by Mr. Davies and others. A most interesting point, briefly referred to in this paper, is the occurrence of certain maritime plants at a locality so far removed from the influence of sea water. The existence of shells of littoral molluscs in a clay bed on the Crumlin River had been cited as evidence proving that the sea, in a most recent geological period, extended up into the depression of Lough Neagh. Owing to one of the latest elevations of our land this anciently maritime lough was now a freshwater lake; but these plants, which usually flourish by the seacoast, remain to corroborate the evidence of the mussel shells of Crumlin River.

Mr. Wm. Swanston remarked that the occurrence of plants whose natural habitat is along the sea coast so far inland, and established on the margins of Lough Neagh, is a most valuable point brought out by Mr. Davies, which goes far to confirm the view that at no very distant geological date the Lough was marine. This botanical evidence is new, but as far back as 1879 the same conclusion was surmised on geological grounds by the discovery of beds, near the southern shore, containing shells of the common mussel (*Mytilus edulis*). These shells—or rather fragments—were determined by the late Dr. Gwynn Jeffreys, the greatest authority on British Mollusca then living. The microscopic examination by our fellow-member, Mr. Joseph Wright, of the strata in which the shells were found, also prove the marine origin of the beds, Mr. Wright being able to record several species of Foramenifera (a group of minute organisms exclusively marine) from the small quantity of material examined, those being forms such as may readily be found any day on our sea shores. Quite recently zoological evidence was unexpectedly established by Mr. Robert Welch, of our city, and Dr. Scharff, of Dublin, who, while dredging in Lough Neagh, found in some plenty a small crustacean (*Mysis relicta*), new to Britain, but a member of a marine group of which four species are recorded by the late Wm. Thompson from the Irish coasts. These scattered pieces of evidence—very interesting in themselves—when brought together, are, in my opinion, conclusive, and show in a very remarkable manner the value of noting and recording observations seemingly trifling in themselves. Mr. Davies' paper deserves the fullest notice the Society can give it.

Mr. Davies, in replying, thought that little remained to be said save for him to express his best thanks for the manner in which the paper had been received, and for the kind words that had been spoken. Sometimes one heard the conjecture expressed that the Pollan, to which allusion had been made, was possibly a transformed herring, but he hardly supposed that that was intended to be taken seriously. If it were such, the transformation was positively marvellous in that it did not possess the generic characters of the herring. There was a prevalent notion that it was peculiar to Lough Neagh, but he believed that it also occurred in Lough Erne and in Lough Derg. Closely allied species were met with in Wales and on the Continent. For the naturalist there were not many places with more varied enticements than Lough Neagh.

SOME ACCOUNT OF THE OBJECTS COMPRISED IN LORD DERAMORE'S RECENT DONATION, PRINCIPALLY ANTIQUARIAN.

PART. I.—ANTIQUARIAN.

By W. H. PATTERSON, M.R.I.A.

(*Abstract.*)

The Society is much indebted to Lord Deramore for his kindness in presenting to their Museum a large collection of objects of scientific and antiquarian interest. It is quite fitting that the antiquities, being mainly Irish, should find an abiding place in an Irish Museum, and especially in one where Irish antiquarian remains already form an important feature. Lord Deramore's gift makes our series of ancient implements still more complete, and in this way helps us to realise how these primitive or barbaric people lived, and what means they had for carrying on their occupations of war and the chase.

The stone implements in the Deramore collection are not numerous as compared with those of bronze. Two hammer stones of a tough quartzite, with hollows in the sides for convenience in holding, represent this class of antiquities. One of these is oval, measuring 6 inches by 4 inches; the other is almost round, measuring 3 inches across.

And here I may say that, most unfortunately, none of the antiquities, either stone or bronze, have any labels attached (with one or two exceptions only), stating where or when they were found. If collectors would only realize in time how the value of a specimen of any kind is enhanced by the preservation of full particulars of place and date, and circumstances of finding, their collections would be of much greater scientific value than they often are.

The Deramore antiquities, we must assume, are in the main Irish, but we do not know any of the circumstances connected with the discovery of the objects themselves.

The collection contains fourteen polished stone celts, varying from $2\frac{1}{2}$ inches to 13 inches long. These are the hatchet-shaped implements, which are so well represented in all collections of Irish antiquities, and of which vast numbers have been found, and are still being found, in Ireland ; perhaps I might say especially in County Antrim. Most of these fourteen celts are of close-grained black stone, in fact, varieties of basalt, but the largest, and another next to it in size, are of a whitish-coloured stone. Some of the middle-sized ones, say from 4 to 5 inches long, are in very fine and perfect condition, and there is one of very unusual form with the side edges flattened and hollowed ; one of the larger, about 6 inches long has been made from a slaty rock, and large flakes have weathered off both sides, leaving, however, the edge intact.

The objects of flint are few in number ; there are two well-marked flint-flakes of light-coloured flint, both showing secondary working.

There are twenty-five flint arrow-heads, barbed, stemmed, and leaf-shaped, from $\frac{3}{4}$ inch to $2\frac{1}{2}$ inches in length. Many of these are beautifully chipped into form, and show what exquisite skill the flint workers of our stone-age had attained to.

We come now to the antiquities formed of bronze. This fine metal, which has been found by analysis to be made up of about ten parts of copper and one part of tin, is exceedingly hard and close grained, and is capable of taking an edge almost as fine and sharp as iron or steel. The ancient bronze age people made their weapons and implements by casting, in the first place, and then, by hammering and grinding, they were finished to form the things as we now find them.

Many of the moulds have been found in Ireland in which spears, hatchets, and other weapons were cast, and in some places finds have been made of moulds, broken-up bronze, and finished and partly finished implements, showing plainly that such sites were the workshops of old artificers in bronze.

In the Deramore collection there are nineteen flat bronze celts, from 4 inches to 8 inches in length, varying very much in breadth, and also in the shape and curve of the cutting edge, some having the edge almost straight, others half-moon shaped. This is the simplest form of bronze celts, and is supposed to have been suggested by the stone celts which were in such common use in the stone age. These flat celts were either cast in sand, from models of wood or metal, or in moulds cut in sandstone. Some of these moulds have been found.

The next development of the bronze celt has been called the flanged celt. In this form the sides have been hammered so that a flange has been raised, sometimes scarcely perceptible, and sometimes of considerable breadth; and later on, if we may use the expression, when a still broader flange was wanted, the moulds were altered or were so made that a bold flange was made in the casting at once. The collection contains nine flanged celts, very interesting specimens, from 4 inches to 5½ inches long, and showing a gradation of flanges from the very slightest to ones that are broad and bold.

We now come to a most interesting series of celts, called by antiquaries "palstaves," or winged celts. This type shows a distinct advance upon those just named, and has been planned for the much more effective fixing of the wooden handle. The side flanges have been enlarged and strengthened, and in this way deep hollows have been formed; a "stop ridge" right across the centre of the celt has been added at both sides, and we can readily see what a fine weapon or implement for war, the chase, or agriculture a well-handled palstave celt would be.

The Deramore collection contains twenty-six palstaves, from 4 inches to 7 inches long, and of great variety in form and strength. Some show a little ornament. One of the palstaves; 6 inches long, has been labelled "Found along with a skeleton near Armagh." Among the palstaves there are three small unfinished narrow celts, about 4¼ inches, much weathered, and almost exactly alike. As these have not an Irish look, I submitted one of them to Sir John Evans, who writes me that he thinks it is of English origin, and is in all probability from the great hoard found at Stibbard, in Norfolk, where about seventy such rough castings were found, as well as ten castings for spear-heads, evidently the factory of an old English worker in bronze.

We now come to the most advanced and perfect form of bronze, axe-shaped objects—namely, the socketed and looped celt. Of these celts there are twenty-two in the Deramore collection, from the large, strong celt, measuring $4\frac{1}{2}$ inches long down to tiny ones, little more than $1\frac{1}{2}$ inches long. What these very small ones were used for it is hard to conceive, and yet they must have had their use, although this could not have been to strike a hard blow; they are too light and small for that.

The way in which socketted celts show a great advance in the metal-workers' art is the clever way by which the deep socket or hollow was formed, and the casting left comparatively thin, except, of course, near the edge, where some thickness of metal was wanted for frequent grinding and sharpening. The socket was made by the introduction in the mould of a core, and this was probably done in just the same way that a modern moulder or brassfounder would adopt. Celts of this type had almost always a bronze loop cast on, close to the opening of the socket. This, no doubt, was for the purpose of receiving a thong or other tie to secure the bronze head to the wooden handle, and thus prevent its falling off and being lost in battle. All the Deramore socketted celts have loops.

There are twelve bronze spear-heads, some unfortunately in a rather fragmentary state; eight of these have each two loops fixed against the socket for helping to secure the spear head to the shaft. The largest of these is only 9 inches in length, and the shortest about 4 inches, so that there are none of the very fine long spears seen in some collections. The broad, keen blades and deep sockets are so cleverly fashioned that these spears may be pronounced masterpieces of the bronze-workers' art. There are two other spears of quite a different type, with long openings in the blades; one of these is labelled "Spear from Naples, R.B. 1849." The R. B. is obviously the late Sir Robert Bateson, first baronet, grandfather of the present Lord Deramore. The second spear is very similar in shape, but fresh and clean, instead of being deeply corroded. There are two broad, thick and short blades with rivet holes at base, which may have been battle axes.

There is a dagger-knife blade, 5 inches long, labelled "Irish skeyn, Co. Kildare," and there is another somewhat similar, with socket and rivet holes.

Of the leaf-shaped swords, which are usually seen in collections of Irish antiquities, Lord Deramore's collection contains eight; some are much broken; the largest of these is 20 inches long. There is an object of bronze which seems to be the point of a scabbard; it is $6\frac{1}{2}$ inches long, and is decorated with fine engraved lines.

I find among the bronzes two socketted gouges; they are of small size, and are of a well-known type.

There are forty-eight bronze rings, some of them hollow, varying from 1 inch to $3\frac{1}{2}$ inches in diameter. Such rings have been found in great numbers in Ireland, the Museum of the Royal Irish Academy containing more than one thousand of them. It is supposed that they were for personal use, and may have been sewed on clothing to serve as ornaments, or as a protection against sword cuts.

There is also a large ring, 4 inches across, which appears to be made of jet.

In the collection there is a bronze crucifix; it is 12 inches high; the figure which is 4 inches high seems quite archaic, but the cross looks rather modern.

There are a few more objects of bronze in this interesting collection, which may be briefly named :—two bronze spurs; a bronze smoking pipe; a bronze or brass cup, egg-cup shaped, 4 inches high; a bronze boss $2\frac{1}{2}$ inches in diameter; a circular spoon or ladle, 4 inches across, and a few things that were probably for domestic use, such as buckles, etc.

I should say that there are also a few objects of stone, pottery, etc., apparently from Egypt, Greece, or other Eastern countries, and there is a fine black stone adze, probably from New Zealand.

PART II.—GEOLOGICAL.

By S. A. STEWART, F.B.S.Edin.

The geological specimens in the Deramore collection are numerous and varied. There are specimens from several formations, mainly of the Secondary or Mesozoic Period. A few of the fossils are of species which are found in the Carboniferous rocks, but the greater part come from the Cretaceous and Liassic formations. There are a good many Ammonites, some of them very good examples, especially those from the Lias. Two of the Liassic oysters are remarkably fine, as are also some of the bivalves from the chalk. One very fine palate or crushing tooth is also from the chalk—presumably English. There are some small pieces of silicified wood, and also a number of rock specimens, and minerals, but not being furnished with localities these are much less instructive than would otherwise be the case. This remark applies also to the fossils. As to them we can fix the genera under which they must be placed, and with a little trouble the specific names may be ascertained. In many cases the locality of their origin may be inferred with strong probability, but without entire certainty on this point the value of fossils is much diminished. The necessity of attention to this matter of indicating on each specimen the locality whence it came deserves to be impressed very strongly on all collectors.

NOTES ON SOME CLAY CONCRETIONS FROM THE CONNECTICUT VALLEY, U.S.A.,

By W. Swanston, F.G.S.

(*Abstract.*)

In introducing this remarkable series of concretionary nodules I should state that, as I have not personally collected them, I am unacquainted with such details of their occurrence as I should have been glad to bring before the meeting. They were collected near Hartford, U.S.A., in beds of the Triassic series. Nodules and concretions of similar character occur in most sandstone and clay deposits irrespective of geological age. We may therefore safely infer that, under similar conditions, their mode of formation will be somewhat alike. The following appears under the heading "Concretions" in an authority consulted. "Concretions are nodules, balls, or irregular masses which occur scattered through the body of the rock, and consist of mineral matter which was formerly diffused through the material of the rock. Some are crystalline, as gypsum in clay; others may have internal radiating structures, as iron pyrites in shale, etc. Fantastically shaped concretions are not uncommon in fine clays, and are known as 'fairy stones' by the country folk in some districts. They are produced by molecular aggregations subsequent to the deposition of the strata, whereby the substance of the rock is forced into spherules or balls." Similar nodules, but of less delicate form and texture, are occasionally found in stream courses cutting through the new red sandstones of County Antrim, the softer body of the rock having been removed by the action of the water, the concretions are found adhering to the sides of the miniature canyons. The extremely delicate character of the examples exhibited is doubtless due to the finer texture of the rocks in which they were found. Their stratified appearance—which is only external—is probably due to the different degrees of hardness of the more minute strata of the beds in which they are found, the more pervious strata allowing the seggregation to push along their parallel lines, subsequent weathering giving the strange resemblance some of them have to objects produced on the lathe.

After an examination of the specimens a series was presented by the reader to the Museum.

20th December, 1900.

MR. J. BROWN, PRESIDENT, in the Chair

SOME SIDE LIGHTS ON THE CHINA QUESTION,

By REV. A. R. CRAWFORD, M.A.

(*Abstract.*)

The first portions of Mr. Crawford's paper were devoted to the Chinese view of human life. The general incapacity of Chinese government, especially in regard to its foreign relations, and the civilisation and religion of the country having been very ably discussed, Mr. Crawford dealt with the recent Boxer movement, which created such anxiety amongst the civilised governments of the world. He said it was undoubtedly patriotic, but in a limited sense of the word. Its aim was negative—the ridding of the country of foreign influence. It had nothing positive to suggest with a view to remedying the acknowledged unsatisfactory condition of the country. Amongst the causes which produced the revolt were to be found the superstitious element and a long-continued drought in the spring of the present year, which brought large numbers of the population in the Northern Provinces to the brink of starvation, and produced a widespread feeling of dissatisfaction. A very important reason for the outbreak had been the aggressive attitude of the various European nations. Unfortunately we had got into the way of speaking of the "partition of China," and of claiming "spheres of influence" in a way which must have been very galling to any Chinese who were possessed of the slightest spark of patriotism. Proceeding, Mr. Crawford said they could not omit from the list of aggravating causes the missionary problem. Although his testimony might be ruled out of court as being *ex parte*, he thought it might be fairly claimed for Protestant missionaries at least that they had not sought to intermeddle with Chinese politics. In spite of the magnitude of the outbreak, we must not for a moment imagine that the whole of China was against us at this time. In provinces where there seemed for a time to be a serious outbreak the motive was anti-dynastic rather than anti-foreign, and since the time when the allies began to obtain the upper hand in the North the source of danger had subsided. He for one could not bring himself to believe in a "yellow peril" as an actual, practical menace to the world's peace. It must be remembered what Sir R. Hart, in expressing grave fears on that score, wrote but a few days after the raising of the siege of the legations. It was not surprising that he should at such a time have looked at things through dark spectacles. It should be noted that combination had always been China's weak point, and that, strong as the Boxer movement had been, it would have been a mere rabble but for the adhesion of the Imperial troops. It was now for the allied powers to take effective measures for restricting the introduction of firearms into China. Much, Mr. Crawford thought, had been learnt on both sides, and if toleration was mixed with firmness and due regard to justice they must all believe and hope that China would yet take her place in the comity of nations, and that in time she would become a source of strength, and not of danger, to the whole civilised world.

The lecture was profusely illustrated by special limelight slides and maps.

The hearty thanks of the society were accorded to Mr. Crawford, on the motion of Mr. T. F. Shillington, J.P., seconded by Mr. F. R. Lepper.

Mr. Robert M. Young, B.A., M.R.I.A. (Hon. Secretary), presented the Society with a well-executed portrait of Mr. Robert Lloyd Patterson, D.L., F.L.S., who on several occasions filled the position of its president.

The President acknowledged the receipt of the interesting gift, and said it was most appropriate that the Society should possess portraits of its presidents.

8th January, 1901.

Mr. J. BROWN, President, in the Chair.

REPORT OF DELEGATE TO CORRESPONDING SOCIETIES' CONFERENCE, BRITISH ASSOCIATION MEETING, 1900.

By J. Brown.

(*Abstract.*)

As your delegate I attended both meetings of the Conference. At the first meeting two resolutions on proposed changes in the arrangement of the proceedings were negatived, but the discussion threw light on the wishes of the delegates, implying that they did not desire to hear papers at the conference, but rather to discuss methods of procedure that might make local societies successful. The question of the protection of copy right of societies in their proceedings was brought up and referred to the general committee.

At the second meeting, after hearing and discussing a paper on "Dew Ponds," the conference received the usual reports from sections. Section C is anxious for co-operation of corresponding societies in the work of the Geological Photographs Committee and the Erratic Blocks Committee. Mr. Sowerbutts, representing Section E, made suggestions for more active co-operation of corresponding societies. Mr. Hartland, representing section H, brought forward the request of the Anthropological Photographs Committee for photographs of prehistoric stone monuments, stone implements, primitive pottery, and of objects connected with local superstitions. Such objects were frequently met with in local museums. I am asked to bring these requests before the Society, and I feel sure there are many members competent to comply with them. I should be glad to take charge of any photographs, and the names of senders would be published in the annual report of the British Association.

As items of general interest to our members, I may mention that our distinguished fellow-member, Dr. J. Larmour, presided over Section A, and delivered a characteristic address. Professor John Perry, another distinguished student of Q.C.B., now President of the Institution of Electrical Engineers, also took an active part. Professor Letts, who is making the new Queen's College Laboratory the home of important original research, read several papers, and I had the honour of exhibiting the viagraph (including the usual striking diagram of the Lisburn Road) at the Lord Mayor's conversazione and before Section G, where there was also read a paper by Professor Hele Shaw on "Tractive Force on Roads." Subsequently the Association appointed a committee to further investigate this question. As your President I was honoured by a request to act as first spokesman of the deputation to invite the Association to Belfast in 1902. Professors Letts and Symington and Mr. W. Gray added their promises of welcome, in which I doubt not the city will generously bear us out."

IRISH RAILWAYS AND THE STATE.

By LYNDEN MACASSEY, C.E., B.A., LL.B., B.L.,
Lecturer Railway Department, London School of Economics.

(*Abstract.*)

The relations that should exist between railways and the State possess great commercial and political importance. Railways may be privately or State owned, and four relations are found—railways privately owned and subject to or free from the control of the State, as in England and America, and railways State owned and worked by the State or by private individuals, as in Prussia and France respectively. For the distinction, the Continental disposition to leave everything to the State, as compared with the Anglo Saxon inclination to give private enterprise full sway, really is the explanation.

In Ireland railways are privately owned, but State controlled. That control is directed to construction, public safety, public convenience, and rates. As regards the first three subjects mentioned, the control is perhaps too effective ; the real question is that of rates. There exists a maximum schedule of goods rates in excess of which Irish railways may not charge. But the limits are rightly high, and the companies do not now charge anything like full rates. Railways do not try to increase profits by raising rates, but by lowering them and so swelling their traffic. Nor can you limit dividends. If you do you make it to the advantage of a company to do a small business at a high rather than a large business at low rates. All proposals for nationalisation are grounded on the inefficiency of the present system of control, and on the defects in management of Irish railways. As the latters' profits are not excessive, their charges are not either. The average dividend paid in 1900 on the capital invested was only 3.9 per cent. Rates certainly are not unreasonable. Eggs are carried from Galway to London for $\frac{4}{5}$d per dozen, fish from $\frac{1}{2}$d and

¼d per lb., according to the class. Special trains are given to the fish traffic for consignments as low as 20 tons.

Increase in train mileage represents increase in public facilities, and in respect of increase in passenger and goods train mileage Irish railways are 1 per cent. and 8 per cent. respectively ahead of English railways, while the tonnage and number of passengers increased by 21 per cent. and 28 per cent., which compares very favourably with England. The corresponding receipts only increased by 17 per cent. and 13 per cent. Irish railways therefore do not seem to be neglecting the public. The recent amalgamations will be a benefit, working expenses will be reduced; competition in Ireland is impossible, and itself would merely result in amalgamation or the pooling of traffic. Dissatisfaction with Irish railways is therefore unreasonable; the requirements of Ireland are served; to provide facilities in excess would be financially impossible.

Defects in private management are not the cause of State management of railways on the Continent. There the Governments had generally to construct railways themselves in the absence of effective private enterprise, or they acquired private lines merely to consolidate their military strength. In France unimpared company monopoly has been the price of State control; in Belgium the efficiency of the State railways is due to their long competition with once privately-owned railways. Rates founded on 'cost of service' is the motto on which every Government started business. The theory proved unworkable, and Governments had, like companies, to charge 'what the traffic would bear.' The latter principle makes to a large extent the advancement of railway prosperity involve the advancement of the district served.

Governments cannot manage commercial undertakings well. They do not reduce rates, except on popular agitation. The history of the Post Office proves this: penny postage and sixpenny telegrams were the outcome of great pressure.

Irish trade particularly needs careful nursing. That, we could not trust the State to do. The purchase of Irish railways would be a financial impossibility for Ireland itself to stand. England would scarcely contribute. Although nationalisation is inadvisable, the relations between the State and Irish railways may be improved. At present the Board of Trade compels a line in Connemara to be as substantially constructed as a line in London, without regard to the probable traffic. So, too, with regard to safety appliances, a line in Galway must be as perfectly signalled and equipped as a line in England with heavy traffic. This all involves a heavy sinking of unremunerative capital, and is not business. 'As the traffic, so the road,' the principle in America, is founded on common sense. The procedure for acquiring land for railways is more expensive in Ireland than in England. A landowner in England gets one hearing before an arbitrator or a jury ; in Ireland he gets three. The costs on acquiring a single acre often amount to two or three times the value of the land. The State should perfect their present system of control by cheapening the procedure of the Railway and Canal Commission Court, entirely out of the reach at present of humble litigants.

Future railway extension in Ireland must depend on the State, which in the past has adopted a restrictive policy. Baronial guarantees are wrong. If a district cannot support a railway, to tax it for the support will be a burden. Free grants or cheap loans to judiciously located lines—not to lines constructed merely to give employment—would promote railway extension. Railways the subject of State aid at present are limited to light railways, but the construction of light railways has shown how much the State can do to open up and develop Ireland.

Mr. Isaac J. Murphy said he had very seldom heard a lecture of the kind with the leading ideas of which he was in such absolute agreement. This was a subject on which he had a considerable amount of information, and, in these days when the old principles of Cobden and Bright on free trade and private enterprise were supposed to be exploded, he was glad to hear those sound principles so clearly and strongly enunciated by Mr. Macassey.

Mr. Robert Dunwoody thought a change in the heads of departments and the directorate on some of the Irish railways would be one of the very best things that could happen. There had been a great improvement in recent years in the management of some of their local railways, and he instanced the Great Northern in particular. He knew of one industry that had been immensely helped by the generous way in which Mr. Plews, the manager of that line, had helped it.

Professor Fitzgerald sympathised especially with that part of the paper which pointed out the annoyance caused by applying the same elaborate system of signalling to small lines over which there ran two or three trains per day as was applied to lines which had trains running every two minutes.

Mr. John Carson said he would have been glad if Mr. Macassey had gone a little further than he had. Ireland was a very poor country, and required Government aid, especially in the important matter of her railways. He thought the management of some of our lines could be very greatly improved, and he suggested that excursion trains at cheap fares should be run, say, two days per week, between Belfast and Dublin and Dublin and Belfast, in order that the people of the metropolis and the people of the Northern capital might become better acquainted with each other. Intercourse between the two cities should certainly be encouraged. Mr. Macassey had not in his paper dealt with the subject of electrical lines. In the Isle of Man the electric system, as far as passenger traffic was concerned, had worked well, and he did not see why it should not be applied to goods traffic as well. He thought the Bangor and Holywood line should be worked by electricity instead of having fifty-ton engines employed. The system on this line should be made more like a tramway system with, say, a ten minutes' service.

Mr. H. Leslie Thomas was in favour of State-owned railways. They were a success in India, Egypt, and Belgium, and he did not see why they should not be a success in Ireland. Germany failed because she neither left this matter to private enterprise nor took it entirely over.

The Post Office would not be nearly so well managed in private hands. There is, for instance, much to be desired in the present management of the telephone. In the hands of Government the service would be better and cheaper. The tendency at present was in favour of State aid being given, not only to railways, but to every large industry that was a necessity to the general public. He thought electrical traction would be safer and cheaper than steam traction.

Mr. Walter Bailey said he was surprised to find that no one present had made a serious suggestion that the State ownership of Irish railways would be a benefit to the country at large. He was under the impression that the State purchase of Irish railways was one of the strongest planks in the platform of many gentlemen in Belfast to-day. He thought, however, that most people believed that private enterprise was, upon the whole, far better than the State working of Irish or any other railways. The subject of the price to be paid for Irish railways, should the Government think the scheme feasible, was one of the greatest circumstance, and on it a great deal might have been said, but the point had not been raised. Indeed, the discussion had been of a very cursory description, and he did not wish to trouble the meeting with statistics on that particular point.

On the motion of Dr. Redfern, seconded by Mr. Adam Speers, Holywood, the hearty thanks of the meeting were accorded to Mr. Macassey.

5th February, 1901.

Mr. J. BROWN, President, in the Chair.

The President moved the following resolution :—" That the members of this Society desire to express their deep sorrow at the death of her Majesty Queen Victoria, their sense of the great loss thereby sustained by the British nation, and to tender their most humble and loyal duty to his Majesty King Edward, with the fullest confidence that he will worthily occupy the high place of her late revered Majesty."

Mr. Robert Young, J.P., seconded the resolution, which, on being put, was passed unanimously, the audience standing.

COLOUR.

By Professor W. B. Morton, M.A.

(Abstract.)

The subject of colour had been selected as lying in the borderland between science and art, in the hope of interesting the many members of the Society who were artistic in their tastes. The discussion would be limited to the treatment of colour as a sensation, and would leave untouched the purely physical side of the question. The origin of all the colour in nature was found in the composite nature of white light. In illustration of this, experiments were shown with a spectrum thrown on the screen. The colours of transparent bodies were due to the fact that they absorbed some of the constituent rays of white light, and allowed the rest to pass. Opaque coloured bodies absorbed some rays, and scattered the rest back from their surfaces. The colour shown by any surface must, therefore, depend on the quality of the illumination. This was illustrated by holding different coloured papers in different parts of the spectrum, and also in the pure yellow light of a sodium flame. All the various tints and shades could be got from the separate spectrum colours by altering either their intensity or their purity, with the exception of purple tints, for which it was necessary to mix the extreme colours of the spectrum. In very bright light colours tend to become yellowish ; in dim light, such as moonlight, the bluish colours are alone visible.

The laws of mixture of colours were then explained and illustrated experimentally by making coloured patches on the screen overlap, and by whirling rapidly parti-coloured discs. The results obtained had to be distinguished from those got by mixing pigments, and led to the assumption of red, green and violet as the primary colour sensations. The treatment of the rather complicated facts of colour-mixture was rendered easy by the use of a colour diagram in the form of a triangle, with the primary colours at its angles. Attention was drawn to the unique position occupied by green, and the artistic consequences of this. Specially important from the artistic point of view was the grouping of colours into complimentary pairs, which combine to give white or grey—*e.g.*, blue and yellow, green and purple, red and greenish-blue. The phenomena of contrast depended directly on these groupings. They might be explained as an error of judgment on the part of the eye, the standard of white being affected by the prevailing colour. Thus in a prevailing yellow illumination the standard of white would be displaced towards a yellowish tint, and surfaces which were really grey would look to have the complementary colour blue. This was illustrated by the well-known effects of coloured shadows, seen, for instance, in a room lit by both ordinary and incandescent gas burners. In general, coloured objects seen on an extended coloured background had their true colours mixed with that complementary to the background. A number of instances were shown in which two rings, cut from the same coloured paper, but pasted on back-grounds of different colours, looked of entirely different shades. The effect was best seen when the colours were made paler by covering with a sheet of white tissue paper. It was shown that phenomena of this kind gave a clue to the explanation of the fact that certain pairs of colours "go badly together."

The lantern was manipulated by Messrs. John Wylie, B.A., and T. B. Vinycomb, B.A., upon the capable performance of whose duties in this respect the lecture in considerable degree depended.

Professor Redfern commented upon the brilliance and instructiveness of the lecture, and moved that the best thanks of the Society be accorded to Professor Morton for having delivered it.

Rev. Robert Workman seconded the motion, which was supported in warm terms by Mr. William Workman, Mr. George Coulter, Mr. William Gray, M.R.I.A., and passed by acclamation.

Professor Morton briefly acknowledged the vote of thanks.

5th March, 1901.

Sir JAMES HENDERSON, D.L., in the Chair.

SCENERY AND ANTIQUITIES OF SLIGO, CONNEMARA, AND CLARE.

By Seaton F. Milligan, M.R.I.A., F.R.S.A.

(Abstract.)

The Chairman said probably every one present had already heard Mr. Milligan describe the scenery of what they all believed to be the finest country in the world, and consequently it was unnecessary to use many words in introducing him on that occasion. A lecture on the scenery of the West of Ireland was very appropriate, because in the coming season they wanted to attract as many visitors to Ireland as possible so as to benefit the country. He was of opinion that the Irish Tourists' Association reached the zenith of their success last April, when Queen Victoria, the greatest and most important lady in the British Empire, visited Ireland; but they should not slacken their efforts in developing the tourist traffic as much as possible in future. It was a matter of regret that the King and Queen could not visit the country this year for reasons which weighed with all of them, but it was their hope that next year they would have the pleasure of welcoming their Majesties.

The Lecturer said—It is admitted by well-informed people that Ireland is one of the most healthful and picturesque countries in Europe, but its charms had remained hidden, and its beauties were only known to those who had ample means and time to explore them. The most interesting places and the finest scenery are situated in remote parts difficult of access and expensive to reach.

This drawback has been removed in recent years by the opening of new lines of railway and the erection of comfortable and commodious hotels in the centres where the best scenery is situated. Tourists and visitors in search of health, possessed of moderate means, can visit these hitherto exclusive districts at a comparatively small outlay. The railway from Galway to Clifden has opened up the district of Connemara. The extension of the railway from Westport to Mallarany and the Sound of Achill has made that island quite accessible with all its wealth of cliff and mountain scenery, and its invigorating breezes fresh drawn from the Atlantic. Further south the West Clare Railway opens up in County Clare a most charming and interesting district—viz., Lahinch, Miltown Malbay, and Kilkee. The hotel and golf links at Lahinch, overlooking Liscanor Bay, are attracting quite a crowd of tourists. Nature has made Kilkee one of the finest, if not the very finest, watering-places in Europe, where the great Atlantic rolls in on its gently-sloping silver strand or dashes with thundering force on its huge cliffs, carrying spray and foam upwards over their topmost summit to be carried landward on the gale for miles. County Clare is comparatively unknown to North of Ireland people. It lies away in the South-West, out of the beaten track of travellers, and until quite recently was most difficult of access. Since the opening of the Balfour railways this remote district has become much better known. Lisdoonvarna, in North Clare, is noted for its sulphur, iron, and magnesian spa, which is said to equal any in England. We can reach these places by various routes—by rail from Athenry to Ennis, and thence by the narrow guage to Kilkee, or to Ennistymon and thence by coach to Lisdoonvarna. I went straight, via Galway, thence across the bay by steamer to Ballyvaughan, and public car, fare one shilling. The steamer goes three days a week, and it is the most direct route. From Lisdoonvarna to Ennistymon is nine miles, fare by public car 1s 6d ; you can take train from thence to Kilkee, or stop at Lahinch for the golf links. In July last I spent a week at Lisdoonvarna with the Royal Society of Antiquaries, who held their summer meeting there. I next proceeded to Kilkee, and finished up by returning to Galway by rail, and from thence to Recess in Connemara. Recess is an extremely good centre from which to explore Connemara, and the hotel there is owned and managed by the railway company, who have done everything possible to attract visitors to it.

I will now refer to the western seaboard of Ireland, and describe as briefly as possible some of the sights that will meet the traveller coming from Sligo in the north-west to he reaches Kilkee in the south-west. The people who inhabit these parts of Ireland are bilingual, and speak Irish and English, the former from choice and the latter from necessity. These people are most interesting to meet and speak to, the older people are conversant with the habits and customs of the ancient Celtic race, and relate old stories and folk tales, and croon you some of the ancient airs that we are now trying to write down and preserve from being entirely lost. Through Mayo, Galway and Clare the old manners and customs can be studied, which are surely and slowly dying out through the increased contact with visitors and tourists. The sublime cliff scenery of Achill and Clare can now be visited with comparatively little fatigue, as well as the rivers, lakes, and bens of Connemara. The Midland Great Western Railway runs right across the centre of Ireland from Dublin to Galway, and from thence through Connemara to Clifden, the capital of that district. From Athlone, almost the centre of Ireland, it extends through Roscommon and Mayo to Westport, and thence to the Sound of Achill, and to Ballina and Killala. Here on the line at Mallarany the railway company have erected a fine and commodious hotel on a site commanding a view of Clew Bay. The tourist visiting Connemara and Achill will be delighted with many miles of the grandest and most picturesque lake and mountain scenery in the United Kingdom. The panoramic view of Killary Bay for eight miles, with its wild, romantic mountains towering into the sky, and the volcanic-like "Mweelrea" (2,688 feet) at the entrance, cannot be surpassed. The wild grandeur of Kylemore Pass and

Lake, with the "Twelve Bens" (2,000 feet) in the background, is unrivalled. The silvery lakes—Glendalough, Derryclare, Inan—teem with salmon and trout, and offer inexhaustible sport. The seacliffs and headlands of Clifden and Achill, washed by the broad Atlantic, are grand and wild. Clew Bay, comprising an area of 28 square miles, studded with over 100 islands, affords from Croagh Patrick (2,500 feet) one of the rarest panoramic views in the world, not excepting the Thousand Isles of the St. Laurence. Lough Corrib, 18 miles long, is a small, fresh-water, inland sea. The venerable ruins of Cong Abbey are not only beautiful, but traditional and legendary. Loughs Conn and Cullin, the former eight miles long, affords views that are the real of the extravagant scenic artist's ideal—wild foreground, water-jutting headlands, backed by numerous lines of hills and high mountains. Lough Gill and Hazlewood Demesne afford a change from the wild and romantic to the wooded class of scenery, still, however, blended in the background with desert-looking, serrated mountains. To the scenic tourist, the health-seeker, the angler, the sportsman, the botanist, the geologist, the archaeologist, the artist, or the pedestrian, the attractions offered by the Western Highlands are unrivalled, with the additional charm of being in parts unexplored. Its streams and waters are as pure as its breezes wafted in by the Atlantic. No barriers on its rivers stop the fish from running up from the sea, nor does any product of manufacture poison them. The coracle skims over its bays and inlets, reaping the harvest of the deep. The western peasant believes in home manufacture, as he and his family produce almost all they require of food and clothing, and are technically educated to an extent that the peasant of the North is not. They spin, weave and dye the wool of their sheep, knit their hosiery, make their shoes, coracles, and many other articles. They are good builders of walls without mortar, and frequently erect their own dwelling-houses. Nature provides for these western districts many things that in our cities could not be procured at any cost. Scientists state that ozone is produced when the waves of the sea are dashed and split up against the cliff. No place known to me are the waves so smashed up into what I may term waterdust as along the coast of Achill and Clare. Here the greatest production of ozone in Europe is constantly in operation. We have a nature's own factory for the production of the most life-sustaining and health-giving air in the world. No such invigorating supply is produced on any part of the coast of the Riviera, where people flock for health, whilst the temperature along this western county is very equal and mild all the winter through. The breezes from the gulf stream so temper the air that fuchsias grow into great trees and bloom in mid-winter. I have seen at Kilkee the Atlantic stirred up by a western gale, particles of white foam flying high up in the air and carried inland for a great distance out of sight. We will show views of Kilkee in fine weather, and also the wave effects during a gale ; but no views can do justice to the grandeur and sublimity of the scene during a stiff gale from the west. We think that the health-giving and invigorating properties of the air at Kilkee are not sufficiently known to the public or the medical profession. The out-door life now recommended in case of lung disease where the air is pure should be tried in some of the sheltered valleys of the west coast ; there the force of the wind would not be felt, but where its purity would remain unimpaired.

COUNTY SLIGO.

Our tour naturally divides itself into three parts—Sligo, Connemara, and Clare. If we start from the north-west at Sligo, we find it has a class of scenery peculiarly its own. It differs entirely from Connemara and Clare. It has fine mountain ranges, beautiful lakes, with well wooded islands, and picturesque fishful rivers. Its fields are green and fertile, its valleys and hill slopes are well wooded, giving a richness and warmth to the scenery not found elsewhere in the west. The farm houses are comfortable, clean, and well kept, so that no one would imagine this to be in the poor Ireland so often pictured. It differs widely from the districts in Mayo and Galway, both in its appearance and people. Many Cromwellian soldiers were settled in County Sligo as the border county of Connaught. They were mostly of English descent, and they introduced improved methods of farming, which are visible to the present day. Lough Gill, close by Sligo town, is a charming lake five miles long, by about a mile and a half wide. It contains several well wooded islands, and the ruins of an ancient Celtic Church on one. It is surrounded on almost every side by high mountains, which give it quite the appearance of Killarney, but on a smaller scale. The arbutus grows in Hazlewood Demesne on the northern side of the lake, the hills of Cleveragh, overlooking lake and river, are also finely wooded. There is a holy well and altar at Tober Nalt on the margin of the lake, where a pattern is held on the last Sunday in July called Garland Sunday. The river Garvogue, which discharges the surplus waters of the lake, is the earliest salmon river in Ireland, as fishing commences on the 1st of January, when the fish are found to be in prime order. The Owenmore that empties into Ballysodare Bay very close to the Sligo river, strange to say, is fully three months later. The rapids and falls of the latter river at Ballysodare are very fine, particularly when the river is in flood. For several hundred yards the rapids extend from the bridge towards the sea, and finally tumble over a fine fall, and are lost in the bay. Glencar Lake, on the northern side of Sligo, some ten miles distant, lies right under the Benbulbin Mountains ; it contains two crannoges, or artificial islands, which in ancient times were used as strongholds. Bronze and stone implements have been found in them, also great quantities of bones of the red deer, ox, goat, and other animals. There is a celebrated waterfall at Glencar, with the peculiar feature that when the wind blows strong from a point in front of it the water seems to rise up the face of the mountain and is lost in spray. The visitor to Glencar can return to Sligo by the village of Drumcliff, founded by St. Columba. It possesses a beautiful sculptured cross and a portion of a round tower. The ancient church has disappeared, but the cross and round tower point to the antiquity of the place. Close by this village is the charming district of Lisadell, and the seat of Sir Henry Gore Booth, Bart. This district is noted for ancient forts, cashels, cromleachs, giants' graves, and other interesting objects of ancient times. In one day the traveller can visit Glencar, Drumcliff, and Lisadell, returning to Sligo same evening. Another interesting tour from Sligo is to Carrowmore, to see the cromleachs and stone circles; thence to the Glen, and finally to Knocknarea. Driving as far as Primrose Grange School, where a twenty minutes' climb will bring us to the summit, 1,078 feet above sea-level. It lies exactly between the bays of Sligo and Ballysodare, and commands a most extensive view across Donegal Bay and southwards to the Curlews. The greatest cairn in Ireland crowns its summit, called Mescaun Maeve, supposed to have been erected about the period of the Christian era, in memory of Maeve, Queen of Connaught. Close by the river side in Sligo town are the ruins of the abbey founded about the year 1252 by Maurice Fitzgerald, for the Order of Dominicans. This Maurice, who was Lord Justice of Ireland at this time, was the ancestor of the Leinster Fitzgeralds, now represented by the Duke of Leinster. A drive around the lake should not be missed. It passes around the southern side, reaching the little town of Dromahaire, and returning back by the Enniskillen Road. The ruins of the Franciscan monastery of Creevelea can be included on the way back, as well as the great prehistoric sepulchral monument in the deerpark, known as the Irish Stone Henge. We next proceed to County Mayo, on our way to Connemara. We can go by two routes—take train via Collooney and Claremorris for Westport, or by long car from Sligo, via Ballysodare and Dromore West, for Ballina, from which a short train journey reaches Westport. This drive enables us to see the rapids and falls of Ballysodare and the interesting scenery by Dromore West until we cross the river Moy at Ballina, which divides Mayo from County Sligo. The

Moy is a fine salmon river, and Lough Conn is also close by, where there is extremely good fishing. In the vicinity of Ballina there are several places of great antiquarian interest. Rosserck and Moyne Abbeys and the Round Tower of Killala; a circular drive from Ballina will take in all three. The place where the French landed in 1798 is pointed out about three miles from Killala. We can proceed by train direct to Westport via Manulla junction from Ballina.

ACHILL ISLAND.

Westport is situated at the head of Clew Bay, and is the most convenient place from which to visit Achill Island, or start for Connemara. It is a very picturesque town, with a river running through the centre of it, and trees planted on either bank, which has a very pretty effect in summer. Lord Sligo has a seat quite close, and the entrance gate opens from the town; the demesne, which is very extensive, should be visited, and many fine views of Clew Bay may be had from it. We proceed by rail from Westport to Mallarany, where the railway company have erected a fine and commodious hotel. We can visit from Mallarany all the places of interest in Achill, going by rail to Achill Sound, taking a car there, and driving to the various places, returning again to Mallarany by last train in the evening. We may, after seeing all the places of interest at or near Mallarany, proceed to Dugort, where Mr. Sheridan, the popular proprietor of the Slievemore Hotel, can put us up most comfortably, and also guide us to every spot of interest in the island. The population of this interesting island in 1891 was 4,677. Tillage on a small scale and fishing are the only employments of the people. The distance from Dublin to Achill Sound, where the line terminates, is 187½ miles, the extension from Westport to the Sound is 26¼ miles. The Sound is a narrow strait connecting Clew and Blacksod Bays. A bridge now crosses the Sound, opening in the centre on a swivel to allow small vessels to pass, and is a great convenience to all going to or from the island. The bridge was built mainly through the efforts of Mr. John G. Porter, of Lisbellaw, County Fermanagh, who contributed about one-third of its total cost. Achill is about 15 miles long by 11 broad, and is the largest island off the Irish coast. It has very fine cliffs and seal caves. Croghaun is 2,192 feet high, presenting a magnificent section to the Atlantic. Slievemore is 2,204 feet high. The village of Dugort at its base contains the hotel, church, police barracks, and principal buildings. From Dugort all the sights are easily reached, the ascent of Slievemore and Crogham, the seal caves, and cliffs of Menawn, the cathedral, rocks, and the native village of Keel. There is a fine strand near this village, extending for about three miles, and close by the village of Slievemore are the remains of many objects of antiquarian interest. Dugort is about nine miles from the sound, and cars run in the tourist season on arrival of the trains. From the summit of Croaghhaim a magnificent sea clift, only equalled by Slieve League in Donegal, a most extensive view can be obtained either inland towards Westport and Connemara, or seaward towards Clare Island and the other islands scattered along that portion of the Atlantic seaboard.

CONNEMARA.

Leaving Achill we return to Westport, which is the starting place for Connemara. We take our seat on the tourist car for Leenane, by the lovely Erriff Valley, through which the Erriff River, a fine trout and salmon stream, flows into Killary Harbour. We stop at the Leenane Hotel, from which a series of excursions may be taken. There is fine lake, river, and sea fishing to be had here, some free and also at a moderate rental by the day or week. For those fond of mountaineering there are several most interesting excursions—the ascent of Leenane Mountain (at the foot of which the hotel is situated), which rises 1,404 feet, and commands a splendid view of the twelve Bens, Killary Harbour, and the lakes and rivers of Connemara, the Delphi pass, and the ascent of Mweelrea, which lies along the northern side of the Killary, rising to a height of 2,688 feet, can be made from Leenane. If I were asked to describe the scenery of this district around Leenane in as few words as possible, I would reply, huge mountains dotted all round, connected by deep, dark valleys, through which lakes wind, and from which rivers flow to other lakes or to the sea. Many of the mountains are bare rock, others clad in heather, and vegetation very sparse. Interesting excursions can be made from Leenane as a centre by car, boat, or small steamer, and the tourist car from Clifden to Westport passes the door. Leaving Leenane by the tourist car for Clifden, we pass by Kylemore and Letterfrack. Kylemore Lake and Castle, the property of Mr. Mitchell Henry, is a charming place, its natural beauties being developed by all that good taste and money could do. Letterfrack is a well-to-do village, founded by a Quaker gentleman, who has done a great deal to found industries and improve the locality. There is a comfortable hotel, owned by Mrs. O'Grady, in the village. Renvyle Hotel is about five miles from here. The house was the family mansion of the Blake family, who some twenty years ago turned it into a hotel to provide accommodation for those coming here for fishing, shooting, and sea bathing. It is exceedingly comfortable, homely, and well-kept. Renvyle is an extremely good centre from which to explore this district. From Letterfrack to Clifden occupies one hour and a half to drive. It is the capital of Connemara, built on rising ground overlooking a beautiful inlet of the sea called Ardbear Harbour. Clifden is built on the property of the D'Arcy family; population, about one thousand. From Clifden we may drive to Roundstone, or, if we are interested in angling, can go by rail to Recess. At Recess the Railway Hotel, which is owned by and under the management of the Midland Railway Company, is adjacent to the Recess Station on the Galway and Clifden line. The hotel, which is furnished with every modern comfort and convenience, occupies a picturesque situation in the midst of the well-known lake district of Connemara. It is sheltered from the north-easterly winds by the Maam Turk Mountains, and from its position it affords magnificent views of the famous Twelve Bens. When stopping at Recess we observed the anglers had all well-filled baskets on their return, principally salmon and trout. The climate is very mild in winter, so that it should be a good winter resort for invalids who could enjoy a soft, balmy air in mid-winter coming direct off the Gulf Stream, which flows along the coast. When finally leaving Recess a minutes' walk brings us to the special hotel platform, where our luggage has preceded us, and from whence we take train to Galway, which we reach in about two hours.

ARRAN ISLANDS.

Galway city is now so well known that it will be unnecessary to dwell on the various places of interest still remaining from bygone days. The Arran Islands, which we reach by steamer from Galway, have also become much better known since the visit of the Royal Society of Antiquaries in 1895. They issued a very fully illustrated handbook, giving copious illustrations and descriptive sketches of all places of interest in the islands. These islands possess a special charm, no matter how often visited; they contain the finest specimens of prehistoric Pagan forts in Europe—viz., Dun Angus, Dun Oghill, and Dhu Caher in the north island, and Dun Connor, situated on the summit of the middle island. Arran of the Saints contains as well many examples of our earliest churches—the Seven Churches, or Temple Brecan, and Temple Mac Duach, on the north side of Arranmore; on the south side is Temple Benen and Monaster Kieran, together with the remains of a round tower. On the shore of the bay at Killeany is Arkin Castle, or Cromwell's Fort, built during the time of the Protector and garrisoned by his troops. There is plenty of material on the islands to employ the visitor for a week, and accommodation may be had at the Atlantic Hotel, Kilronan. The cliffs of Moher and the coast of Clare can be distinctly seen from the islands on a clear day. The steamer from Galway goes daily in the summer months, and takes three hours to reach Kilronan pier. The Irish language is that commonly used by the people amongst themselves, but most of the young people can speak English as well. Many rare ferns grow on the islands, including maiden hair and royal fern

COUNTY CLARE (LISDOONVARNA.)

We went from Galway to Lisdoonvarna by the direct route across the bay by steamer to Ballyvaughan, which lies on the opposite or Clare side of the bay; from here we afterwards drove by the public car to Lisdoonvarna. Ballyvaughan is the best and nearest point from which to visit the celebrated ruins of Corcomroe Abbey. A great battle was fought in this locality in the year 1317, when many of the O'Briens fell, and were buried within the Abbey. The drive from Ballyvaughan goes through the Shale district, across the high hills, by the well-known Corkscrew Road. On reaching the summit a fine view of the Bay of Galway may be obtained, with the ancient city of the tribes and a great rocky amphitheatre lying in the foreground of the picture close to us. The visit of the Royal Society of Antiquaries here took place in July, 1900. The party numbered almost 100, and though it was the busy season they all managed to get comfortably provided for amongst the various hotels. The town is situated about 600 feet above sea level on a limestone subsoil, within three miles of the Atlantic. The air is very bracing, and the spa is said to equal any in England. The Gowlan river flows through the place in a deep gorge or ravine which it has cut in the course of ages through the rock. The principal sulphur spa is situated at the foot of the hill from the Queen's Hotel at one side, and the Eagle and Atlantic View on the other. There is a pump house built over the spring close by the river side. The water is pumped up through glass-lined pipes, and supplied to visitors at a very moderate charge. The following are amongst some of the places visited during our stay at Lisdoonvarna—Ballinalackin, a 15th century tower belonging to the O'Brien's. It is situated on the top of a high rock, which is perpendicular on two sides. The cliffs of Moher extend for a distance of about seven miles along the coast of Clare, the most prominent points of which are Slievenageeragh, 668 feet high ; Ailnasharragh, the fool's cliff, 603 feet ; O'Brien's Tower, 587 feet ; and the Hag's Head (in Irish Cearn, Calliach) 407 feet. From the cliffs of Moher a most glorious view may be had of the cliffs themselves, as some portions project from which a view may be obtained. You can see towards the north Innishmaan, crowned with the great fort of Dun-Connor, The Bens of Connemara ; southward Liscanor Bay, the spire of Miltown Malbay behind Spanish Point, Caherrush, Mutton Island, the bold head of Boltard, and Loop Head. And on a clear day the mountains of North Kerry may be seen, and inland Bureen, Elva, Callan, and the distant peak of Telegraph Hill, 1,746 feet high, at the remote end of Clare. The cliffs derive their name from an ancient stone fort or caher which stood on the top of the cliffs, but now dismantled. Leaving the cliffs of Moher after lunching, we drove downhill by the village and ruined castle of Liscanor, passing by St. Bridget's Holy Well, where the scene of the picture for "The Blind Girl at the Holy Well" was taken. We stopped to examine the ancient Church of Kilmacreehy, standing on the shore of Liscanor Bay. A little further round is the village of Lahinch, and the Norwegian-built Golf Hotel, similar to Rosapena, where you will find the finest 18-hole golf links in Ireland, two miles long and a mile and a half broad. These various places were all included in a circular drive from Lisdoonvarna, returning there in time for dinner. Another day's excursion was to the ancient Cathedral Church of Kilfenora, where there is a very fine sculptured high cross ; from thence to a fine stone fort, or caher, called Ballykinvarga. The walls of it are from 12 to 15 feet thick, built in three concentric sections, like the coatings of an onion. For external defence a very fine chevaux-de-frise extends to a distance of 100 feet from the wall of the fort. The entrance is by a single doorway, with a stone lintel, seven feet long. The wall stands at present from 12 to 16 feet high. A fine and never-failing spring of water near the entrance supplied the fort. It has never been tampered with by any restorer, and is a good example of a pre-historic fort. After leaving Ballykinvarga, we returned homeward, calling on our way at the ancient castle of Leemaneagh. It consists of a tall tower, built in 1480, to which a large Tudor house was attached a century later. This castle belonged to a branch of the O'Brien family of Clare. A gateway and arch have the arms of Conor O'Brien, dated 1643. Many other places possessing both historic and pre-historic interest are situated within reach of Lisdoonvarna. The examples we have referred to may suffice to point out what an interesting antiquarian centre it is, in addition to the curative properties of its famous spa.

KILKEE TO LOOPHEAD.

We left for Ennistymon, where we were fortunate in seeing an extremely fine waterfall under favourable conditions. The river was in flood, and the mass of water was enormous, sufficient to drive several factories and light the town by electricity. We took the train from here on the West Clare line for Kilkee. Time will not permit us to speak of the many interesting places on our way. Our time is all too limited for Kilkee and vicinity. After seeing all the watering places of Ireland, none of them can approach Kilkee for magnificent cliff scenery, wave effects, or the extreme purity of its air. The town is built around a horseshoe-shaped bay, called Moore Bay. It is about one mile around. The old portion of the town, where the shops, telegraph, and post office, banks, and other public buildings are is on the eastern side; also the railway station. The water flows in from the Atlantic over a ledge of rocks that breaks the force of the waves approaching the strand, which has a gentle slope over a floor of fine, firm silver sand. It is sheltered from the north by the lofty cliff of George's Head. Outside the town, both north and south, are great sea cliffs, against which the huge Atlantic billows strike with a force we have never seen equalled elsewhere. During the season the strand at Kilkee presents a very lively sight. It is dotted with bathers and bathing boxes, which are drawn backward and forward to suit the tide by donkeys, whilst cricket and tennis may be seen in progress at the same time. The esplanade is protected from the sea by a very thick, low wall, that does not rise high above the road, and which forms a convenient place for people to sit upon whilst looking out to sea. From the fact that the force of the waves is broken before they reach the strand by the Duggerna and Edmond rocks, it is perfectly safe for ladies and children to bathe there, whilst the gentlemen have a spring board and iron ladders further round towards the west where they can have a plunge in deeper water. There are also pools left by the receding tide to suit bathers who wish to get a plunge at a moderate depth in safety. Walking towards the west end the road leads up over a green sloping hill covered with short crisp grass. Diverging off this road we come to the cliffs which continue for a long distance towards the south. There are caves in the rocks along the shore that can be entered when the tide is out. Many varieties of shell fish may be collected here, also dulse, and Carrigeen moss. The latter when boiled forms a jelly, which is very nutritious, and said to be good for weak lungs. Large quantities of it were used in 1846 during the famine, by which many were saved from starvation. Further along the strata is quite horizontal, and you can descend to the sea level by natural steps from layer to layer. Proceeding still further south, the rocks again become perpendicular and much higher. There is a puffing hole here, which acts when the wind blows the sea in from the west. The water is forced up to a great height, and in falling again in spray, if it is sunshine, all the prismatic colours are shown, which adds to the beauty of the scene. Towards Bishop's Island is the amphitheatre, so called from its crescent shape. The waves here during a western gale are magnificent, and strike the rocks with thundering force, rising in spray occasionally to their highest summit to be blown in foam landward on the gale. There is a cave here extending backward for 60 feet and 30 feet wide at the entrance. Mackerel is the principal fishing, which are cured and exported to America. Herrings, haddock, whiting and cod are also plentiful In addition to its good fish supply, it is well provided in the season with excellent mutton, and a plentiful supply of fowls, which the peasants bring to the doors of the various lodges for sale. Board and lodgings can be had at the best hotels at £3 per week, and apartments with cooking and attendance can be had at a reasonable rate. There is a good bath house where hot and cold sea water baths may be had. The roads are good for cycling, and most attractive scenery all the way to Loop Head, a distance of some 15 miles. Return journey may be made by Carrigaholt, situate on the north side of the Shannon estuary. It has the additional advantage of a water supply of the purest and coolest from a holy well, the patron saint of which is Senanus, or St. Senan, as he is sometimes called. There is a little distance further off a second holy well called Tober Kee, after the saint who gave his name to Kilkee. It is a picturesque sight to see the people with pitchers of water on their heads and others praying around the well. On the east end of the town there is an ancient chambered rath surrounded by a moat about twenty feet broad. In a field at the rere of Moore's Hotel there is a fallen cromlech, whilst on Bishop's Island there is an ancient beehive oratory. All the way on the Atlantic side of the peninsula, which extends from Kilkee to Loop Head, are a series of most interesting views of cliffs and headlands and sea caves, and huge rock monoliths standing up isolated in the water, and defying all the fury of the Atlantic. Dunlicky Castle is an object of great interest. Built on a promontory, which is joined to the land by a very narrow neck, in ancient times it was impregnable. The natives have a legend that it was owned by pirates, who decoyed vessels in here, and had an armed sloop in hiding to fall on the hapless vessel when it came in. A mile beyond Dunlicky is the pretty fishing village of Goleen. Standing above Goleen is the lofty Knockmagarron Hill, 410 feet above the sea, and formerly used as a signal station. The natural bridges of Ross are the next objects of interest, situated near to the village of that name. There are two bridges; the largest is about 45 feet in length, 30 feet broad, and three feet in thickness. The layers of rock are horizontal; the bottom of the span is about 40 feet above low water. Two very beautiful arches, called the cathedral arches, may be seen close by. Reaching Loop Head, the lighthouse should be visited for the extensive view that it commands. Leap Head, now Loop Head, took its name from the extraordinary leap of the great Irish hero Cuchullin, who, to escape a too importunate lover, leaped the chasm separating the head from the cliff adjoining. The lady leaped it successfully, but in returning to follow him she fell and was killed. We have now reached a point north of the great estuary of the Shannon, and can return by a different route, calling at the ancient Castle of Carrigaholt, thence to Kilrush, Scattery Island, with its round tower and ancient churches, the abode of St. Senan. The group of ruins are extensive, embracing an early Irish church, a round tower, and cathedral of the middle ages.

I have now briefly attempted to describe some of the beauties of Ireland lying along its western seaboard, which gives a very imperfect idea of the reality. We will now proceed to illustrate what we have been describing with photographs, the majority of them never before exhibited in Belfast, and some of those taken at Kilkee during a storm show wave effects that could not be described by any words of mine.

The views were then thrown on the screen and much appreciated, the lantern being skilfully manipulated by Mr. F. M'Gibney, of Messrs. Lizars.

Mr. Garrett Nagle, R.M., moved a hearty vote of thanks to Mr. Milligan for his most interesting and charming lecture, which he was sure would long be remembered by all who had had the pleasure of listening to it. To himself it had, indeed, been a special pleasure, for he was born and brought up in the

South of Ireland, and the pictures and the descriptions of them had brought before his mind familiar scenes. They must all feel grateful to Mr. Milligan for his efforts to bring the scenery of Ireland under the notice of the people of England and Scotland and foreigners.

Mr. John Carson seconded the motion.

The motion was passed by acclamation, and appropriately conveyed to the chairman.

Mr. Milligan, in replying, said he felt greatly indebted to Mr. Nagle for his kind words, and he assured them that he took a delight in increasing an interest in their country.

Dr. Moran moved a vote of thanks to Sir James Henderson for presiding.

Mr. Wm. Gray, M.R.I.A., seconded the motion, and after alluding in appreciative terms to the chairman's interest in the well-being and progress of their conntry, joined with him in the hope that the King and Queen would visit them next year.

The vote was passed with great heartiness, and the compliment suitably acknowledged,

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2nd April, 1901.

Mr. J. BROWN, President, in the Chair.

Mr. George Goffey, M.R.I.A., read a paper on

THE ANTIQUITY OF MAN AND THE DAWN OF ART,

Illustrated by a Special Series of Lantern Slides of Paleolithic Implements, etc.

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*Young, Robert Magill, B A., J.P., M.R.I.A., Rathvarna, do.

HONORARY MEMBER·

Dufferin and Ava, K.P., The Marquis of, Clandeboye, Co. Down.

HONORARY ASSOCIATES.

Gray, William, M.R.I.A., Glenburn Park,	Belfast.
Stewart, Samuel Alex., F.B.S. Edin., Belfast Museum,	do.
Swanston, William, F.G S., Cliftonville Avenue,	do.
Tate, Prof. Ralph, F.G.S., F.L.S , Adelaide,	South Australia.
Wright, Joseph, F.G.S., Alfred Street,	Belfast.

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Bruce, James, D.L., J.P., Thorndale House,	Belfast.
Carr, James, Rathowen, Windsor,	do.
Cleaver, A. S., B.A., Dunraven,	do.
Davidson, S. C., Sea Court,	Bangor.
Fulton, G. F., Howard Street,	Belfast.
Gamble, James, Royal Terrace,	do.
Green, Isaac, Ann Street,	do.
Hanna, J. A., J.P., Marietta, Knock,	do.
Hazelton, W. D., Cliftonville,	do.
Higginbotham, Granby, Wellington Park,	do.

Hutton, A. W. Chichester Street, Belfast.

Jones, R. M., M.A., Royal Academical Institution, do.

Kelly, W. Redfern, M.I.C.E., F.R.A.S., Dalriada, Malone Park, do.

Lynn, William H., Crumlin Terrace. do.

Macassey, Lyndon, C.E., B.A., LL B., Holywood.
Malone, John, Brookvale House, Cliftonville, Belfast.
M'Laughlin, W. H., Brookville House, do.

Redfern, Prof. Peter, M.D., F.R.C.S.I., Lower Crescent, do.

Scott, Conway, C.E., Annaville, Windsor Avenue, do.
Stephens, S. Holywood.
Swiney, J. H. H., B.A., B.E., Bella, Vista, Antrim Road, Belfast.

Tate, Alexander, C.E., Rantalard, Whitehouse, do.
Thompson, John, J.P., Mount Collyer, do.
Turpin, James, Waring Street, do.

Report and Proceedings

OF THE

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1901-1902.

BELFAST:
PRINTED BY ALEXR. MAYNE & BOYD, 2 CORPORATION STREET
(PRINTERS TO QUEEN'S COLLEGE.)

1902.

CONTENTS.

Belfast Natural History and Philosophical Society.

ESTABLISHED 1821.

SHAREHOLDERS.

1 Share in the Society costs £7.		
2 Shares	,,	costs £14.
3 Shares	,,	costs £21.

The Proprietor of 1 Share pays 10s. per annum; the proprietor of 2 Shares pays 5 shilllngs per annum; the proprietor of 3 or more Shares stands exempt from further payment.

Shareholders are only eligible for election on the Council of Management.

MEMBERS.

There are two classes—Ordinary Members who are expected to read Papers, and Visiting Members who by joining under the latter title, are understood to intimate that they do not wish to read Papers. The Session for Lectures extends from November in one year till May in succeeding one. Members Ordinary or Visiting, pay £1 1s. per annum, due 1st November in each year.

Each Shareholder and Member has the right of personal attendance at all meetings of the Society, and of admitting a friend thereto; also of access to the Museum and Library for himself and family, with the privilege of granting admission orders for inspecting the collections for any friend not residing in Belfast.

Any further information can be obtained by application to the Secretary It is requested that all accounts due by the Society be sent to the Treasurer.

The Museum, College Square North, is open daily from 10 till 4 o'clock. Admission for Strangers, 6d. each. The Curator is in constant attendance, and will take charge of any Donation kindly left for the Museum or Library.

Belfast Natural History and Philosophical Society.

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ANNUAL REPORT, 1902.

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THE Annual Meeting of Shareholders of the Society was held on 3rd July, in the Belfast Museum, College Square North. Mr. John Brown, F.R.S., President, occupied the chair, and amongst those present were—Messrs. R. Lloyd Patterson, D.L.; R Patterson, F.Z.S., M.R.I.A.; John Horner, M.I.M.E.; Joseph Wrigh, F.G.S.; W. Swanston, F.G.S.; S. F. Milligan, M.R.I.A.; W. Gray, M.R.I.A.; R. Dod, J.P.; Conway Scott, C.E.; J. E. Magill, A. Kinnaird, William Faren, Isaac W. Ward, and Davys Bowman.

The Hon. Secretary (Mr. Robert M. Young, B.A.) read the Annual Report which contained the following :—

The Winter Session was opened in the Museum on 10th December, 1901, when an address was kindly given by Mr. Francis C. Forth, Assoc. R.C.Sc.I., Principal of the Municipal Technical Institute, Belfast; subject—"The Municipal Technical Institute, its Aims and Aspirations."

The Second Meeting was held on 6th January, 1902, when Mr. Joseph Barcroft, M.A., Fellow of King's College, Cambridge, gave a lecture on "Respiration," illustrated by experiments.

On the 4th February the Third Meeting was held, when Mr. John M'Kean contributed "Notes on Local Survivals of Ancient Harvest Customs," with specimens ; and Mr. John

J. Marshall lectured on "The Northern Blackwater: its Scenery, Antiquities, and Battlefields," illustrated by special lantern views.

The Fourth Meeting was held on 5th March, when Mr. Seaton F. Milligan, M.R.I.A., gave a popular lecture, fully illustrated; subject—"The Irish Industrial Awakening." The chair was occupied, in the absence of the President, by Sir R. J. M'Connell, Bart., and the proceeds were devoted to the reduction of the debt owed by the Causeway Defence Fund.

The Closing Meeting was held on the 8th April. Mr. John L. Macassey, C.E., read a paper; subject—"The Mourne Scheme for the Supply of Water to the City of Belfast," illustrated by special lantern views.

The President also gave an account of the meeting of delegates to the British Association in Glasgow.

The meetings were less in number than usual, mainly owing to the renovation of the Museum building, which delayed the opening of the session. There was a satisfactory attendance of the members and general public at all the meetings, and several of the papers submitted were subsequently favourably referred to and discussed in the local Press. The number of societies holding their meetings in the Museum shows no diminution. As usual, the attendance of the public was very large at Easter, when the Museum was opened at a nominal charge.

As will be seen from the Hon. Treasurer's Statement of Accounts, duly audited by the Local Government Board's Auditor, a reduction of balance has been caused by the special expenses involved in renovating the Museum premises. This will, however, be partially met by subscriptions given by members towards this purpose.

Owing largely to the zealous efforts of Mr. Robert Patterson, F.Z.S., M.B.O.U., a considerable sum has been contributed by friends of the Society with a view to place the collections of objects of natural history on a satisfactory footing. Old and worn-out examples in the Thompson collection of Irish birds will be replaced by new specimens, partly presented by local collectors, and the balance acquired by purchase. Your council have arranged, as intimated in their last report, for the renewal where required, of other collections, including local geology, conchology, and antiquities. Everything will be completed in time for the meeting of the British Association in September next. The painting of the interior of the Museum has caused an amount of extra work in taking down such specimens as are displayed outside the cabinets, and cleaning and replacing them. This prevented, to some extent, attention being paid to other portions of the collections, not only during the improvements, but for some time after. Subsequently the revision of the MacAdam collection of local fossils has been proceeded with. This collection is an extensive one. It was accumulated at very great expense and labour by the late Mr. James MacAdam, F.G.S., and contains many specimens of species which have been only rarely or not at all obtainable by recent geologists. It is the most complete collection of Irish cretaceous fossils ever made by one individual. Amongst many other good things the type specimen of *Loricula Macadami* has been recovered. As far as can be ascertained at present, this is unique. Your Council took advantage of the inquiry held in Belfast by the Royal Commission on University Education in Ireland to present a memorial to them on the 5th April, setting out their views on the question of the teaching of natural history in Queen's College, and advocating increased facilities in that direction. Your Council received with deep regret the announcement of the death of the Marquis of Dufferin and Ava, the only surviving honorary member of the Society. Several members of Council represented the Society at his funeral.

A list of donations to the Museum, and of the publications received in exchange from home and foreign societies, will be printed with the present report.

Your council desire to express their best thanks to the local Press for their reports of the various meetings.

The following members retire from office, and offer themselves for re-election :—S. F. Milligan, John Brown, Andrew Gibson William Swanston, and W. H. F. Patterson.

The Hon. Secretary stated that he had received a letter from the Hon. Treasurer, who apologised for his inability to attend the meeting. The Statement of Accounts showed a balance of £16 16s. 7d. in favour of the account.

The Chairman, in moving the adoption of the report, said perhaps the most important matter contained in it was with regard to the renovation of the collections and the painting of the Museum. This was undertaken with the object of making the premises as presentable as possible in view of the approaching visit of the British Association to Belfast. Owing to the zealous efforts of Mr. Robert Patterson a considerable sum of money had been collected, but he did not think that Mr. Patterson was yet satisfied, and he would be glad to receive further donations. They would see that a beginning of the work had been made as regards the collection of birds. Unfortunately Mr. Robert Patterson was not on the council, but especially since he was devoting so much time and talent to the Museum it was very desirable that he should be on it, and if there had been an opportunity they would have been glad to have co-opted him. There was, however, still an opportunity of electing him, and they thought it best to leave the matter to that meeting. The Statement of Accounts showed that the balance had decreased, but indeed he was surprised it had not decreased more, because of the expense incurred in the renovations already mentioned.

Mr. John Horner seconded the adoption of the report.

Mr. R. Lloyd Patterson, drew attention to the paragraph in the report in which there was an allusion to the renovation of the natural history collections. This was partly the outcome of a report which he and his nephew Mr Robert Patterson, were asked to make a year ago. They had reported on the specimens, many of which were in a bad condition, and some of them worthless. After some little time the usual difficulty presented itself to the Council. That was the difficulty about funds, as it was only with the most rigid economy they could keep their expenditure within their income. A certain member of the Society offered a donation of £10 to start a substantial fund for this work, and his nephew took up the matter energetically, and was able to raise a sum of money by which the collection of birds would be entirely renovated and a general rearrangement of the collections made, which would bring them up to date, so that by the avoidance of unnecessary duplications a large amount of space would be saved and room made for other specimens. He thought attention should be drawn to the matter, so that, in view of the approaching visit of the British Association, they should have the place in as good order as possible. He was afraid that owing to the generosity of Sir Wm. Whitla, who was defraying the cost of the erection of a Medical Institute, they would lose the Medical Society as tenants, and consequently they would lose the rents which that eminent and learned body had up to now paid to them. He expressed the hope that there would be a general "beating up" for new members and new shareholders, and that they would not experience the discomforts of a diminished income, which at the present moment was staring them in the face.

The report was unanimously adopted.

Mr. Patterson also mentioned a suggestion which had been made to him as to the desirability of holding their meetings in the afternoon instead of in the evening. This practice was followed in London and many other places.

Several members spoke against such a change being made, and, as the feeling of the meeting was evidently against it, the suggestion was not adopted.

Mr. Wm. Gray proposed that Mr. Robert Patterson be elected on the Council. He said that Mr. Robert Patterson was a young man, who had inherited the traditions of his family in the investigation of natural history, and he was one of the most active and successful, as well as most modest, member of their community.

Mr. R. Young seconded the proposition.

Mr. George Horner proposed that the five retiring members of the Council be re-elected.

Mr. R. Young seconded.

A ballot having been taken, the Chairman declared that the following gentlemen had been elected on the Council :—Messrs. R. Patterson, John Brown, William Swanston, W. H. F. Patterson, and S. F. Milligan.

Mr. Conway Scott proposed a vote of thanks to the Chairman for presiding. He congratulated him on being elected a Fellow of the Royal Society, and hoped he would be elected president of that body.

Mr. Wm. Gray, in seconding the motion, said it was a great honour to Belfast when an amateur, as their Chairman, by his original research, should obtain a distinction which some of their biggest Professors did not. They ought to be proud of their President, as he was a representative of the traditions of the old Natural History Society of Belfast, which was the first established in the kingdom seventy years ago.

The motion having been unanimously passed, the Chairman briefly returned thanks. He said he prized very much the honour which had been conferred upon him, and it was made doubly pleasing by the many kind words of congratulation that he had received, none of which he valued more than those offered by that Society.

The election of Office-Bearers for the ensuing year was then proceeded with in Committee. The following were elected :—President, John Brown, F.R.S.; Vice-Presidents, Robert Young, J.P., C.E.; William Swanston, F.G.S.; R. L. Patterson, D.L., F.L.S.; Rev. T. Hamilton, D.D., LL.D., President Queen's College ; Hon. Secretary, R. M. Young, J.P., M.R.I.A.; Hon. Treasurer, W. H. F. Patterson ; Librarian, J. H. Davies.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict. ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year 30th April, 1902.

Dr. **Cr.**

CHARGE.

To Balance as per last Account				£63	4	4
,, Amounts received during the period in respect of Donations, Bequests, or other Endowments				3	10	0
,, Amount of Subscriptions received in the year ended 30th April, 1902				110	3	0
,, Amount of Dividends received in the year ended 30th April, 1902				16	19	9
,, Amount of Rents received in the year ended 30th April, 1902				46	11	6
,, Amount of Fees received in the year ended 30th April, 1902				0	7	6
,, Amount realized by Sales in the year ended 30th April, 1902				0	1	6
,, Amount of Miscellaneous Receipts in the year ended 30th April, 1902 (not included in the foregoing), viz:—						
Poor Rate Refunded	£0	12	6			
Entrance Fees at door at Easter	19	11	1			
,, ,, ,, during rest of year ...	18	18	2			
				39	1	9
				£279	19	4

DISCHARGE.

By Amount of Payments made in the year ended 30th April, 1902, under the following headings:—						
Maintenance of Premises, &c.	£51	3	0			
Rent and Taxes, &c.	28	16	4			
Salaries	103	3	2			
Printing and Stationery...	12	0	0			
Advertising	8	3	7			
Postage and Carriage	5	8	2			
Fuel and Gas	17	8	1			
				226	2	4
Other Payments, viz:—						
Insurance Premiums, £2 12s 6d, £1 19s 9d, £1 19s 9d...	6	12	0			
Auditor's Fee...	1	1	0			
Hire of Lantern	0	7	0			
Printing Report	20	3	4			
Commission on Cheques	0	0	9			
Special Expenses at Easter	6	10	2			
Subscription *Irish Naturalist*	2	2	0			
Cheque Book	0	4	2			
				37	0	5
Total Payment				263	2	9
,, Balance in favour of this Account on the 30th April, 1902				16	16	7
Total				£279	19	4

N.B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., 4½ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.

W. H. F. PATTERSON, Accounting Officer.

Dated this 16th day of May, 1902.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

3rd day of June, 1902.

DONATIONS TO THE MUSEUM, 1901-1902.

From Mr. Granby Higginbotham.

Cast of a fossil brachiopod shell (*Spirifer disjuncta*) from Silurian rocks at Tintagel, Cornwall. Similar specimens are sold there as fossil butterflies.

From Representatives of Mr. J. S. Alexander, D.L.

A singular stone implement found in the River Bann, at Portglenone.

From Miss M. E. Reid.

Three butterflies from the Argentine Republic, South America.

From Miss Duffin.

A cabinet of marine and freshwater shells, minerals, etc., Native and Foreign.

From Mr. R. Welch.

A series of shells of *Limnea peregra*, var. *lacustris*, from the Bann River at Toome, also specimen of the coralline strand at Greatman's Bay, Co. Galway.

From Mrs. Coulter.

A collection of marine shells gathered near Bangor, Co. Down.

From Mr. Victor Coates, D.L.

A Royal seal which was attached to a patent.

From Mr. S. A. Stewart, F.B.S., Edin.

A number of Cretaceous fossils from Chalk and Greensand rocks of Antrim and Derry.

ADDITIONS TO THE LIBRARY, 1st MAY, 1901, TILL 1st MAY, 1902.

ADELAIDE.—Transactions of the Royal Society of South Australia. Vol. 25, parts 1 and 2, 1901.
The Society.

BASEL.—Verhandlungen der Naturforschenden Gesellschaft in Basel. Vol. 13, part 2, 1901, and Sachregister, 1875-1900. *The Society.*

BELFAST.—Report and Proceedings of the Belfast Naturalists' Field Club. Ser. 2, vol. 4, part 7, 1902.
The Club.

BERGEN.—Bergens Museums Aarbog, parts 1 and 2, 1901. Meresfauna, part 1, 1901. Aarsberetning for 1901 ; and Crustacea of Norway. Vol. 4, parts 1 and 2, 1901, and 3—6, 1902.
Bergen Museum.

BERLIN.—Verhandlungen der Gesellschaft für Erdkunde zu Berlin. Vol. 28, parts, 4—10, 1901.
The Society.

BREMEN.—Abhandlungen vom Naturwissenschaftlichen Verein zu Bremen. Vol. 15, part 3, 1901, and vol. 17, part 1, 1901. *The Society.*

BRESLAU.—Zeitschrift für Entomologie vom Verein für Schlessiche Insektenkunde zu Breslau. New series, part 26, 1901. *The Society.*

BRIGHTON.—Annual Report and Abstracts of Papers of Brighton and Hove Natural History and Philosophical Society, 1901. *The Society.*

BROOKLYN.—Science Bulletin of the Brooklyn Institute of Arts and Sciences. Vol. 1, No. 1, 1901.
The Institute.

BRUSSELS.—Annales de la Société Entomologique de Belgique. Vol. 45, 1901. *The Society.*

BRUSSELS.—Annales de la Société Royale Malacologique de Belgique. Vol. 35, 1901. *The Society.*

BUFFALO.—Bulletin of the Buffalo Society of Natural Sciences. Vol. 7, No. 1, 1901. *The Society.*

BUENOS AYRES.—Comunicaciones del Museo Nacional de Buenos Aires. Vol. 1, Nos. 8—10, 1901. *The Director.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 30, parts, 3 and 4, 1901 ; vol. 31, parts, 1—3, 1901 ; vol. 32, parts 1 and 2, 1899 ; vol. 33, part 2, 1901, and vol. 34, part 1, 1901. Also, Palæontologia Indica, new series ; vol. 1, part 3, 1901 ; and General Report for year 1900-1901. *The Director of the Survey.*

CAMBRIDGE.—Proceedings of the Cambridge Philosophical Society. Vol. 11, part 3, 1901, and part 4, 1902. *The Society.*

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Zoology. Vol. 36, Nos. 7 and 8, 1901 ; vol. 37, No. 3, 1901 ; vol. 38, 4 Nos., 1900-1902, and vol. 39, No. 1, 1901. Also Report of the Keeper for the year 1900-1901. *The Keeper.*

CASSEL.—Abhandlungen und Bericht (46) des Vereins für Naturkunde zu Kassel, 1901. *The Society.*

CHRISTIANIA.—Forhandlinger, I. Videnskabs Selskabet I. Christiania, for year 1900. *The Royal Norske Frederiks University.*

CINCINNATI.—Reproduction Series, Bulletin No. 2 of the Lloyd Library, 1901. Mycological Series, No. 1, 1902, and Mycological Notes by C. G. Lloyd, No. 5, 1900, and Nos. 6—8, 1901. *The Messrs. Lloyd.*

COLORADA SPRINGS.—Colorado College Studies, vol. 9, 1900. *Colorado College Scientific Society.*

COLUMBUS.—Bulletin of Ohio State University, series 5, No. 1, 1900, and series 6, No. 1, 1901.
The University.

DANTZIC.—Schriften der Naturforschenden Gesellschaft in Danzig. New series, vol. 10, parts 2 and 3 1901. *The Society.*

DUBLIN.—Transactions of the Royal Dublin Society, series 2, vol. 7, No. 8, 1900, and Nos. 9—13, 1901; also Scientific Proceedings. New series, vol. 9, part 3, 1900, and part 4, 1901. *The Society.*

,, Report of the Director of the Institutions of Science and Art, 1901; also Directory of the Royal College of Science, session 1901-1902.
The Technical Instruction Department.

EDINBURGH.—Proceedings of the Royal Physical Society, 129th session, 1901. *The Society.*

EMDEN.—Jahresbericht der Naturforschenden Gesellschaft in Emden, 1899-1900. *The Society.*

GENOA.—Rivista Ligure di Scienze Letture ed Art. Anno 23, fasc. 2—5, 1901, and anno 24, fasc. 1, 1902.
The Society.

GLASGOW.—Transactions of the Geological Society of Glasgow. Vol. 11, part 2, 1900. *The Society.*

,, Transactions of the Natural History Society of Glasgow. New series, vol. 6, part 1, 1901.
The Society.

,, Proceedings of the Philosophical Society of Glasgow. Vol. 32, 1901. *The Society.*

GORLITZ.—Abhandlungen der Naturforschenden Gesellschaft zu Gorlitz, vol. 23, 1901. *The Society.*

GOTHENBERG.—Goteborg's Kungl. Vetenskaps Och Vitterhets Samhälles Handlingar for 1898—1901.
The Society.

HAMBURG.—Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg. Series 3, vol. 8, 1901, and vol. 9, 1902 ; also Abhandlungen, vol. 16, part 2, 1901. *The Society.*

IGLO.—Jahrbuch des Ungarischen—Karpathen Vereins, 28th year, 1901. *The Society.*

INDIANOPOLIS.—Proceedings of the Indiana Academy of Science for 1900. *The Academy.*

KHARKOW.—Proceedings of the Sociétié des Sciences Physico-Chimiques, of the University of Kharkow. Part 27, for 1899. *The Society.*

LAUSANNE.—Bulletin de la Société Vaudoise des Sciences Naturelles, vol. 36, No. 138, 1900, and vol. 37, Nos. 139—142, 1901. Also Observationes Meteorologiques, 1901. *The Society.*

LAWRENCE.—Bulletins of the University of Kansas. Vol. 9, Nos. 3 and 4, 1900, and vol. 10, Nos. 1 and 2, 1901. *The University.*

LEIPSIC.—Mittheilungen des Vereins für Erdkunde zu Leipzig, for 1900 ; also Wissenschaftliche Veroffentlichungen, vol. 5 and Atlas, 1901. *The Society.*

,, Sitzungberichte der naturforschenden Gesellschaft zu Leipzig, 26th and 27th years, 1899-1900. *The Society.*

LONDON.—Report of the seventy-first Meeting of the British Association, Glasgow, 1901. *The Association.*

,, Quarterly Journal of the Geological Society of London. Vol. 47, parts 2—4, 1901, and vol. 48, part 1, 1902. Also Lists of Fellows of the Society, and of the Geological Literature added to the Library in 1900. *The Society.*

,, Journal of the Royal Microscopical Society, Nos. 142—145, 1901, and 146 and 147, 1902. *The Society.*

LONDON.—Transactions of the Zoological Society of London, vol. 16, parts 2 and 3, 1901, and part 4, 1902; Also Proceedings, vol. 1, parts 1 and 2, 1901, vol. 2, part 1, 1901, and part 2, 1902.
The Society.

MADISON.—Transactions of the Wisconsin Academy of Sciences, Arts and Letters. Vol. 13, part, 1, 1901,
The Academy.

„ Wisconsin Geological and Natural History Survey. Bulletin 7, part 1, 1901. *The Director.*

MADRAS—Bulletin of the Madras Government Museum. Vol. 3, No. 3, 1901, and vol. 4, No. 2, 1901; also Catalogue of Prehistoric Antiquities, 1901, and Administration Report for 1900-1901.
The Superintendent.

MANCHESTER.—Journal of the Manchester Geographical Society. Vol. 16, Nos. 10—12; Vol. 17, Nos. 1—3, 1901; and Supplement to vol. 13, 1901. *The Society.*

„ Transactions of the Manchester Geological Society. Vol. 27, parts 1—7, 1901, and parts 8 and 9, 1902. *The Society.*

MARSEILLES.—Annales de la Faculté des Sciences de Marseille. Vol. 11, fasc. 1—9, n.d. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. New series, vol. 13, part 1, 1900, and part 2, 1901; also vol. 14, part, 1, 1901. *The Society.*

MEXICO.—Boletin Mensual del Observatorio Meteorologico Central de Mexico, July, 1900—July, 1901.
The Director.

„ Boletin del Observatorio Astronomico Nacional de Tacubaya. Vol. 2, No. 7, 1901; and Anuario 22, 1901. *The Director.*

MILWAUKEE.—Bulletin of the Wisconsin Natural History Society. New series, vol. 1, No. 4, 1901.
The Society.

MINNEAPOLIS.—Bulletin of the Minnesota Academy of Natural Sciences. Vol. 3, No. 3, 1901. *The Academy.*

MISSOULA.—Bulletin of the University of Montana. Biological series, No. 1, 1901. *The University.*

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Vol. 3, parts 20 and 21, 1901, and vol. 4, parts 19—22, 1901. *The Director.*

MOSCOW.—Bulletin of the Society of Naturalists of Moscow. Nos. 3 and 4, 1900; Nos. 1 and 2, 1901; and Nos. 1 and 2, 1902. *The Society.*

NANTES.—Bulletin de la Société des Sciences Naturelles de l'Ouest de la France. Vol. 10, parts 3 and 4, 1900, and series 2, vol. 1. parts 1 and 2, 1901. *The Society.*

NEW YORK.—Annals of the New York Academy of Sciences. Vol. 13, parts 2 and 3, 1901; vol. 14, part 1, 1901; and Memoirs, vol. 2, part 3, 1901. *The Academy.*

„ Bulletin of the American Geographical Society. Vol. 23, Nos. 2—5, 1901. *The Society.*

NOTTINGHAM.—Report and Transactions of the Nottingham Naturalists' Society for 1900 1901. *The Society.*

ODESSA.—Memoirs of the Society of Naturalists of New Russia. Vol. 23, part 1, 1899, and part 2, 1900; also Mathematical Memoirs, vol. 19, part 2, 1899. *The Society.*

OSNABRUCK.—Fourteenth Jahresbericht des Wissenschaftlichen Vereins zu Osnabruck, 1901. *The Society.*

OTTAWA.—Annual Report of the Geological Survey of Canada. New series, vol. 11, and Maps. General Index to the Survey Reports from 1863 to 1884. Also Canadian Birds, part 1, 1900. *The Director of the Survey.*

PHILADELPHIA.—Proceedings of the Philadelphia Academy of Sciences. Vol. 53, parts 1 and 2, 1901. *The Academy.*

" Proceedings of the American Philosophical Society. Vol. 11, Nos. 165 and 166, 1901 ; also Memorial Volume, vol. 1, 1900. *The Society.*

PISA.—Atti della Societá Toscana di Scienze Naturali, Processi Verbali. Vol. 12, March—July, 1901, and vol. 13, November, 1901. *The Society.*

PORTLAND, MAINE.—Proceedings of the Portland Society of Natural History. Vol. 2, part 5, 1901. *The Society.*

ROCHESTER, N.Y.—Proceedings of the Rochester Academy of Science. Vol. 4, pp. 1—64, 1891. *The Academy.*

ROME.—Atti della Reale Accademia dei Lincei. Vol. 9, semestre 2, fasc. 4—6, 1900 ; vol. 10, semestre 1, fasc. 7, 8, 9, 11, 12, 1901 ; semestre 2, fasc. 1—10 and 12, 1901 ; vol. 11, semestre 1, fasc. 1—6, 1902 ; also Rendiconto dell' Adunanza Solenne del, June 2, 1901. *The Academy.*

" Bolletino della Societá Zoologica Italiana, series 2, vol. 2, fasc. 1—6. 1901. *The Society.*

" Journal of the British and American Archæological Society of Rome, vol. 3, No. 3, 1901. *The Society.*

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BELFAST
NATURAL HISTORY & PHILOSOPHICAL SOCIETY

SESSION, 1901-1902.

10th December, 1901.

MR. J. BROWN, President, in the Chair.

THE BELFAST MUNICIPAL TECHNICAL INSTITUTE: ITS AIMS AND ASPIRATIONS.

BY F. C. FORTH, ASSOC. R.C.SC.I.

(*Abstract.*)

IN the course of his remarks, Mr. Forth stated that as early as the year 1807 a meeting was held in Belfast for the furtherance of instruction in Science and Technology. At a more recent period, viz., in the year 1883, the Royal Commission on Technical Education had held an enquiry in Belfast as to the facilities provided for technical instruction. Extracts read from the report of the Commissioners went to show that the educational facilities provided in the city were at that period in a very unsatisfactory state.

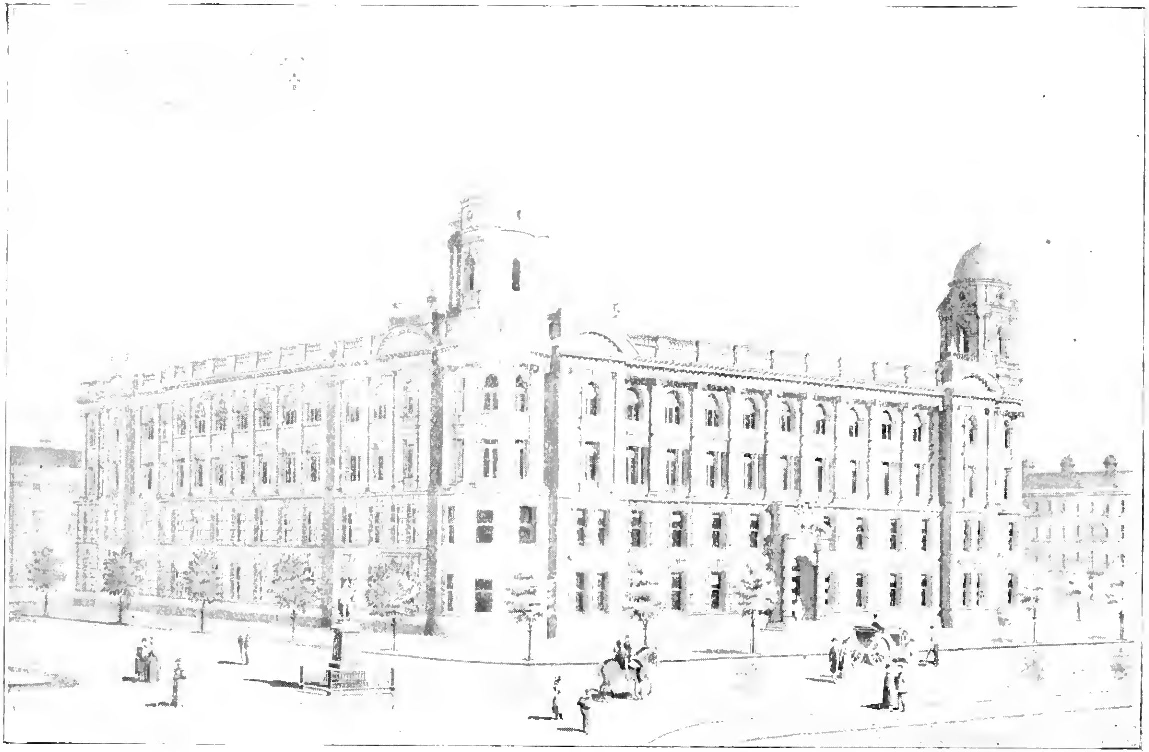
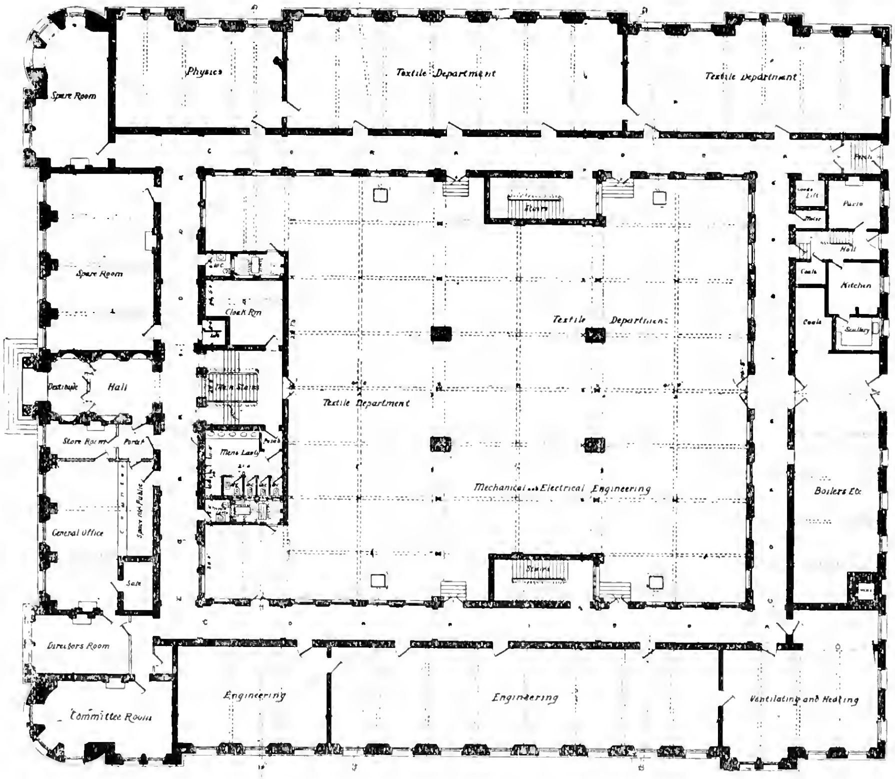


Fig. I.

NEW MUNICIPAL TECHNICAL INSTITUTE, BELFAST.



GROUND PLAN

The Site measures 240 feet by 204 feet 6 inches.

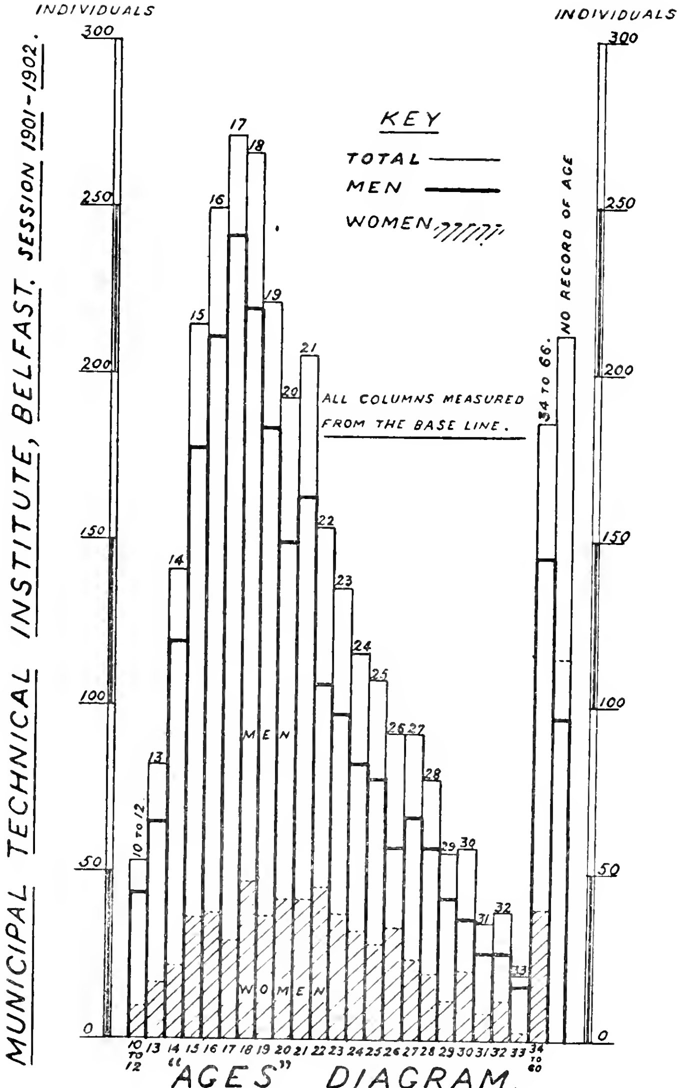
Fig. 2.

The lecturer then reviewed the steps which had led up to the recent revival of interest in technical instruction, beginning by referring to the labours of the Recess Committee. He then detailed the steps that had been taken for the development of the Municipal Technical Institute scheme, and stated that the classes recently established had been largely availed of, and that the numbers in attendance were well above the estimated numbers.

Reference was then made to the imperfect accommodation which is at present available for the majority of the classes, and the proposals with regard to the new Technical Institute were explained, the remarks being illustrated by reference to views of the proposed new building, the views being projected on the screen by means of the optical lantern. The perspective view of the building is shown in fig. 1, and the ground plan in fig. 2. The dual character of the Institution was dwelt upon, the explanation being given that there would be a Day Department and an Evening Department. The functions of these Departments were outlined, and explanations supplied as to the training which would be imparted to the students in the respective departments. Special emphasis was laid on the fact that it was necessary to adapt the courses of study to the industrial requirements of the City, care being taken that as far as possible the instruction should be well balanced. It was explained that students trained in this way would be fitted to take up situations as foremen and managers, and to fill other like positions of responsibility.

It was stated that the building is intended to be erected on a site bordered by College Square North and College Square East. Various details in regard to the areas of the building, the style of architecture, the position of the entrance hall, vestibule, corridors, classrooms, and the departmental accommodation were then supplied.

Mr. Forth next proceeded to discuss the question of the supply of suitably prepared students for the Institution, stating



VERTICAL SCALE = 40 INDIVIDUALS PER INCH.

Fig. 3.

that these would have to come from the National Schools and Secondary Schools. He drew attention to the inadequacy of the training given in the Primary Schools, and offered the opinion that some facilities should be provided for higher primary instruction, suggesting that four or five schools might be established in special districts of the City to deal with children who had passed beyond the sixth standard of the ordinary National School. He explained that scholarships would be available, giving admission to the Day Department of the Technical Institute, and stated that Free Studentships admitting to the Evening Department were already in operation.

Referring to the existing Evening Department he mentioned that over three thousand * tickets for evening courses of instruction had been issued, and that over two thousand † tickets had been issued for single lectures.

It was shown by means of a diagram (figure 3) that the students were not of immature age, as was sometimes imagined, but that the proportion of those eighteen years of age and over, to those under eighteen years was as five is to two.

He spoke of the fear that had been expressed that the Technical Institute might prejudically affect some of the existing institutions, and said that, in his opinion, this fear was unfounded. He also deprecated the unnecessary duplication of courses of study. He pointed out the economy resulting from the co-ordination of institutions running on similar lines instancing the various institutions which had been recently merged in the Technical Instruction Scheme. The lecturer stated that his main fear was not that overlapping would take place, but that the chief difficulty would be found in filling up the hiatuses in the present education system. By means of a

* Now (April 1902) over 4,000.

† Now (April 1902) over 4.500.

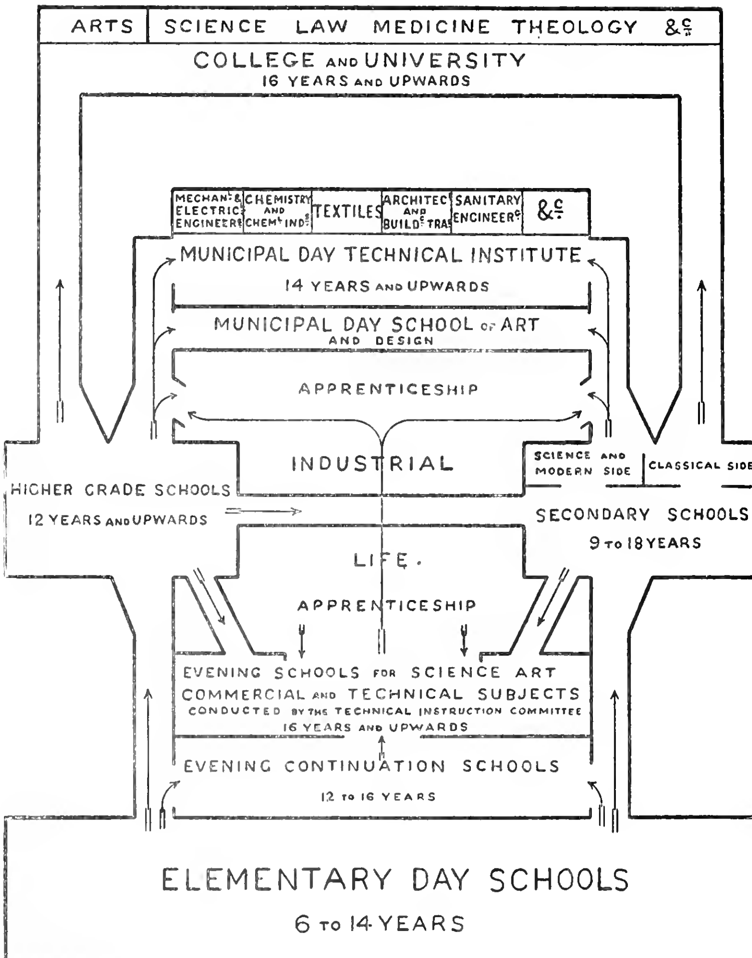


DIAGRAM ILLUSTRATING THE CORRELATION OF EDUCATION

Fig. 4.

diagram (fig. 4) projected on the screen, he then illustrated an educational programme showing a direct connection between the Primary Schools and the Municipal Technical Institute and the University.

Mr. R. H. S. Reade proposed a hearty vote of thanks to Mr. Forth for his very able lecture. Although Belfast had been slow to assimilate the idea of the necessity of technical instruction, he thought from what they had heard that they might be satisfied that it had embarked on the course in a right spirit, and that the work would be done properly under the guidance of Mr. Forth. He had proved that evening that he had grasped the whole subject of education, and showed them that technical education was only a part of the great system of education in the country, which ought to be co-ordinated, and that technical instruction should form an outgrowth from it. He had brought under their survey the whole system of education, which he (Mr. Reade) believed was bound to be taken up and re-organised if they were to hold their place with the other nations of the world.

Professor FitzGerald, in seconding the motion, thought the Technical Instruction Committee was to be congratulated upon the vanishing of a large amount of obstruction which at one time existed in the city—and he thought in the Corporation—to counting many of those subjects as technical at all. It was supposed then that technical instruction must necessarily be confined absolutely to trade instruction, without teaching anything in the matter of scientific subjects. With regard to Mr. Forth's remarks in regard to primary schools, he did not know what powers the Corporation possessed as to constituting themselves managers under the National Board of any model schools which might be established in the city. But now that the Corporation had made a start in the matter of technical education, after a delay of seventeen years, they would have to do more. He had long ago advocated the establishment of a system of evening continuation schools by the Corporation, and was glad to find that it seemed likely that what would be, in effect, such a system, was now under consideration.

Sir James Henderson endorsed all that had been said by Mr. Forth, who, he thought, had hit the weak spot in our educational system. Something was required between the national school and the higher educational establishments in the future. With regard to the Technical School in Belfast, the large sum of £85,000 would be necessary to put the building into the from which had been so admirably described by Mr. Forth, therefore the Committee were compelled to ask the ratepayers for 1d in the £1, which would bring them £5,000. At the present time this sum, together with the £10,000 which they were receiving from the Department of Technical Instruction in Dublin, was the annual amount available for technical education in Belfast. The Belfast Natural History and Philosophical Society was deserving of the highest praise for allowing them the privilege of hearing that lecture, which would be of great assistance in spreading technical instruction in Belfast.

Sir Otto Jaffe considered that at an early period they would see a fair amount of progress in Belfast as a result of their efforts. The Corporation in selecting Mr. Forth as the principal of the new school had got one of the best officers they could have obtained for this department.

Dr. M'Keown said in the matter of primary education he saw little hope of any great improvement so long as they had such a Board of National Education as existed at the present in Dublin. It was his firm conviction that until the people took the control of education into their own hands it would never be right. They wanted in a city like Belfast a board representing the people for the purpose of regulating this primary education. Now, many of the schools from a sanitary point were unfit for occupation by children. He believed that the time would come when the Corporation would have to build schools of their own, and not allow them to be appendages to any Church whatever. A teacher in a primary school was an important individual, and until his position was elevated and he was removed from being the slave of the manager, matters never would be right. Although teachers are paid by the State, many of them were slaves to the managers, which should not be the case. They wanted a proper guiding hand to undertake the co-ordination of primary, secondary, and university education. Coming to the matter of technical education, it was well to point out that at the present time there was a Commission of Inquiry sitting in this country inquiring into technical education, and it was a very extraordinary body. The Irish members of that Commission, who sat recently in Dublin, and took evidence on technical education, were excellent men in their own way, but there was not one of them who was fit to deal with technical education, and only one known to have had a scientific education. That solitary individual was a pathologist, not likely to have much knowledge of trade and industry. He would not like to say much about their finding on technical education, but he did know a remarkable fact, that two gentlemen who could have given valuable evidence, and who tendered it, had not yet been examined. It was to be hoped their evidence would be taken at a later sitting.

Mr. William Gray, was of the opinion that the prospects were exceedingly encouraging, judging by the number of pupils who were coming forward, and they trusted that the anticipations of Mr. Forth would be fully realised. The time had come when they ought to take some positive steps in Belfast to improve the primary education of the rising generation.

Dr. MacCormac held that teaching results would accrue mentally to those attending the continuation schools.

The Chairman then put the motion, which was passed by acclamation.

6th January, 1902.

Professor Redfern, M.D., F.R.C.S.I., in the Chair.

RESPIRATION.

By Joseph Barcroft, M.A.

(*Abstract.*)

Mr. Barcroft said that on a previous occasion he had the pleasure of addressing the Belfast Natural History and Philosophical Society upon a subject which, among physical phenomena, has always been of peculiar interest to himself—namely, "The Properties of Liquid Surfaces." The interest of such a subject as that seemed, however, to fade before the fascination possessed by even the simplest process of living matter. There is a subtlety about the secret of life, an uncertainty as to whether the chemical changes which take place in living matter are governed by the laws which are enunciated in the laboratory that make the study of the functions of living matter especially alluring.

On occasions the physical and chemical properties of living matter seem to be exactly the opposite of those displayed by that which is inanimate. He would take two examples. There could be no greater travesty of their ordinary ideas than that water should flow upwards, yet when they got into the domain of life they saw trees one hundred, two hundred feet high, and in the fine tubes composing the wood of those trees they knew that the sap is continually ascending.

Drawing attention to the burning of a match, the lecturer proceeded to say that the wood was decomposing with evolution of heat, and the solid material was being oxidised and dissipated into the air as aqueous vapour and carbonic acid gas ; but could they, he asked, reverse the process, and, by supplying the necessary heat, make wood out of carbonic gas and water ? That would be like expecting water to flow up a hill, for the laboratory rule is that chemical changes are such as to produce heat and do not take place in the opposite direction. Yet this is exactly how the wood has been made ; the tree has silently absorbed these very substances and built them up into wood.

Of the ordinary functions which living bodies perform, the one which is most nearly understood is respiration, and therefore he had chosen it for the subject of that night's lecture. Respiration in its most superficial sense means the breathing in of pure air, and the exhalation of impure air. But they might give a larger meaning to the word. He had alluded to a burning match, and said that the wood of this match was being oxidised by oxygen drawn from the air, that it emitted heat, and that the substance got dissipated. The same process, he pointed out, is taking place continually in every part of the human body. When he moved his finger some oxygen was used up and some carbonic acid gas and water were parted with ; the oxygen was breathed in by the lungs, the carbonic acid and water would in due time be breathed out by them. The problem was to investigate the processes by which the oxygen of the inspired air is carried to the hidden recesses of the body, and those by which the carbonic acid is carried from the tissues to be cast out into the air of the lung.

They would observe on the screen a slide representing human blood ; it was made up of numerous corpuscles which float in a clear fluid. Each of these corpuscles is a sort of submarine boat plying between the lungs and the tissues, and at every journey it takes in a cargo of oxygen at the lungs, which it unloads on reaching the small blood vessels of a muscle or other tissue. The corpuscle is composed largely of a red material—hæmoglobin—to which the colour of the blood is due. This red material has the power of absorbing oxygen when exposed to the atmosphere. There are other substances such as pyrogallic acid which do the same, but the red substance of the blood differs from pyrogallic acid in the fact that when it is exposed to an atmosphere devoid of oxygen it disgorges all the oxygen which it has previously absorbed.

The lung is an apparatus for exposing an immense surface of blood to the air. While thus exposed each corpuscle takes up its cargo of oxygen, and then gets propelled with extreme rapidity in the blood stream to some indigent muscle or nerve which has used up all the oxygen that it possesses. Here, not being surrounded by oxygen, the corpuscle gives up its store of that gas just as a wet sponge-rag would yield up its store of water when removed from a damp to a dry atmosphere.

It was formerly a matter of great labour, involving the use of large quantities of blood, to demonstrate the relative amounts of oxygen in blood going to and coming from the lungs, but recent researches had made it so simple that he could easily show them how much oxygen the blood loses at its ports of call.

He had compared the colourless fluid portion of the blood to a waterway, and he could press the comparison a stage further. The clear fluid part is more than a medium for carrying the corpuscles—it serves to flush out every piece of muscle and nerve and bone. Each of these accumlates its little store of carbonic acid as it does its work, but this gas si exceedingly soluble in water, and so as fast as it is produced it gets caught up in the colourless part of the blood and carried to the lungs. A pint of water would absorb about a pint of carbonic acid gas. If the solution be shaken up with air the water would lose carbonic acid till both the air and the water contained the same percentage of the carbonic acid. He had almost said that that was an illustration of how the blood lost its carbonic acid in the lung ; that an immense surface of blood was continually circulating through the lung separated only by the thinnest of membranes from the air in that organ ; that it tended always to share its carbonic acid equally with the air, but that, as the air was always changing, it never had time to obtain as much carbonic acid as the blood would give up, and so a continual stream of carbonic acid passed from the blood to the air in the lung.

But he must pause, for whilst many distinguished physiologists would endorse such a statement, there were others who considered that they were confronted at that point with a paradox of life such as he had already mentioned; that in the ordinary way after the blood has given up its quotum of carbonic acid the living wall of the lung exerts an influence on the blood which no dead membrane could exert, and makes the blood concede yet further stores of carbonic acid to the air, thus enormously increasing the efficiency of the respiratory apparatus. The point is one of great interest to physiologists, and it is one on which much careful work has been done. While the matter remains unsettled it would ill befit him to express an opinion upon it, in view of the fact that some of the most recent and telling researches on the subject have been those of Dr. John Haldane and Professor Lorrain Smith in the laboratory of Queen's College, Belfast.

Professor Lorrain Smith said their Secretary had asked him to move a vote of thanks to Mr. Barcroft for his interesting lecture, but he would preface his remarks by a promise to and no more details to the many facts Mr. Barcroft had put before them. He himself had followed the lecture with the greatest interest, and he was sure this had also been done by everyone present. As one whose duty it was to lecture and experiment at the same time, Mr. Barcroft had managed to get through a subject which was perplexity itself with wonderful rapidity. The success with which he had carried out the experiments at the end of the bench, where he had been engaged analysing the blood from oxygen, was remarkable. It was not so very long ago since it took a large part of a day to carry out an experiment of that sort, but Mr. Barcroft had shown them that night that this observation can now be carried out with the simplest possible apparatus with perfect accuracy and great rapidity. The method was new, and the easy way in which it could be carried out gave rise to great hopes in the medical profession that they would be able to apply this method to the human body both in health and disease. He had great pleasure in moving that vote of thanks to Mr. Barcroft for his lecture.

Professor Thompson, in seconding the motion, said Mr. Barcroft had handled an exceedingly difficult subject with great skill. He came to Belfast with the reputation of being a neat and skilful experimenter, and he had very successfully maintained that reputation. He had indeed a very difficult subject to make clear to them, but he had managed to make clear to everybody in the room what the essential features of respiration are. He (Professor Thompson) had great pleasure in seconding the motion.

The Chairman, in putting the motion to the meeting said they had come there that night to learn something of respiration, and they had not been told what sort of process it was, but they had been made to see it. Every step of the process had been shown them most successfully, and not one tittle of the experimental truth had in any degree failed. As they came there that night to learn something of respiration, he would advise them when they went to their respective homes to take a sheet of paper and jot down the particulars of the facts shown them, and in that way they would remember, have before them, an account of respiration such as, he ventured to say, they had never had before, and were not likely to get again for a long time. The various demonstrations had been most admirable, complete, and perfect. It was rarely indeed they found when a series of experiments had to be performed that some little thing did not go wrong, but nothing of the sort had happened that night from start to finish. He trusted that in the study of physiology, which is becoming an experimental science for the purpose of the investigation of the process of life, Mr. Barcroft would not only have a happy year, but that he would continue a great number of years to teach as he had taught them that evening.

The resolution was heartily passed.

Mr. Barcroft, in acknowledging the compliment, said he wished to thank the mover and seconder of the motion for their kind words, and the members of the audience for the patient way in which they had listened to that subject, which, as Professor Lorrain Smith had stated, was complicated. He also thanked Professor Thompson for having put his laboratory at his disposal for the purpose of having the experiments prepared.

4th February, 1902.

Mr. J. Brown, President, in the Chair.

NOTES ON LOCAL SURVIVALS OF ANCIENT HARVEST CUSTOMS.

By John M'Kean.

The Hare, Churn or Collya.

This Harvest custom is widely spread over the North-East corner of Ireland. When the corn is being cut the last handful is plaited up as shown in this specimen. Then the harvesters all gather round and proceed as follows :—

They either stand about 9 feet off and throw their sickles in turn at it until it is cut down, or each is blindfolded in turn, advances towards it, and has one cut at it with a scythe till it is mown down. Or again, each pulls up a root in turn till all the roots are pulled up.

Two other modes, obviously degenerate forms are to cut it with the scythe or the machine without any ceremony.

In those cases where the ceremony still survives, the harvester who cuts the ears or the harvester who pulls the last root is honoured in different ways. Generally he gets the first drink at the harvest-home, which is everywhere called the "churn." Near Glenarm, he or she hangs the "hare," as it is there called, over the doorway and has a right to kiss the first person of the opposite sex who enters. In one part of Armagh the reaper's hand is crossed with silver. Near Keady, in days gone by, the successful person led the "churn" or harvest dance.

The "churn" is kept for the whole year or even longer where the custom still lingers strongly. This specimen is one of three got at one farm, but more usually the custom has decayed and the churn is kept only for a short time. In one place the "churn" is said to guard one's store, but as a rule the country folk give no reason for the custom except sometimes a vague idea that it is lucky.

The three names which I have given are not all used together. The name "churn" is by far the commonest, the name "hare" I have found only in the glens, the name "collya" only in Armagh. It is worth noticing that the name "churn" is applied to the harvest-home even in places where the queue of oats has a different name.

I have found the custom both in the extreme north and south of Antrim, in Down about Newtownards and perhaps near Newcastle, and in north Armagh. In fact I have found it everywhere where I have been able to search for it. I have also heard vague accounts of such a custom in Tyrone but the accounts are not accurate enough to mention.

The "churn" should be compared with customs like the English "Kernababy," and the Scotch kern-maiden, and a host of other examples given in Mr. J. G. Frazer's "Golden Bough." The same authority, vol. ii, p. 269 (second edition), mentions exactly the same custom in Ayrshire and Galloway where the plait is called the Hare.

THE NORTHERN BLACKWATER: ITS SCENERY, ANTIQUITIES AND BATTLEFIELDS.

By John J. Marshall.

(*Abstract.*)

Mr. Marshall introduced his subject by stating that in the history of all countries rivers had ever played an important part, whether as waterways to bear the argosies of commerce upon their breast or as the fitting theatre of events exercising a decisive influence on the nation's future. The rivers of Europe recalled to memory many historic scenes enacted on their banks, and to Ulstermen the Blackwater was ever associated with the memories of the brave O'Neills, and in later years with Charlemont and Grattan. Though the stately ruins of no cloistered abbey were reflected in Blackwater's wave, yet sacred legends and hallowed associations were connected with the stream from the dawn of Christianity in Erin, while earlier still the cairn on the summit of Knockmany, overlooking the fort of Rathmore, carried them back to Ireland's heroic age. Rathmore, in Magh-Lemna, as it was usually called, to distinguish it from the Rathmore in County Antrim, was the great fort situated in the Palace grounds at Clogher, and, according to the annalist, was dug by "Baine, daughter of Scal," the date being early in the second century. The lady was buried on the summit of the adjoining hill of Knockmany; hence its name. There was also in this district the remains of Aughentaine, another interesting Plantation castle, noteworthy as the birthplace of William Montgomery, author of the Montgomery MSS. The next important place on the river was the town of Aughnacloy, founded by the Moore family. Here Wolfe Tone passed a night on his way as a prisoner from Derry to Dublin in 1798. Tynan, so long associated with the name of Dr. Reeves and also famous for its stone crosses, next claimed attention, as well as Tynan Abbey, the picturesque residence of Sir James H. Stronge; while on the opposite bank of the river stood Caledon, with its memories of Sir Phelim O'Neill and the days of 1641, with many a stirring tradition of fight and foray in still earlier times, when it was a residence of the O'Neills. Continuing down the river, the Battleford Bridge was reached. It was here that in 1646 the Scots' army, under Munro, was defeated by Owen Roe O'Neill, and driven with great slaughter across the Blackwater. One of the most important places in Ulster during the latter part of Queen Elizabeth's reign was Portmore, or the Fort of Blackwater, erected as a curb on the power and independence of O'Neill. It was taken and retaken several times, and it was in order to effect its relief that the celebrated battle of the Yellow Ford was fought in 1598, in which the English army suffered a crushing defeat at the hands of O'Neill and Red Hugh O'Donnell. It was finally allowed to fall into decay when Charlemont was erected by Lord Deputy Mountjoy, the modern castellator of Ulster, in what he considered to be a more suitable place. From Charlemont onward the river flowed through fertile pasture lands unmarked by any object of interest until it discharged its waters into Lough Neagh, some seven miles farther down, at the village of Maghery. At this point the river divided into two branches, forming a delta known as Derrywarrgh Island. On this island, if so it might be termed, there stood a chimney and part of a gable, being the only remaining portions of the Fort of Blackwater at the river foot, which was planted there during the rebellion of 1641 as a check on the garrison of Charlemont.

The lecture was illustrated with upwards of seventy limelight views, specially taken by Mr. Marshall, and shown by Mr. M'Gibney, of Messsrs. Lizars.

A hearty vote of thanks to the lecturer brought the meeting to a close.

5th March, 1902.

Sir R. J. M'Connell, Bart., in the Chair.

THE IRISH INDUSTRIAL AWAKENING.

By Seaton F. Milligan, M.R.I.A.

A popular lecture, illustrated by Lantern views ; the proceeds were devoted to the reduction of debt of the Causeway Defence Committee.

8th April.

Mr. J. Brown, President, in the Chair.

REPORT OF DELEGATE TO CORRESPONDING SOCIETIES' CONFERENCE, BRITISH ASSOCIATION MEETING, 1901.

By J. Brown.

As your delegate I attended both meetings of the Corresponding Societies' Conference, and now beg to offer a very brief report referring merely to the chief points brought forward, and leaving the further elucidation of even these to be looked for in the full report issued by the Association. At the first meeting, Mr. F. W. Rudler, F.G.S., presided, and in his address dealt chiefly with the importance of the Registration of Type Specimens in Local Museums in order that reference to such specimens might be readily attainable by those interested in the particular domain of science to which they belonged.

After a long discussion, the Chairman called on the

Rev. J. O. Bevan to open the subject accepted of him by the Corresponding Societies' Committee for discussion at this Conference :—"That the Committees of the Corresponding Societies be invited to lay before their members the necessity of carrying on a systematic survey of their counties in respect to ethnology, ethnography, botany, meteorology, ornithology, archæology, folklore, etc."

The discussion resulted in the appointment of a small Committee, whose report, as follows, was adopted at the second Conference.

"The following provisional list of subjects, together with the names of some of the Societies which have already done work in connection therewith, and the names of persons who would be willing to receive communications thereon is recommended by the Conference of Delegates for adoption by the Corresponding Societies' Committee of the British Association, and to be issued by them to the Corresponding Societies in the hope that those Societies not already engaged in similar work may take part in so much of it as comes within their scope, in order that the work may be extended over a wide area, and be done as far as possible upon a uniform system.

"Registration of Type Specimens," Dr. A. Smith Woodward.

"Coast Erosion," Mr. W. Whitaker.

"Record of Bore Holes, Wells, and Sections," North of England Institute of Mining and Mechanical Engineers, and Prof. J. H. Merivale.

"Tracing the Course of Underground Water," Yorkshire Geological and Polytechnic Society, and Mr. A. R. Dwerryhouse.

"Erratic Blocks," Yorkshire Naturalists' Union, and Professor P. F. Kendall.

"Geological Photographs," Belfast Naturalists' Field Club, and Professor W. W. Watts.

"Underground Fauna," Rev. T. R. R. Stebbing.

"Variations in the Course of Rivers and Shape of Lakes," Dr. H. R. Mill.

"Archæological Survey by Counties" Woolhope Field Club, and Rev. J. O. Bevan.

"Ethnographical Survey," Anthropological Institute.

"Botanical Survey by Counties," Mr. W. G. Smith.

"Photographic Record of Plants," Mr. A. K. Coomra-Swamy.

Professor H. M'Leod, on behalf of Section B, said they had nominated a Committee to register the Scientific Chemists who are at work in Manufactories, and would be glad of assistance in finding out the names of such persons.

Section C (geology) again asks for Geological Photographs and information regarding erratic blocks.

Section H (Anthropology) wants records of the survival of primitive customs, industries, appliances, etc.

Section K (Botany) would be glad to receive specimens of blue-green algæ of various conditions for examination, also photographs of bctanical interest.

THE MOURNE SCHEME FOR THE SUPPLY OF WATER TO THE CITY OF BELFAST.

By John L. Macassey, C.E.

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Natural History & Philosophical Society.

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Report and Proceedings

OF THE

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1902-1903.

BELFAST:
PRINTED BY ALEXR. MAYNE & BOYD, 2 CORPORATION STREET
(PRINTERS TO QUEEN'S COLLEGE.)

1903.

CONTENTS.

Belfast Natural History and Philosophical Society.

ESTABLISHED 1821.

CONSTITUTION.

The membership of the Society consists of Shareholders in the Museum, Annual Subscribers (Associates), Honorary Members and Honorary Associates.

Shares in the Museum cost £7 each. A holder of one Share pays an annual contribution of ten shillings; a holder of two Shares (in one certificate) an annual contribution of five shillings; while a holder of three or more Shares (in one certificate) is exempt from annual payments. Shares on which the annual payments as above are in arrear are liable to forfeiture. The Council retain the right to decline to consolidate two or more share certificates into one certificate.

Annual Subscribers (Associates) pay £1 1s. (one guinea) due 1st November in each year in advance.

A General Meeting of Shareholders in the Museum is held annually in May or June, or as soon thereafter as convenient, to receive the Report of the Council and the Statements of Accounts for the preceding year, to elect members of Council to replace those retiring by rotation or from other reasons, and to transact any other business incidental to an annual meeting. Shareholders only are eligible for election on the Council.

The Council elect, from among their own number, a President and other officers of the Society.

Each Member has the right of personal attendance at the ordinary lectures of the Society, and has the privilege of introducing two friends for admission to such; and he has also the right of access to the Museum and Library for himself and family residing under his roof, with the privilege of granting admission orders for inspecting the collections in the Museum to any person not residing in Belfast or within five miles thereof. The session for lectures extends from November till May.

The Museum, College Square North, is open daily for the admission of visitors, for such hours as the Council may from time to time decide; the charge for admission to non-members is sixpence each. The Curator is in constant attendance, and will take charge of any donation kindly presented to the Museum or Library.

Any further information required may be obtained from the Honorary Secretary.

Belfast Natural History and Philosophical Society.

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ANNUAL REPORT, 1902-3.

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The Annual Meeting of the Shareholders of this Society was held on 3rd July, 1903, in the Belfast Museum, College Square North. The chair was occupied by Mr. John Brown, F.R.S. (President), and there were also present—Sir Robert Lloyd Patterson, D.L., F.L.S.; Professor Johnson Symington, M.D., F.R.S.; Rev. Lamont Orr, Dr. John MacCormac; Messrs. George Kidd, J.P.; Robert Young, J.P.; R. M. Young, J.P., M.R.I.A., Hon. Secretary; Joseph R. Fisher, B.L.; W. Gray M.R.I.A.; R. Patterson, M.R.I.A., F.Z.S.; John Smyth, M.A Nevin H. Foster, John Horner, Isaac W. Ward, W H. F. Patterson, Hon. Treasurer.

The Hon. Secretary having read the notice convening the Meeting, submitted the Annual Report as follows :—

"The Council of the Belfast Natural History and Philosophica Society desire to submit their Report of the working of the Society during the past year. The Winter Session was opened in the Museum, on the 5th November, 1902, when the President, Mr. John Brown, F.R.S., gave an opening address taking as his subject 'The Liquefaction of Gases,' illustrated by numerous experiments. The Second Meeting was held on 2nd December, when Professor Gregg Wilson, D.Sc., kindly delivered an address on 'Recent Fishery Research,' illustrated by special lantern slides. The Third Meeting (a special one) was held on 17th December. On this occasion Mr. Richard J

Ussher, M.R.I.A., Waterford, gave a lecture, subject 'Evidence of the Caves,' illustrated by lantern views. On the 6th January, 1903, the Fourth Meeting was held, when Dr. John MacCormac lectured on the subject of 'Heredity in its Relation to the Nervous System,' illustrated by specially prepared lantern slides. The Fifth Meeting took place on the 3rd February, when two papers were read. I. 'The Micro-fauna of the Boulder Clay, with some Remarks on the Movement of Glaciers, illustrated with tables, diagrams, and lantern slides, by Mr. Joseph Wright, F.G.S. II. 'Notes on Some Igneous Rocks in Down and Antrim,' illustrated by specimens, slides, and microscopic sections, by Miss Mary K. Andrews. The Sixth Meeting was held on the 3rd March, when Rev. W. Spotswood Green, M.A., kindly gave an illustrated lecture, subject 'The Armada Wrecks on the Irish Coast.' The Seventh Meeting took place on the 7th April, when Mr. George Coffey, M.A., M.R.I.A., kindly lectured on 'A Lost Principle in Art,' illustrated by a special series of lantern views of ancient and mediæval buildings. At all these meetings the attendance of members and of the general public showed no diminution, and several of the lectures were the subject of reference and discussion in the Press.

Owing to the erection of the new Medical Institute, our Society has lost the Ulster Medical Society as tenants. This is to be especially regretted, as the relations between the two Societies have been uniformly harmonious. The room which was occupied by them has been taken by the Belfast Naturalist Field Club for the purpose of a library and meeting place for members. The other societies holding their meetings in the Museum continue to do so.

The attendance of the general public has been, as usual, very large at the Easter holidays, when the Museum was opened at a nominal charge, and no damage was done to the collections.

As will be seen by the Hon. Treasurer's Statement of Accounts, duly audited by the Local Government Board's

Auditor, a satisfactory balance remains after paying all expenses. This, however, it must be borne in mind, results from the thoughtful generosity of the local committee of the British Association, who decided to pay to the Society the balance of the general fund raised for last year's meeting.

Mainly as a result of the suggestions made by Professor Gregg Wilson in his lecture on 'Recent Fishery Research' on 2nd December, a meeting of representatives of our own Society, the Belfast Naturalists' Field Club, and the Queen's College was convened by your Secretary on the 16th December to consider the advisability of the establishment of a marine biological laboratory. As a result the Ulster Fisheries and Biology Association has been established, with Mr. Robert Patterson, M.R.I.A., F.Z.S., as its Honorary Secretary and Treasurer. Already good work has been done, and much interest aroused for its future welfare.

The natural history collections in the Museum have received a great amount of attention during the year, and the much-needed work of revision and rearrangement has to a large extent been carried out by a number of volunteer experts. The Irish fossils, which form a large and valuable series, have been taken off the old tablets and remounted on a new system by Mr. W. Swanston, and now make a most effective display. The important set of County Down graptolites is not yet in place, but is being renamed and classified by Professor Lapworth and will then form a standard collection of the Irish species of these ancient fossils.

The collections representing Irish vertebrate zoology have been taken in hand effectively by Mr. Robert Patterson. Old and imperfect specimens have been replaced, and those retained carefully cleaned, adding much to the brightness and attractiveness of the rooms. Seven drawers of birds' eggs have been classified and mounted on the modern system by Messrs. Nevin H. Foster and John Cottney. Many clutches of eggs, hitherto absent or imperfectly represented, have been added, and there is now a complete series of the eggs of Irish nesting birds.

The Rev. W. F. Johnston and Mr. H. Lamont Orr have done much work in supplying, arranging, classifying, and mounting the collections of native insects. Some of the groups are fairly well represented, especially coleoptera, but large gaps still remain. It is to be hoped that some of these will ere long be closed up.

Mr. Joseph Wright, F.G.S., took up the arrangement of the Foraminifera. A large number of specimens were added by him to the existing collection. All were re-mounted on the most effective system known, and by Mr. Wright's kindness the Museum now possesses a series of Irish Foraminifera, both recent and fossil, more complete than that of any other institution in the country.

There have been many valuable recent additions to the Museum collections. The specimen of golden eagle from County Donegal, presented by Sir James Musgrave, is noteworthy by reason of the ever-increasing scarcity of this bird in Ireland. Two cases of salmon, pictorially mounted, presented by Mr. Robert Patterson, are also specially attractive additions. The collections generally have been removed from the cabinets, cleaned, and replaced, and the relabelling of the objects is now being carried out by the assistant curator. Dr. A. Harris, of Stewartstown, has kindly placed in the Museum on loan his very valuable collection of Naga weapons and personal ornaments of the hill tribes of India. These while they remain will form an interesting and attractive exhibit. A list of donations to the Museum and of the publications received during the Session from the various societies with whom we are in correspondence will be printed with the present report. Five members of the Council retire from office as usual, of whom four are eligible for re-election.

The Hon. Treasurer read the Statement of Accounts, which showed that the year had commenced with a balance of £16 16s. 7d., the total receipts being £361 17s. 5d. The two principal items were bequests and donations, £136 1s., and subscriptions, £112 10s. The expenditure for the year amounted to £303 4s. 5d., the balance in Treasurer's hands being £58 13s., while £400 worth of the York Street Spinning Company's Debenture Stock is still held by the Shareholders.

Professor Symington said that he had much pleasure in moving the adoption of the Report and Statement of Accounts. He need not say much, because it appeared to him that Report generally was of a very satisfactory nature. During last winter they certainly had a very excellent series of lectures, and he was glad to hear that the valuable collection in the possession of the Society was being taken good care of, and in many respects rearranged and brought up to modern requirements.

Sir Robert Lloyd Patterson expressed his pleasure in seconding the resolution. He need not take up much of their time, for in every way they considered the Report satisfactory. He wished, however, to point out that but for the fortunate circumstances of receiving a cousiderable sum from the local committee of the British Association their finances would not have been in the satisfactory condition they were. They could not expect that item to arise again, and he would urge, as he had done often before in that room, the importance of that Society and the claims it has on public support, which claims, he was sorry to say, were not recognized as the members felt they ought to be.

The President said he ought to take this opportunity of expressing the great regret which he was sure they all felt at hearing of the death of one of their oldest members, Mr. Isaac J. Murphy. At one time he was a very frequent attender at their meetings, and gave many interesting lectures, while he also presented to the Society considerable apparatus. They all regretted very much that he had passed away.

In speaking of the Report, one of the things he was happy to notice was the great preponderance of natural history papers. Although he was not a naturalist himself, that was a naturalists' society, and it was many years since they had so many, and so good, papers on the subject. In former years it was left to the engineers and other such people to save the Society from utter extinction, so far as the reading of papers was concerned, by bringing forward subjects in which they were interested.

A very important event in the past Session was the nauguration of the Ulster Fishery and Biological Association, which had largely emanated from Professor Gregg Wilson's lecture on 'Fishery Research.'

It was satisfactory to see that donations still flowed in, and almost seemed to increase through the kindness of the people named in the Report. He was pleased to note also that others had been kind enough to help them to rearrange the collection, which was now in a much better state than it had been for a long time; the balance in hands was satisfactory, and altogether he thought they might be congratulated upon having had a prosperous year.

The Report and Statement of Accounts were then passed.

Mr. Robert Young suggested that it would be desirable to send a letter of condolence to the family of the late Mr. Isaac Murphy.

Sir R. Lloyd Patterson seconded, and the suggestion was unanimously approved of.

The following gentlemen were elected to the Council of Management for the ensuing year:—Rev. Dr. Hamilton (President, Queen's College), Professor Symington, F.R.S., Professor Gregg Wilson, Mr. R. M. Young, J.P.; and Mr. T. F. Shillington, J.P.

Mr. Joseph R. Fisher said he had pleasure in rising to move a vote of thanks to the President for his conduct in the chair during his term of office. As a new member, he was not in a position to speak with any amount of experience of Mr. Brown's services in that particular capacity, but generally his great scientific attainments and knowledge of business had fitted him to carry on the invaluable work of that Society. He (the speaker) would simply move that the best thanks of the Society be given to Mr. Brown for his presidency during the last three years.

Mr. William Gray, in seconding, said he thought it ought to be a great satisfaction to the citizens of Belfast to have amongst them a gentleman of Mr. Brown's attainments, and whose family was connected with the material progress of the city; one who had distinguished himself by his original research. As members of that Society, he thought they ought to be very grateful indeed to him for applying his high attainments in promoting the best interests of the Society.

The vote of thanks was heartily accorded.

Mr. Brown, in response, said that he was very much obliged to the members for their kindness. Any work he had done for the Society had been a labour of love, and he had only been anxious that it should be on the right track, and productive of good results. Although he was retiring from the office of President, his interest in the Society would be just the same as ever, and he hoped to do what he could for it in the future as in the past.

The public meeting then terminated.

The following Officers of the Society for the year 1903-4 were elected at this and a subsequent meeting of the Council:—President—Professor Johnson Symington, M.D., F.R.S.; Vice-Presidents—Sir Robert Lloyd Patterson, D.L., J.P., F.L.S.; Wm. Swanston, F.G.S.; Rev. T. Hamilton, D.D., LL.D., M.A., and Robert Young, J.P., C.E. Hon. Treasurer—W. H. F. Patterson. Hon. Librarian—J. H. Davies. Hon. Secretary—Robert M. Young, J.P., M.R.I.A.

EDUCATIONAL ENDOWMENTS (ACT), 1885, 48 and 49 Vic., ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended, 30th April, 1903.

Dr. **Cr.**

CHARGE.

To Balance as per last Account			£16 16 7
,, Amount of Donations, Bequests, and other Endowments, received in the year ended 30th April, 1903 ...			136 1 0
,, Amount of Subscriptions received in the year ended 30th April, 1903			112 10 0
,, Amount of Dividends received in the year ended 30th April, 1903			16 17 11
,, Amount of Rents received in the year ended 30th April, 1903			28 4 6
,, Amount of Fees received in the year ended 30th April, 1903			0 11 6
,, Amount realized by Sales in the year ended 30th April, 1903			6 8 9
,, Amount of Miscellaneous Receipts in the year ended 30th April, 1903 (not included in the foregoing) viz:—			
Carriage Refunded Belfast Steamship Co. ..	£0 5 11		
Door Admission Fees during year	21 16 8		
,, ,, ,, ,, Easter ..	20 3 4		
,, ,, &c.—Coronation Holidays ..	2 2 3		
			44 7 2
			£361 17 5

DISCHARGE.

By Amount of Payments made in the year ended 30th April, 1903, under the following headings:—			
Maintenance of Premises, &c.	£72 11 7		
Rent and Taxes, &c.	28 3 10		
Salaries	104 0 5		
		£204 15 10	
Other Payments, viz:—			
Printing and Stationery	4 16 4		
Advertising	10 17 10		
Postage and Carriage	4 8 7		
Fire and Gas	16 12 2		
Insurance—£2 12s 6d, £1 19s 9d	4 12 3		
Stamping Transfer Forms	0 12 0		
Purchase of Shares	13 0 0		
Subscription *Ulster Journal Archæology* ..	0 10 0		
,, *Irish Naturalist*	2 2 0		
Printing Report	14 11 6		
Lecturers' Travelling Expenses	2 18 4		
J. Brown—Lecture Expenses	1 17 7		
Tickets and Boxes for Specimens ..	7 3 0		
Auditor's Fee	1 1 0		
Coronation Expenses	3 10 1		
Easter Expenses	5 11 1		
Hire of Lantern	2 9 0		
Sundries	1 15 10		
		98 8 7	
Total Payment		303 4 5	
,, Balance in favour of this Account on 30th April, 1903 ..		58 13 0	
Total		£361 17 5	

N.B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., 4½ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M YOUNG, Governor.

W. H. F. PATTERSON, Accounting Officer.

Dated this 27th of May, 1903.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

19th day of June, 1903.

DONATIONS TO THE MUSEUM, 1902-1903.

From Mrs. Carroll.

A mounted specimen of the Gannet (*Sula alba*).

From Mr. Robert Bell.

A fine specimen of Natrolite from Trap rock at Whitewell.

From Sir James Musgrave, D.L.

A mounted specimen of the Golden Eagle (*Aquila chrysætos*) shot in County Donegal.

From Sir R. Lloyd Patterson, D.L., F.L.S.

A mounted specimen of the Crane (*Grus cinerea*).

From Mr. Robert Young, J.P.

Two vertebral joints of an *Icthyosaurus* from the Lias at Woodburn, County Antrim.

From The Egypt Exploration Fund.

Numerous specimens of ancient pottery and other objects obtained by recent researches and excavations at Abydos.

From Mr. Robert Patterson, M.R.I.A., F.Z.S.

Two large specimens of Salmon (*Salmo salar*) from Glenarm River, pictorially mounted in glazed cases; also many specimens of Irish birds, including the Common Buzzard (*Buteo vulgaris*), Redbreasted Merganser (*Mergus serrator*), and a Velvet Scoter (*Œdemia fusca*) shot in Belfast Lough.

From Mr. George A. Carruthers, Weymouth.

Stem of a Cycad from the "Dirt Bed" at Portland, Dorset. Portion of fossil tree stem from the Oolitic limestone of Portland. Three gigantic Ammonites. Casts of oysters, and of *Trigonia*, and of *Cerithium portlandicum* from the same bed. Two fossil oysters from the Oxford clay at Weymouth, also specimen of crystallised carbonate of lime.

From MESSRS. J. P. CORRY & CO.

Two planks of elm in which a stake of ash is included. The stake had been fastened by pegs to the young elm tree, and the elm has grown around the ash stake and completely enfolded it.

From MR. W. D. BARRETT.

A specimen of lead ore (*Galena*) from Co. Kerry.

From MR. R. M. PATTERSON.

A specimen of the giant puff bull (*Lycoperdon giganteum*).

From MR. CHARLES HALLIDAY, BANBRIDGE.

One of the old six-barrelled revolver pistols.

From MR. VICTOR COATES, D.L.

The Skin of a Vulture (*Gypætos meridionalis*) from South Africa.

From MR. H. MARSHALL, NEWRY.

Preserved specimens of Otter, Woodpecker, Water Rail, etc.

From MR. F. B. SIMMS.

Eggs of Gannet from the Bass Rock, and Eggs of Tern from Copeland Islands.

From MR. WM. R. SINCLAIR.

Skin of a reptile (*Iguana ?*) from South Africa.

From MR. JAMES SLOAN.

The upper stone of a Quern.

From MISS REA.

A large collection of geological specimens.

From MISS M. K. ANDREWS.

A framed photograph of coast erosian at Cultra.

From MR. ROBERT WELCH.

A specimen of the curiously perforated limestone at Lough Corrib.

From Mr. William Swanston, F.G.S.

A numerous series of fossil specimens.

From Mr. S. A. Stewart, F.B.S

Glaciated limestone from Castle Espie, and a number of fossils.

From Messrs. R. J. Ussher, Nevin Foster, and John Cottney.

A large number of eggs of Irish birds.

From Mr. Joseph Wright, F.G.S.

A large number of mounted specimens of Irish Foraminifera.

From Mr. Granby Higginbotham.

Specimen of a fossil plant from the Coal Measures.

ADDITIONS TO THE LIBRARY, 1st MAY, 1901, till 1st MAY, 1902.

Received from

Adelaide.—Memoirs of the Royal Society of South Australia. Vol. 2, part 1, 1902. Transactions, vol. 26, parts 1 and 2, 1902.
Presented by the Society.

Basel.—Verhandlungen der Naturforschenden Gesellschaft in Basel. Vol. 13, part 1, 1901, and part 2, 1902; vol. 14, 1901; and vol. 15, part 1, 1903; also Zur Erinnerung an Tycho Brahe, 1901.
The Society.

Belfast.—Catalogue of Early Belfast Printed Books, second supplement to third edition.
The Linen Hall Library.

Bergen.—Bergens Museums Aarbog for 1902, parts 1 and 2, 1902, and part 3, 1903; also Crustacea of Norway, vol. 4, parts 7—12, 1902, and parts 13 and 14, 1903. *Bergen Museum.*

Birmingham.—Proceedings of the Birmingham Natural History and Philosophical Society. Vol. 11, part 2, 1902. *The Society.*

Boston, U.S.—Proceedings of the Boston Society of Natural History. Vol. 29, No. 15, 1900, Nos. 16—18, 1901, and vol. 30, Nos. 1 and 2, 1901; also Occasional Papers, No. 6, 1901.
The Society.

Boulder, Colorado.—College Studies. Vol. 1, Nos. 1 and 2, 1902; and Quarto Centennial Celebration of Colorado University, 1902.
Colorado University.

BREMEN.—Abhandlungen vom Naturwissenschaftlichen Verein zu Bremen. Vol. 17, part 2, 1903. *The Society.*

BRESLAU.—Zeitschrift für Entomologie vom Verein für Sclesiche Insektenkunde zu Breslau. New series, part 27, 1902. *The Society.*

BRIGHTON.—Annual Report and Abstract of Papers of Brighton and Hove Natural History and Philosophical Society, 1902. *The Society.*

BRUSSELS.—Anales de la Société Royale Malacologique de Belgique. Vol. 36, 1902. *The Society.*

BUENOS AYRES.—Annales de Museo Nacional de Buenos Aires. Ser. 2, vol. 7, 1902. *The Director.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 33, part 3, 1902; vol. 34, part 2, 1902; vol. 35, part 1, 1902. Palæontologia Indica, ser. 16, vol. 2, parts 1—3, 1902; and General Report for 1901-1902. *The Director of the Survey.*

CAMBRIDGE.—Proceedings of the Cambridge Philosophical Society. Vol. 11, parts 5—7, 1902; and vol. 12, parts 1 and 2, 1903. *The Society.*

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Zoology at Harvard. Vol. 38, No. 7, 1902; vol. 39, Nos. 2—5, 1902; vol. 40, Nos. 1—3, 1902; and Nos. 4 and 5, 1903; also Annual Report, 1902. *The Keeper of the Museum.*

CASSEL.—Abhandlungen und Bericht (47) des Vereins fü Naturkunde zu Kassel, 1902. *The Society.*

CHERBURG.—Memoires de la Société Nationale des Sciences Naturelles et Mathematiques de Cherbourg. Ser. 4, vol. 33, fasc. 3, 1902. *The Society.*

CHICAGO.—Bulletin of the Chicago Academy of Sciences. Vol. 2, Nos. 3 and 4, 1900. *The Academy.*

CHRISTIANIA.—Forhandlinger i Videnskabs Selskabet i Christiania for year 1901.
The Royal Norske Frederiks University.

CINCINNATI.—Bulletin of the Lloyd Library. Nos. 4 and 5, 1902. *The Messrs. Lloyd.*

DANTZIC.—Schriften der Naturforschenden Gesellschaft in Danzig. New series, vol. 10, part 4, 1902. *The Society.*

DAVENPORT, IOWA.—Proceedings of the Davenport Academy of Sciences. Vol. 8, 1901. *The Academy.*

DUBLIN.—Scientific Transactions of the Royal Dublin Society. Series 2, vol. 7, parts 14—16, 1902; vol. 8, part 1, 1902; and vol. 9, part 5, 1903; also Economic Proceedings, vol. 1, part 3, 1902. *The Society.*

EDINBURGH.—Proceedings of the Royal Physical Society. Vol. 14, part 4, 1901. *The Socety.*

ELBERFELD.—Jahresbericht des Naturwissenschaftlichen Vereins in Elberfeld. Part 10, 1903. *The Society.*

EMDEN.—Jahresbericht der Naturforschenden Gesellschaft in Emden for 1900-1901. *The Society.*

GENOA.—Rivista Ligure di Scienze Lettere ed Arti. Fasc. 2—6, 1902, and fasc. 1, 1903. *The Society di Letture e Conversazioni ed Art.*

GIESSEN.—Thirty-third Bericht der Oberhessichen Gesellschaft für Natur und Heilkunde, 1902. *The Society.*

GLASGOW.—Transactions of the Natural History Society of Glasgow. New series, vol. 6, part 2, 1902. *The Society.*

,, Proceedings of the Royal Philosophical Society of Glasgow. Vol. 33, 1902. *The Society.*

GOTHENBURG.—Goteborg's Kungl Vetenskaps Och Vitterhets-samhalles Handlingar. Part 4, 1898. *The Society.*

HAMBURG.—Abhandlungen aus dem Gebiete der Naturwissenschaften. Herausgegeben vom Naturwissenschaftlichen Verein in Hamburg. Vol. 17, 1902. *The Society.*

IGLO.—Jahrbuch des Ungarischen—Karpathen Vereins. 29th year, 1902. *The Society.*

KIEW.—Memoirs of the Society of Naturalists of Kiew. Vol. 17, part 1, 1901; and part 2, 1902. *The Society.*

LAUSANNE.—Bulletin de la Société Vaudoise des Sciences Naturelles. Vol. 38, Nos. 143—145, 1902; also Observationes Meteorologiques, 1902. *The Society.*

LAWRENCE.—Bulletin of the University of Kansas, Science. Vol. 1, Nos. 1—4, 1902. *The University.*

LEEDS.—Eighty-second Annual Report of Leeds Philosophical and Literary Society, 1902. *The Society.*

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig, 1901. *The Society.*

LIMA.—Boletin del Cuerpo de Ingenieros de Minas dei Peru. Nos. 1 and 2, 1902. *The Director.*

LONDON.—Quarterly Journal of the Geological Society of London. Vol. 58, parts 2—4, 1902; and vol. 59, part 1, 1903; also List of Fellows, and Geological Literature, 1902. *The Society.*

Series of British Museum Guide Books as under. Guide to Mammalia; to Reptiles and Fishes; to British Echinoderms; to Shells and Starfish; to Sowerby's Models of Fungi; to the Mycetozoa; to Coral Gallery; to Fossil Reptiles and Fishes; to Fossil Invertebrata and Plants (2 parts); Introduction to Study of Meteorites; to Study of Rocks; to Study of Minerals; Guide to Mineral Gallery, and Students' Index to the Minerals; also ten pamphlets of Directions for Collectors. *The Director.*

Journal of the Royal Microscopical Society. Parts 148—151, 1902; and 152 and 153, 1903. *The Society.*

LONDON.—Transactions of the Zoological Society of London. Vol. 16, parts 5—7, 1902. Proceedings for 1901, vol. 2, part 1; and 1902, vol. 1, parts 1 and 2; vol. 2, part 1; also Index for 1891-1900.
The Society.

MADRAS.—Administration Report of the Government Museum and Public Library, 1901-1902.
The Superintendent of the Central Museum.

MANCHESTER.—Journal of Manchester Geographical Society. Vol. 17, Nos. 7—12, and Supplement, 1901; vol. 18, Nos. 1—3, 1902, and Supplement for 1896. *The Society.*

„ Transactions of Manchester Geological Society. Vol. 27, parts 10, 11, 12, 13, and 17, 1902.
The Society.

„ Annual Report and Transactions of Manchester Microscopical Society, 1900-1901.
The Society.

MARSEILLES.—Anales de la Faculté des Sciences de Marseille. Vol. 12, 1902. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. New series, vol. 14, part 2, 1902; vol. 15, part 1, 1902; and part 2, 1903. *The Society.*

MEXICO.—Boletin del Instituto Geologico de Mexico. No. 15, 1902, and No. 16, 1902. *The Institute.*

„ Boletin Mensual del Observatorio Meteorologico Central di Mexico. August till November, 1901, and January, 1902. Informe (text and atlas) 1901-1902. Anuario, No. 23, 1902.
The Director.

MILWAUKEE.—Bulletin of Wisconsin Natural History Society. New series, vol. 2, No. 4, 1902.
The Society.

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Vol. 4, part 1, 1902. *The Director.*

MOSCOW.—Bulletin of the Imperial Society of Naturalists of Moscow. Nos. 3 and 4, 1902, and No. 3, 1903. *The Society.*

NANTES.—Bulletin de la Société des Sciences Naturelles de l'Ouest de la France. Series 2, vol. 1, parts 3 and 4, 1901; vol. 2, parts 1 and 2, 1902; also Table des Matières de la Premiére série, 1891 1900. *The Society.*

NEW YORK.—Annals of New York Academy of Sciences. Vol. 14, part 2, 1902. *The Academy.*

" Bulletin of the American Geographical Society. Vol. 24, Nos. 1—5, 1902, and vol. 25, No. 1, 1903. *The Society.*

NOTTINGHAM. — Report and Transactions of Nottingham Naturalists' Society, 1901-1902. *The Society.*

ODESSA.—Memoirs of the Society of Naturalists of New Russia. Vol. 24, part 1, 1901. *The Society.*

OTTAWA.—Contributions to Canadian Palæontology. Vol. 2, part 2 (Fossil insects), 1900; vol. 4, part 2 (Palæozoic Corals), 1901; and vol. 3 (quarto), 1902; also Catalogue of the Marine Invertebrata of Eastern Canada, 1901. *The Director of the Survey.*

PADUA.—Atti della Società Veneto Trentina di Scienze Naturali. Series 2, vol. 4, fasc. 2, 1902. *The Society.*

PHILADELPHIA.—Proceedings of Philadelphia Academy of Natural Science. Vol. 54, part 1, 1902. *The Academy.*

" Proceedings of the American Philosophical Society. Vol. 41, Nos. 168—170, 1902. *The Society.*

" Ressources Vegetales des Colonies Francaises, by Gustavo Niederlein, Chef de Department Scientifique des Philadelphia Museums. *The Author.*

PISA.—Atti della Società Toscana di Scienze Naturali, Processa Verbali. Vol. 13, January, 1902—January, 1903. *The Society.*

ROME.—Atti della Reale Accademia dei Lincei. Vol. 11, semestre 1, fasc. 7—12, 1902; semestre 2, fasc. 1—12, 1902; vol. 12, semestre 1, fasc. 1—6, 1903; and Rendiconto dell' Adunanza Solenne di 1st Guigno, 1902. *The Academy.*

,, Bollettino della Società Zoologico Italiana. Series 2, vol. 3, fasc. 1—3, 1902. *The Society.*

SAN FRANCISCO.—Occasional Papers of California Academy of Sciences, No. 8, 1901. Proceedings (Zoology), vol. 2, Nos. 7—11, 1901; and vol. 3, Nos. 1—4, 1901-1902. *The Academy.*

ST. LOUIS.—Thirteenth Annual Report of Missouri Botanical Garden, 1902. *The Director.*

STAVANGER.—Stavanger Museum Aarshefte for 1891. *The Museum Trustees.*

STETTIN.—Bericht der Gesellschaft für Volker und Erdkunde zu Stettin, 1902. *The Society.*

STIRLING.—Transactions of Stirling Natural History and Archælogical Society, 1902. *The Society.*

STOCKHOLM.—Handlingar of the Royal Swedish Academy. Vol. 35, 1902. Bihang, vol. 27, parts 1—4, 1902. Ofversigt, No. 58, 1901, and No. 59, 1902. *The Academy.*

SYDNEY—Science of Man (Journal of the Royal Anthropological Society of Australasia). New series, vol. 5, Nos. 3—12, 1901-1902. *The Editor.*

TOKYO.—Mittheilungen der Gesellschaft für Natur—und Volkerunde Ostasiens. Vol. 8, part 3, 1902; and vol. 9, part 1, 1902; also Supplement, No. 1, 1902, and Festschrift, 1902. *The Society.*

TORONTO.—Transactions of the Canadian Institute. Vol. 7, part 2, 1902, and Proceedings, vol. 2, part 5 1902. *The Institute.*

UPSALA.—Bulletin of the Geological Institution of the University of Upsala. Vol. 5, part 2, No. 10, 1901.
The University.

VIENNA.—Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien. Vol. 52, 1902. *The Society.*

„ Verhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt. Nos. 3—18, 1902, and Nos. 1—4, 1903. *The Society.*

WASHINGTON.—Year-book of the Department of Agriculture, 1901, and North American Fauna, No. 22, 1902.
The Secretary of the U.S. Dept. of Agriculture.

„ Bulletin of the Bureau of Ethnology. No. 26, 1901. *The Director of the Bureau.*

„ Twenty-first Annual Report of the United States Geological Survey, parts 5 and 7, and Atlas, 1899-1900. Monographs, No. 41, 1902. Bulletin of the Survey, Nos. 177—190, 1901-1902, and Nos. 192—194, 1902. Mineral Resources of the United States, 1902. Reconnaissances in Cape Nome Region, Alaska, 1901. Also Geology and Mineral Resources of Copper River District, Alaska, 1901.
The Director of the Survey.

„ Annual Reports of the Smithsonian Institution for 1900 and 1901. Smithsonian Contributions to Knowledge, No. 1309, 1901. Smithsonian Miscellaneous Collections, Nos. 1312—1314, 1902; also 1174 and 1259, 1902.
The Smithsonian Institution.

„ The American Monthly Microscopical Journal. Vol. 22, Nos. 8, 9, 10, and 12, 1901, and vol. 23, Nos. 1—4, 1902. *The Publisher.*

WASHINGTON.—Bulletin of the Philosophical Society of Washington. Vol. 14, pp. 179—204, 1902.
The Society.

YORK.—Annual Report of the Yorkshire Philosophical Society for 1902. *The Society.*

ZURICH.—Vierteljahrsschrift der Natursforschenden Gesellschaft in Zurich. Parts 1 and 2, 1902.
The Society.

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

SESSION 1902-1903.

5th November, 1902.

THE LIQUEFACTION OF GASES.

INAUGURAL ADDRESS BY THE PRESIDENT, J. BROWN, F.R.S.

(*Abstract.*)

BEFORE taking up the subject proper of my address, will you permit me to express my very grateful appreciation of the honour conferred upon my unworthiness by your Council in electing me as your President for a third term? There is no honour which I value more highly, nor any commendations which appeal to me more than such as come from our own Society, in which I have for the last twenty years or more taken a lively interest and an active part.

In dealing with the subject generally of liquefied gases in this place I feel that I have the privilege of entering on a field made famous by the work of one of our own citizens in our own town. I think it was my friend Professor Fitzgerald who remarked that if the name of our city were to be mentioned in any university in the civilised world the name of one man, and one only, would be recalled by the word "Belfast." It would not be a name connected with our boasted manufactures, our great political lights, or our popular celebrities of any kind. It would be the name of Thomas Andrews, the fame of whose work on the continuity of the liquid and gaseous states is of course world-wide.

Before Andrews's time, we find that in 1823 Faraday had succeeded in liquefying chlorine, sulphuric acid, and some other gases. Faraday, however, did not succeed in liquefying oxygen, hydrogen, nitrogen, &c.

In 1861 Andrews subjected these intractable gases to very great pressure, also without success, but on more easily condensible gases his subsequent work had a value far exceeding this in scientific interest.

In order to fix our ideas as to the conditions necessary for the liquefaction of gases let me point as an illustration to the homely matter of water boiling under ordinary conditions. Evidently heat is required. It is the tendency of heat to produce vapour or gas from liquid. Conversely we may conclude it is a tendency of cooling to produce liquid from a gas or vapour like steam. Here, however, is only half the matter. When water boils in ordinary conditions it is under the atmospheric pressure of 15lb. per square inch on its surface, and the vapour rising from it has to lift this 15lb. off before it can form. As a matter of experiment we know that it will not lift this pressure till the temperature is raised to 100 degrees C. It would be natural to expect, however, that if we lift this atmospheric pressure off by other means a less temperature would suffice for converting the liquid into gas. We shall therefore not be very much surprised to see water boiling and freezing at the same time. Having exhausted the air from above the water in a glass vessel, you see it boiling violently, although quite cold enough to form ice, which is presently seen on its surface.

From this experiment we draw the conclusion that the essening of pressure tends to form gas from liquid, and conversely that increase of pressure would tend to form liquid from gas. We also note incidentally that evaporation is here also attended by loss of heat, producing in this case actual freezing of the liquid. Thus we see that the two conditions tending towards liquefaction of gases are pressure and cold.

Before Andrews's time it was tacitly assumed that any defect in one of these could be made up for by increasing the other. If too little cold, more pressure would cause liquefaction. Andrews, however, discovered that for each gas there was a certain temperature above which no amount of pressure would liquefy that gas. This temperature he called the critical temperature for that particular gas. Below that temperature and at a sufficient pressure, called the critical pressure, the gas would liquefy with a decrease of volume. Above it no liquefaction could be observed ; yet when not much above it there was as the pressure increased a somewhat more rapid decrease in volume, than would correspond with the behaviour of what is called a perfect gas. Yet, again, when above the critical point, and therefore in a gaseous state, the gas, when reduced to about the volume which it would have occupied when liquefied at a lower temperature, yielded only slightly to further pressure. As regards its elasticity, it behaved then as a liquid. These researches were carried out with carbonic acid as an experimental agent, and in them is illustrated what Andrews aptly called the continuity of the gaseous and liquid states of matter. As he says, "From carbonic acid as a perfect gas to carbonic acid as a perfect liquid the transition may be accomplished by a continuous process."

Andrews, who began with an attempt, unsuccessful as it was, to merely liquefy the most refractory gases—oxygen, hydrogen, nitrogen, etc.—was thus led aside to a path rich in scientific interest—perhaps richer even than that which he set out to pursue. This was left to later investigators.

In 1877 Pictet achieved the liquefaction of oxygen by combined pressure and cold, produced by elaborate and costly machinery. A few days only after Pictet's success Cailletet announced a similar achievement. Following oxygen, all the other gases known at that period soon yielded likewise. About the case of hydrogen it is true doubts and difficulties seem to hang. At all events six years elapsed before Wroblewski and Olszewski obtained hydrogen in the form of a static liquid, and to collect liquid hydrogen in some quantity, as Professor Dewar remarks, has taken twenty years from the date of Pictet's experiments.

Though Siemens had suggested the principle earlier, it was about 1895 that Linde, and also Hampson, devised perfect and simple apparatus. It is true that others in the meantime were approaching perfection, Dewar, for instance, having described in 1886 an apparatus embodying this principle. The chief difficulty is the production of a sufficient degree of cold. Lowering of temperature is, in modern apparatus, attained by a device which I shall try to explain in a simple way. In the antique apparatus for obtaining fire known as the fire syringe (a specimen of which has been kindly lent us by Mr. Robert May, whose interesting collection of antique candlesticks is at present on view in the Free Library) heat is obtained by the compression of air. The syringe consists of a strong brass tube with an airtight plunger reaching nearly to the bottom of the tube. On driving the plunger rapidly down, the air beneath is so heated as to set fire to a piece of touch cotton (cotton wool treated with saltpetre and sulphur or with solution of phosphorous), which has previously been attached to the end of the plunger. When the plunger is withdrawn the air, which has been hot enough to set fire to our cotton wool, cools again. To do so it absorbs heat. From this simple experiment we conclude generally that air in expanding cools itself. Thus by the device of first compressing air, and, as it were, squeezing some of its heat out, and then allowing it to expand again, we cool it below the temperature at which we started.

This is the first process in the air liquefying apparatus. Air is compressed in water-cooled pumps to 120 atmospheres, say 1,700lb. per square inch, further cooled by passing through coils of tube immersed in water, and finally allowed to escape through a specially constructed valve, whereby in expanding it cools itself further, though not enough for the purposes of liquefaction. For this there is necessary the so-called self-intensive principle. Just before the air escapes by the valve it has to pass through a coil containing very many turns of tube contained in a non-conducting casing. Through this casing and among the coils of tube the recently escaped and therefore cold air circulates, imparting its cold to the coils, and therefore to the compressed air circulating in them. We have thus a continuous interacting process of cooling, by which in a short time the air in the coils is reduced to a liquefying temperature. This is the self-intensive principle used by Linde, Dewar, Hampson, etc., for liquefaction of air, and finally by Travers for liquefaction of hydrogen, a much more difficult matter.

It would be quite impracticable to keep liquid air in closed vessels because of the enormous pressure that would result when the liquid, by absorbing heat from the surrounding atmosphere through the walls of the vessel, would evaporate and regain its gaseous form. In an ordinary open glass vessel it evaporates in time, of course; but if we reduce the influx of heat by surrounding the vessel with a non-conducting envelope we may retard this evaporation. The best non-conducting envelope known is a vacuous or highly-exhausted space, consequently what are called vacuum jacketed vessels are employed—i.e., the glass tube or flask containing the liquid is surrounded by a second larger glass tube or flask, sealed on so that the interspace can be exhausted of air. Through this space conduction of heat is very slight. Radiation of heat into the vessel is prevented by silvering the interior between the two vessels, and so reflecting the heat rays that strike upon it. The invention of these vessels is claimed by Professor Dewar.

For the opportunity of seeing and experimenting with liquefied air we are indebted to the very great kindness of Mr. Richard J. Moss, of the Royal Dublin Society, who with the greatest cordiality acceded to a request from me for a supply of the liquid. On a former occasion when sending me a supply for use in my own laboratory, Mr. Moss expressed a doubt if the Dublin atmosphere would suit Belfast, but on this occasion he expressed the conviction that an abundant supply of some cooling medium will not be out of place on Guy Fawkes Day in the North. May I assure Mr. Moss, on your authority, that it is not by any means out of place, and that we tender our warmest thanks for this coldest of gifts?

Liquid air is a clear, transparent fluid. The boiling point is about 190° to 200° under atmospheric pressure. The experiments that can be performed with liquid air depend chiefly on the effects produced by this very low temperature. Poured upon water, liquid air floats, forming a cup of ice, in which it boils. Immersed in liquid air, mercury may be frozen, and forms a mercury casting, which can be forged cold into a hook, on which we may suspend a weight, till the warmth of the surrounding atmosphere melts it into liquid drops, when the weight of course fails. Alcohol may be frozen, ice hardened till it is said to cut glass, and indiarubber becomes brittle like a pipe stem. Sulphur, vermilion, and a solution of cobalt chloride in alcohol lose their colours. The electric resistance of metals is decreased manifold. Owing to the fact that the nitrogen in air is more volatile than the oxygen, it evaporates first, and in liquid air which has been standing some time the residue is chiefly oxygen. On this account a process of obtaining oxygen sufficiently pure for many purposes has been proposed. To illustrate this a shaving splinter of wood burns up brightly over such stale liquid air. Felt or cotton wool soaked in the liquid burns with explosive violence. A jet of hydrogen will burn under the surface of liquid oxygen. Liquid air has been proposed as a carrier of power by using it to drive motors of the steam engine type. Here is an illustration where a tube of liquid air enclosed in an appropriate closed vessel gives off air at sufficient pressure to drive the model engine, and on the screen is a slide of a motor so driven. Here however convenient in some respects the process might be, the question of economy comes in. On this point Dr. Hampson states that 1lb. liquid air at 1d. will expand to 800 volumes at atmospheric pressure ; 1lb. steam to 1,700 volumes. One pound steam can be made under good conditions by the combustion of 1-10lb. of coal, or at a cost of 1-120 of a penny, putting coal at 15s per ton. Therefore the power contained in 1lb of liquid air at 1d is, roughly speaking, equal to that contained in ½lb. of steam at 1-240ths of a penny. Of course if liquid air could be produced at 1-240ths of its present cost. allowing for loss in carrying about, it could very favourably compete with steam.

Some years ago a Mr. Tripper, of the United States, claimed that he could make it for less than nothing. We have heard nothing of Mr. Tripper lately.

Liquid air has also been proposed as a cooling agent. Much tall talk was indulged in by the American Press in this connection also. Hampson points out that liquid air would have only 1-10th the cooling power of ice weight for weight, and. as ice is usually less than 1d. per pound, the price of liquid air, the inefficiency is so much the more evident. Liquid air or oxygen as an explosive has been proposed. When mixed with petroleum and infusorial earth it explodes violently. Probably the difficulty of transporting it comes in the way here.

Liquid hydrogen in sufficient quantity to be properly observed and investigated seems to have been first obtained by Professor Dewar in 1898. It is a clear, colourless liquid, perfectly transparent, and about 1-10th the specific gravity of water. It boils at —250 deg. C., under atmospheric pressure, or within 23 deg. of absolute zero. As a cooling agent, it will lower temperature to within 13 deg. to 15 deg. of absolute zero. Its critical temperature is —240 deg., and critical pressure 13·3 atmospheres. Professor Dewar considers the step from the liquefaction of air to that of hydrogen is relatively as great in the thermo-dynamic sense as that from chlorine to liquid air. Some idea of the difficulty of its production may thereby appear. The solidification of the gases is the next step beyond liquefaction. Atmospheric air was frozen by Professor Dewar in 1893. A litre of liquid air subjected to exhaustion in a silvered vacuum vessel yielded about half a litre of a colourless, transparent solid, consisting of a nitrogen jelly containing liquid oxygen. Solid oxygen is obtained by subjecting liquid oxygen to cooling by immersion of the tube containing it in boiling hydrogen. It is clear blue ice. Solid hydrogen has been produced by the same kind of process. It is a transparent ice.

The really important uses of liquefied gases are comprised in their application to low temperature research, providing as they do a means of cooling other bodies hitherto unattainable. We may glance at a general view of this part of the subject. It was at first supposed from the change in the electric resistance of metals produced at this temperature that all metals would become perfect conductors at absolute zero. Further cooling by liquid hydrogen showed, however, that a certain amount of resistance would still exist at 0 deg. absolute. Phosphorescence is much increased by the cold of liquid air, and much more by that of liquid hydrogen. Chemical affinity is almost abolished by cold. Potassium, which bursts into flame on water, remains inert on liquid air or oxygen.

Fractionation by distillation at these low temperatures has been effectively employed by Professor Ramsay and Dr. Travers in 1898 for the extraction from the atmosphere of the new gases, krypton, neon, and xenon, following on the discovery of argon in 1895 by Lord Rayleigh, and helium later.

In connection with the last mentioned, it is interesting to recall how the name arose. In the spectroscopic examination of the sun one line was observed which could not be detected in any terrestrial substance. It was therefore supposed to be peculiar to the sun, and so called the helium line. Subsequently, however, it was proved to be like the other constituents of the sun, terrestrial also, a gas more volatile than hydrogen, and which has not yet been liquefied and solidified.

The influence of very low temperatures an the vital force of living organisms has also been examined. The cold of liquid air has no apparent effect on bacteria. After twenty hours at —190 deg. no diminution in any of their powers was perceptible. Phosphorescent organisms under alternate cooling and thawing showed a remarkable instance of suspension and renewal of vital processes. Cooled down by liquid air, they became non-luminous, but phosphorescence began again with its usual strength when removed into ordinary conditions. In a paper communicated to the Royal Society last August Dr. M'Fadyen states that several forms of bacteria, including typhoid bacillus, survived perfectly an exposure to —190 deg. C. for six months. Even at the temperature of liquid hydrogen (—252 deg.) these much-enduring though minute organisms suffered no injury.

Professor Fitzgerald moved a hearty vote of thanks to the President who, he said, had given them a most profitable evening, and whose experiments with liquid air they had all witnessed with wonder and delight. They all appreciated, too Mr. Brown's tribute to Professor Andrews and his work. To Dr. Moss, of Dublin, and to Mr. Brown's son who had acted so efficiently as his assistant, their best thanks were also due.

Mr. R. M. Jones, in seconding the motion, said Mr. Brown, in addition to being an eminent scientist, was one of the most public-spirited men in Belfast. He had introduced them to many new and interesting discoveries, including the motor-car, wireless telegraphy, and that very ingenious invention of his own for the improvement of our roads. That evening he had introduced them to liquid air, and shown them some of its marvellous properties, in addition to giving them a wonderfully able and concise history of modern research in connection with the liquefaction of gases.

The vote was passed by acclamation, and briefly replied to by the President.

On the motion of Mr. W. S. Swanston, seconded by Mr. Robert Patterson, authority was given to dispose of some duplicate specimens in the Museum.

2nd December, 1902.

PROFESSOR REDFERN, M.D., F.R.C.S.I., in the Chair.

RECENT FISHERY RESEARCH,

BY PROFESSOR GREGG WILSON, D.Sc.

(*Abstract.*)

PROFESSOR WILSON said the subject of sea fisheries ought to be an interesting one to every member of a British audience. He wanted to remind them that the British fisheries were worth a great deal of money. They yielded the fishermen something like £10,000,000 a year. He was sorry a very small part of that money was gained by Irish fishermen—some £300,000 or £400,000. He ventured to hope that the fisheries were worth a great deal more than £10,000,000 to the consumers. He wished to call their attention to the work done by scientific men in recent years in connection with preserving and improving the fisheries.

First, he wanted them to grasp very firmly that their fish area was a small one. The great bulk of the ocean was deeper than 2,000 metres, or yards. For a long time it was believed that there was no life in the deep seas, in the waters beyond about 100 fathoms. One of the most prominent professors of last century maintained that fact, but that idea was got rid off. It was first really proved by the electric cables that had been laid in deep water. They were lifted after a time for repairs, and were found to be covered with marine organisms. This proved the fact that there was life in the depths of the ocean, and in this connection he could not refrain from referring to the magnificent work that was done by Sir W. Thompson, a former professor of Queen's College, who carried out work on the Challenger, the results of which had been given to the world in many volumes.

He was particularly anxious that they should grasp the fact that deep-sea life was not the kind of life that was any use to them. The lecturer then called attention to characteristics of some of the curious looking creatures that they found in the deep sea. He showed that some of these were provided with luminous organs, as the water beneath 100 fathoms is completely dark, and he also pointed out that they were so formed as to be able to exist under the great pressure to which they were subjected so far beneath the surface. Those physical conditions prevented fish living in the higher waters migrating to the lower, and vice versa. Fish taken from those deep waters practically exploded by being brought to the surface and relieved of the pressure which they were formed to resist. The ordinary fisherman in the North Sea knew how to minimise the effects of slight change of pressure. When they took a cod out of even twenty fathoms of water, and wished to keep it alive, they resorted to the precaution—at least they used to —of running a needle into the bladder and letting out some of the gas or air, so that the bulk of the fish might diminish rapidly and accommodate its size to the lesser pressure of surface water. Another preventative from the passage of fish from higher to lower waters, and lower to higher, was the difference in temperature. They had found that the temperature in those deep waters was very little above freezing point.

After alluding to figures which showed a decline in some of our fisheries, especially those for turbot and soles, the lecturer said that fall in the fisheries took place in spite of the fact that there was an enormous increase of fishing apparatus at work.

Their great steam trawlers went further afield than they did a few years ago. They were managing to take about the same quantity of fish out of the water by fishing with an enormous amount of apparatus. They had got to face the fact that there was at least the danger of a very serious decline in their fisheries. On the recognition of that fact there was a sudden impulse to study the question of their fisheries. The Americans, Canadians, Norwegians, Danes, the British, especially the Scotch, had been engaged on that question, and he would like to indicate to them the sort of work that had been going on amongst scientific men who had put themselves to consider the fishery question, and he hoped that sooner or later they would do some fishery work in this district. In the first place, they had been studying fish eggs and the spawning of fish.

The most important fact discovered about the spawning habits of fish was discovered in 1864. That was the fact that most of their food-fishes produce eggs that float. Why was it that they did not see them? Because they were like little beads of glass, they were so transparent. A false idea existed that the spawn of most fish was produced near the shore, whereas many of the best spawning grounds were far from the shore, and legislation to protect the same would require to take that fact into consideration.

He advocated the provision of fish hatcheries in certain circumstances only, and more especially in fresh waters, when spawning ground was deficient. The Americans as early as 1871 went in for hatching. He instanced what they had done in shad hatching as an example of its success. They carried the shad across to the Pacific waters. In the case of salmon and trout, river hatching had been an enormous success. Where they had too little spawning ground and plenty feeding ground hatching was an advantage.

Naturalists were also studying the young of fish. There was the question of the destruction of young fish by trawlers and others, and associated with that question was the study of what he might call fish nurseries. The latter were places where young fish were crowded together, and where there were comparatively few old fish. Trawlers were more successful in catching the young fish than the old fish. All he had to say was, if they emptied the nursery he took it for granted that the drawing-room would not be full in a little time. In Lancashire this matter was being considered, and they were regulating the size of the mesh of fishing nets.

Naturalists had also been considering the food of fish and their feeding habits. A popular belief was that the larger fish fed on the smaller, and so on, but ultimately they found their fishes were dependent on plant life It was the plants that made organic stuff.

Dealing with the question of artificial baits, the lecturer said some fish distinguished their food by smell almost, others by sight almost entirely.

The lecturer then referred to the enemies of our food fishes, and pointed out that naturalists were principally engaged on how to get rid of them by encouraging the enemies of the enemies of our food fish. The question arose could men overfish the seas? Professor Huxley had been of opinion that this was impossible, and that the damage done by man was infinitesimal compared with what was done by other enemies. It was the last straw that broke the camel's back, and if they put on that last straw it made all the difference, and he thought man could play the part of the last straw. There was a great deal of injury which might be prevented, and it was with that he wished to interfere.

In conclusion reference was made to the importance of properly equipped marine stations for the study of all questions relating to the fisheries, and a hope was expressed that before long such a station might be instituted near Belfast.

Professor Symington moved a vote of thanks to Professor Gregg Wilson for his lecture. He thought it was appropriate that they should consider on that occasion what could be done in connection with their own fisheries. With the exception of what was being done by Mr. Holt, under the Agricultural Department, on the Western-Southern Coasts there were absolutely no scientific investigations being conducted in any part of Ireland with regard to that question. In connection with that Society something might be done on the North-East Coast. There was no difficulty in getting a suitable site for starting a modest modern laboratory. Professor Wilson spoke to them that evening as an expert, and he was sure he would be only too anxious and willing to assist any of them that wished to take up that department of the work.

Rev. D. A. Purves, in seconding the motion, as an outsider, was sure that in Professor Gregg Wilson not only Queen's College, but the city of Belfast, had received a great acquisition. While he had given them a scientific lecture, they would all agree that he had been perfectly lucid. He concurred with the suggestion that had been thrown out that the services of a man like Professor Gregg Wilson should be in some way secured to that neighbourhood, and he did trust that the outcome of that meeting would be that steps would be taken to instal a modern laboratory in the region of Belfast.

The motion was carried and suitably conveyed by the Chairman, who referred to the time when many of the most eminent naturalists of Great Britain belonged to the North of Ireland.

A similar compliment was paid to Professor Redfern, on the motion of Mr. J. J. Andrews, seconded by Mr. William Shaw.

17th December, 1902.

Mr. Robert Young, J.P., in the Chair.

EVIDENCE OF THE CAVES.

By R. J. Ussher, J.P.

(*Abstract.*)

Kent's Cavern, in Devonshire, is very extensive, and contains many chambers and passages. On the top of its deposits were blocks and masses of limestone that had fallen from the roof, and the uppermost deposit, a black mould, lay between these. It was largely formed of leaves blown into the cave, and contained miscellaneous relics, from the soda-water bottle of the modern tourist to relics of mediæval, Roman, and pre-Roman times—bronze articles. spindle-whorls, broken pottery, including Samian ware; ancient bone implements, amber beads, and charred wood; also human bones, bones of brown bear, red deer, and of domestic animals, such as dog, pig, ox, and sheep. Beneath the black mould no remains of sheep occurred. None of these relics carry us back beyond historic times.

The second deposit was a floor of granular stalagmite varying from a mere film to five feet in thickness.

The third deposit was confined to one part of the cavern, and was called the black band. It was composed of little bits of charred wood, the hearthplace of the palæolithic cave men. Three hundred and sixty flint weapons or tools were found here, with bones that had been roasted, and bone tools, an awl, a harpoon, a fish-spear, and a needle of bone. With these were bones of hyæna, rhinoceros, horse, ox, and deer. Here was the home of those ancient hunters who lived in England with the hyæna, the mammoth, and the rhinoceros, and who used flint weapons, which they manufactured round this fireplace.

The next deposit, which extended throughout the cave, was a reddish cave earth, and it yielded the greatest store of animal remains. They represented hyæna, horse, woolly rhinoceros, mammoth or woolly elephant, Irish elk, reindeer, red deer, lion, and other animals, some of which exist at the present day, while others are long since extinct. Among the relics of the latter were some teeth of the machairodus, or sabre-toothed lion, whose upper canine teeth were of enormous size and serrated. It was a very ancient and pliocene animal. Hyænas appear from their numerous bones to have been very abundant, and some of the others, as the reindeer, were suited for life in Arctic countries. But, besides the beasts of prey, human inhabitants—doubtless a race of hunters—lived there at times. They probably lighted large fires near the cave's mouth, where the black band occurred, to keep out the wild beasts during their stay. The objects these hunters left behind them were chiefly spear heads of flint, carefully chipped into shape with great labour, as is still done by some savage nations. Carved bone harpoons were also found in the cave earth, and a bone pin, which was in contact with the tooth of a rhinoceros.

But there was an older chapter still in the history of Kent's cave. Another stalagmite floor lay beneath the cave earth, crystalline in structure, which showed its greater age, and it attained in places twelve feet in thickness.

The lowest deposit, which lay under the crystalline stalagmite, was a dark-red sandy paste in places, but was often found in masses of rocklike hardness, and was called the Breccia. It was largely composed, not of limestone fragments, but of pieces of red grit, a rock which is not to be found in the cavern hill, but in hills now separated from it by a valley seventy feet deep below the cave level. Therefore this red grit must have here drifted into the cave before this deep valley had been gradually scooped out by rains and streams. The Breccia contained numbers of bones, but they were all of the great cave bear, except two jaws of lion and another of fox, and none of these bones had been gnawed by hyænas, like those in the cave earth above. Even here, however, human implements of flint were found, not so finely wrought as those in the cave earth above, but unmistakably the work of men. No one can assign a date to these things, but, ancient as must have been the men of the cave earth who lived when mammoths and their companions existed, the people who made the weapons found in the Breccia were vastly older. We can only say that they represented a very far-off age, as when one sees the snowy peaks of lofty mountains rising against a clear sky he is sure they are further than any other visible object, but cannot say how great their distance is.

In 1858 quarrymen working on the site of an ancient cave at Shandon, near Dungarvan, in County Waterford, found the remains of a mammoth with those of reindeer. They were brought to light by the late Mr. E. Brenan, of Dungarvan, and are now in the Science and Art Museum, Dublin. Bones of horse, bear, and other animals were also found in Shandon Cave by Professor Leith Adams, who had done cave exploration work in Malta.

In company with him in 1879 I opened up a small cave half-a-mile south of the Cappagh Station, in the townland of Bally-namintra. It was nearly filled with deposits ; but, now that it is cleared, it forms a tunnel about eight feet wide. When we began to dig we found in the brown earth which lay uppermost many bones of domestic animals—as cows, sheep, pigs and dogs—with some human bones ; but as we dug deeper we came to a grey earth that contained more ancient-looking blackened bones of a larger size. These were fragmentary, but when we came upon pieces of palmated antlers my friend pronounced them without doubt to belong to the Irish elk. Its remains, though frequently found in bogs, had never been discovered before in a cave in Ireland, nor associated here with evidences of man; but no sooner did Dr. Leith Adams find the bones of this gigantic deer in the same bed with charcoal and other relics of man than he freely confessed we had found proof that the Irish elk had existed in the human period in this country. In England Irish elk had been found with man in Kent's cavern. The gigantic size of the stately and beautiful animal may be judged by the skeletons and antlers in our museums. Though found in other countries it has nowhere been found so abundantly as in Ireland, where it had probably had fewer enemies, as there were not so many species of beasts of prey, and it certainly multiplied and flourished largely throughout this island, where its remains are often found in, or rather under, bogs, most commonly in the shell-marl. At Cappagh my father found the bones and antlers of at least sixteen, and in Ballybetagh Bog, County Dublin, no fewer than one hundred and thirty individuals were discovered. It is chiefly the males that are thus found, probably owing to the enormous weight of their antlers having made them more likely to be drowned or bogged.

But to return to the Ballynamintra cave, we found in the earth of the second stratum or in crevices of the rocky walls many bones of the Irish elk. They were split and broken, the ends of the narrow bones being invariably knocked off, as used to be done by all ancient peoples to the bones of an ox and other beasts. Moreover, the pieces of Irish elks' antlers could hardly have been brought into that small cave except by man, the animal being too large to enter it alive. These facts of themselves show that we had found the retreat of an early people who had hunted the Irish elk, of which at least five individuals were represented by their remains. In the same stratum that contained them were quantities of burned wood, and this charcoal, which formed a seam in the midst of the grey earth, marked an ancient floor or hearth, and proved that the bed had not been disturbed. There were also sea shells in it, brought by the human inhabitants, and a number of stones suitable for taking in the hand and striking with, which were chipped along their edges in a way that leaves no doubt they had been used to break the bones with. Beneath the grey earth were remains of a great stalagmite floor, four feet thick in places, which had crystallised. In the lower part of this, which lay upon a bed of gravel, were found embedded the teeth and bones of a huge bear, pronounced by Professor Busk to have been the grisly bear, now confined to the Rocky Mountains of North America. The deposits of this cave also contained some teeth and bones of reindeer. Thus the Ballynamintra Cave yielded relics of three distinct ages—the neolithic, with its polished stone axe and domestic animals; then the age of the elk-hunters; and before that the time of the grisly bear.

Within the last two years good work has been done in other Irish caves by a Committee appointed by the British Association, under Dr. Scharff, who has organised the movement, and assigned to me the execution of the excavations. In 1901 we worked in caves in Keish Corran Mountain, County Sligo, in which were found two distinct strata—the uppermost of grey earth, containing a stone celt, bronze pins and objects of iron, abundance of charcoal, bones of domestic animals, and some oyster and mussell shells. Bones of bear were also found, and a shin bone of reindeer, beneath which charcoal occurred, in the same stratum. This was fair evidence that the reindeer had been contemporaneous with man in Ireland. The second stratum was a clay in which the characteristic animal was the brown bear; but in these caves the jaws and bones of the Arctic lemming were found in abundance. This was the first discovery of it in Ireland, and the species differs from the lemming of Norway, and is not found nearer than Greenland at the present day.

During the summer of 1902 two groups of caves have been excavated at Edenvale, in County Clare. In these the upper stratum has, as usual, yielded in profusion charcoal, bones of domestic animals, many human bones, and other relics of ancient art, knives of iron, objects of bronze, bracelets of metal, an amber bead, pins or awls of bone ; but besides these, chiefly in the second stratum, we found great numbers of bones and teeth of reindeer and bear, and some of the latter of enormous size, whose species remains to be determined. Some relics of the Irish elk also have occurred in the Edenvale caves, which are very complicated and extensive, and are by no means dug out.

In the chalky limestone of the Antrim cliffs numerous caves occur, and during the formation of the new walk at the Gobbins last summer by the Belfast and Northern Counties Railway Company a large cavern was found, closed by a slipped piece of the cliff, and full of the shingle of an old raised beach. In this Mr. Welch has found many bones of domestic and wild animals, and some portions of red deer's antler of large size, which are exhibited. It is hoped that further researches of various parts of Ireland will lead to a much fuller knowledge of its prehistoric past.

Mr. John M. Dickson moved a vote of thanks to the lecturer.

Professor J. Symington, in seconding the motion, said, though Mr. Ussher was a well-known ornithologist, in recent years he had become possibly better known as a cave explorer. He believed interesting investigations could be made on the Northern coast as regarded cave exploration.

Mr. William Gray, from personal research, believed that interesting results would reward the proper investigation of the caves along the North coast of Antrim, from White Park Bay to Carrick-a-Rede. A cave near Pulbraddan was well worth exploring.

Mr. R. Knowles thought the question was deserving of the consideration of the Field Club.

The motion was passed.

7th January, 1903.

Mr. J. Brown, F.R.S., President, in the Chair.

HEREDITY IN ITS RELATION TO THE NERVOUS SYSTEM.

By John M. MacCormac, M.D., L.R.C.P. & S.Edin.

(*Abstract.*)

In assuming that the mind of a child is devoid of character or ideas, Locke attributed nothing to heredity. Man enters this world as a stranger, it is true, but he can investigate and explore, and his mind is ever active to receive various perceptions, and it is a matter of common observation that the same objects produce different effects upon different minds. A poet, painter or geologist looks at a landscape with entirely different ideas. While the country lad knows every bird song and the intricacies of every glade, the town-bred boy revels in bricks and mortar and despises the dirty lanes. In all there is a special quality, which responds to external perceptions, and which is due to heredity.

The broadest principle of heredity is, that like produces like, that all the physiological and psychological characteristics of the parent are transmitted to the child. Hence Darwin's theory of Pangenesis, which supposes that every cell gives off gemmules or germs, which permeating the whole body, and becoming collected in the generative cells, can reproduce the whole organism. This theory was too complex to commend itself to physiologists.

Sanson defines heredity as the transmission of natural or acquired qualities from predecessor to descendants. Professor Weisman founds a theory of heredity, which assumes that acquired characters cannot be transmitted, while many consider that they can be inherited. It is clear that acquired characters, such as mutilations, e.g., the clipping of dogs' ears and tails, the piercing of women's ears, the deformity of the feet of Chinese women, affect the individual only. Dr. Archdall Reid remarks that there are two classes of characters, inborn and acquired, and the question of the transmission of the latter has been warmly debated. This difference of opinion arises from the difficulty of deciding what is due to heredity, and what to environment. It is commonly said that all theories of heredity are in essence theories of evolution, but theories of evolution depend directly upon environment, while theories of heredity are closely associated with the nervous system. Professor Titchener maintains that every child is born with certain tendencies, which differ according as the child takes after this or that predecessor. The nervous system of each is the product of a long course of development, and all sorts of influences have combined to affect it. Hence the different mental characteristics.

But are physiological and psychological heredity mutually dependent or not? Science cannot settle this, unless we are prepared for materialism, and to deny the existence of the soul. This must be considered. The ancients believed that souls migrated from men to animals and *vice versâ*, and this belief, finding its way into the early church, gave rise to different theories of the soul's existence. Later arose the question whether the soul was not generated at the same time as the body, and the theory "Traducianism," arising out of this, was adopted by many of the early Fathers. Lactantius asked from which parent the soul sprang, and exploded the theory.

A later theory "Creationism" suggested that the Creator is perpetually creating souls, and infusing them into bodies. This subjects the work of the Almighty to the will of human beings. A third theory teaches that the Creator, at the beginning, imparted to man a spiritual element, which should, in due course, develop into a force, controlling the body, and becoming fitted for a continuous existence. Thus may be understood the possibility of a permanent physiological state, producing or developing a permanent psychological state corresponding with it. To admit psychological heredity therefore follows the admission of the principle of physiological heredity, and establishes the direct influence of the nervous system upon mental processes. We therefore hold with Spencer that Consciousness is a continuous adjustment of internal with external relations, that every psychical phenomenon is inherent in some organ, and that mental and physical tendencies are alike transmitted.

Evolution, to which reference must be made, depends upon external influences or environment, and influences both the physical and mental characteristics. This influence can be so directed as to considerably affect earlier hereditary traits, and produce variation *within* the species. Illustrations of this fact are well known. The modified theory of evolution of Monsieur Naudin is that its object is to produce a definitive species, since in the earliest period living creatures had a more plastic and variable habit than now, and that this plastic character is an evidence of design. It is however for Science yet to confirm this, as well as the Darwinian theory of the variability of species. No evidence can be found of the transformation of species, while the weak as well as the strong find room for existence. Moreover palæontology establishes the identity of seeds, plants and species with those of ages far remote, while another strong objection to the transformation theory is the uniform sterility of hybrids. It must also be observed that as soon as the operation of environment ceases, there is a gradual return to the primitive type. As Professor Drummond pointed out, choice roses, strawberries, raspberries, and fruit trees, if left untended, without culture, return to the briar, the wild fruit of the woods, the bramble, and the useless undergrowth. Similarly fancy pigeons soon revert to the plain, uniform colour of the original type. The same is observable in human beings, who neglect themselves, and are removed from beneficial and improving influences. These considerations show how closely interwoven are the laws of heredity and evolution, and afford striking evidence of design. One of the greatest of naturalists, Professor Agassiz maintains this, when he says :—" Nothing in the organic kingdom is calculated to impress us so strongly as the unity of plan, which is apparent in the structure of the most various types." And after pointing out the wonderful relations and admirable harmony, he says :—" If all these relations are beyond man's intellectual power to grasp, if man himself is but a part or fragment of the whole system, how could this system have been called into being if there were not a supreme intelligence the author of all things?" Monsieur Ribot raises the ascertained fact of the physiological and psychological transmission of general specific characters to the dignity of a law, with the necessary reservation, that heredity is twofold and that the operation of the law must be in favourable circumstances, otherwise the blind fatality of its laws might make decadence the rule. But as universal life develops in the direction of progress, heredity is not abandoned to a blind fatality. There must be a presiding directing power. So Darwin has taught us that the laws of evolution point to a supreme intelligence. His theory, however, like those of Haeckel and Spencer, is intensely materialistic. While enforcing his law of the persistence of force, Spencer had to admit the possible existence of an intelligent causation; but Haeckel recognised only the materialistic principle, starting with the theory of spontaneous generation. Professor Tyndall and Dr. Dallinger have however disproved this theory by showing that life can only come from the touch of life. Dr. Archdall Reid asks us to consider the vast complexity, physical and mental, of man, to think of our futile microscopes and our infantile chemical analyses, and so to gather some idea of the vanity of attempting to pry into the how of the inheritance of either inborn or acquired traits. The law exists, and from a physiological standpoint argues in favour of determinism. But psychology must also be considered, and hence the influence of the nervous system. If the mind is merely a physical outcome of the brain, then psychological and physiological phenomena cannot be distinguished, but the theory of the soul's existence is an important factor here. Luys and Maudsley both hold that the physical operations of the brain constitute intellectual and moral life, and that by means of these, it feels, remembers, and re-acts. This materialistic doctrine, which asserts the identity of brain and thought, sets aside all idea of free will. It maintains that "The organism is the man himself," that "intelligence is the result of organic phenomena," that "thought is only a function of the nervous centres." But is this so? Internal phenomena can only be perceived by one faculty—consciousness, and Maudsley himself admits that they are incapable of experimental demonstration. The moral and physical are not identical, for the mind, conscious of motion, is also conscious of itself. It is an "ego" and cannot be produced by a material organ. The brain is the organ of thought, as the eye is the organ of vision, and as perfect vision depends upon a perfect eye, so perfect thought depends upon a perfect brain. Now the nervous system has certain leanings in a definite direction, and what that direction is, is determined by influence, which even affected remote ancestors. But it is in youth easily moulded. Hence the great problem of Education for habit becomes second nature.

Psychologically "apperception" is defined as a psychical activity by which individual perceptions are brought into relation to our previous intellectual and emotional life, assimilated with it, and raised to greater clearness and significance. It thus indicates the intimate relationship between Heredity and the Nervous System, and may be considered the connecting link between physiological and psychological developments. This common ground presupposes a mental bias, but what that bias is we cannot predict, we can only learn by experience. That this bias can be altered or modified by attention, an act of volition, to other influences, is a matter of daily observation and experience. We cannot therefore but conclude that the nervous system is seriously affected by environment, habit and volition, and that there is an influence directly transmitted from one generation to another. How far this influence may be directed or counteracted by the will is a question to be determined. If to-day we are the subjects of it, this arises from the freedom of yesterday. Our good or ill may be referred to the free acts of our predecessors, so we, by the force of our own will, are the parents of our own acts, and may influence the acts of others. Our consciousness convinces us that, while we have acted in a certain way, it was in our own power to have acted otherwise. The great past is the outcome of human freedom, and it is to that freedom we must look for the improvement or depreciation of the influences affecting future genetations.

Professor Gregg Wilson, in proposing a vote of thanks to Dr. MacCormac for his lecture, said he was not going to say very much, because after considering such grave matters as those treated in the lecture one was more in a condition to think than to talk. He believed Dr. MacCormac would have the effect of stimulating a great deal of thought and controversy amongst his audience.

Mr. Robert Patterson seconded the vote of thanks, which was uuanimously passed.

Dr. MacCormac briefly replied in acknowlegement of the vote.

3rd February, 1903.

Mr. Robert Young, J.P., in the Chair.

THE MICRO-FAUNA OF THE BOULDER CLAY, WITH SOME REMARKS ON THE MOVEMENT OF GLACIERS,

By Joseph Wright, F.G.S.

(Abstract.)

Boulder Clay is a stiff compact clay, containing numerous boulders as well as smaller stones, the greater portion of which are more or less rounded, their surfaces being often striated and scored. It formed the subsoil of the greater part of this country—it occurred at all elevations, from the sea level to a height of upwards of 1,500 feet above the sea. Foraminifera have been found at many places in the clay. I have examined samples of it from 134 localities—from Ireland, England, Wales, Scotland, Isle of Man, Canada, and Novaia Zemlia, and in 105 of these Foraminifera had been found. In some places they were very rare, in others they were abundant, but their presence was demonstrated in three-fourths of the instances. With one or two exceptions all the species found in the clay occurred recently off our coast, the fossil specimens having usually the fresh lustrous appearance of specimens brought up by the dredge. Ten of the samples were obtained from altitudes of 500 to 1350 feet, all of which, with one exception, contained Foraminifera.

With the exception of sixteen samples received from Novaia Zemlia which, on account of the smallness of their size, had to be examined in detail under the microscope, floatings from the clays were alone examined. To ascertain how far the process of floating could be relied on for giving conclusive results, one ounce troy of the boulder clay from Woodburn, Carrickfergus, was examined with great care. The first floating contained 1,400 specimens, this process having to be repeated twenty-four times before specimens ceased to come up. What remained of the clay was then examined under the microscope, and sixty-seven additional specimens were got from it. Upwards of 2,100 specimens were obtained from this ounce of clay. This experiment clearly demonstrated that the process of floating cannot be relied on for proving the non-existence of Foraminifera in Boulder Clay.

The micro-fauna of the Boulder clay is a peculiar one, more than half of the entire specimens found being referable to *Nonionina depressula*, whilst *Cassidulina crassa*, though somewhat rare as a recent British species, is often plentiful. The Porcellanous forms are usually very rare, whilst the *Arenacea* are represented only by the species *Haplophragmium canariense*.

The marine fauna in a climate so rigorous as must have prevailed during the glacial period could not fail but be a poor one. Mr. S. A. Stewart, in his "Mollusca of the Boulder Clay of the North East of Ireland," says :—" Molluscan shells occuring in the Boulder clay are not numerous. In most cases they are only got by patient searching, and then only in a fragmentary condition ; but in a few instances they are less rare, and include specimens in a perfect state. The presence of perfect shells of *Leda* was known long since to General Portlock, and forced him to the same conclusion as arrived at by the author, that the Boulder clay is a marine sedimentary deposit."*

No doubt many of the shells in boulder clay were transported

*Proc. Belfast Nat. Field Club. App. 1879-80.

by icebergs with stones and rock fragments, but some of them certainly lived at the places where they are now found, and with some few exceptions, all the Foraminifera must have done so, as these microzoa are usually as perfect and as fresh looking as recent specimens brought up by the dredge. There were in glacial times both elevation and subsidence. First glacial striation, then depression, boulder clay, and marine organisms.

At Woodburn and Knock Glen, *Leda pygmæa* and *L. minuta* are frequently found with their valves united, here also Foraminifera occur in the very greatest profusion, 100 species having been found at Woodburn and 79 at Knock Glen. Foraminifera in boulder clay are usually much smaller in size than recent British species, but many of the specimens at these two localities are fairly large in size, the following are the most notable in this respect:—*Miliolina seminulum*, *Nomonina orbicularis* and *Polystomella arctica*. Three of the species found at Woodburn and five of those from Knock Glen are only known as recent British species from gatherings taken off the West Coast of Ireland, two of them also occurring off the West Coast of Scotland. Some of these West of Ireland species have also been found in boulder clay at other places. *Lagena fimbriata* was got at five other localities, one of them being Larch Hill, Co. Dublin, 650 feet above the sea, and *Polystomella subnodosa* was got at Deppel Burn, Ayrshire, at 1061 feet elevation. The presence of these West of Ireland Foraminifera in the boulder clay of Woodburn, Knock Glen, and some other places, would lead us to infer that when these clays were deposited the land stood at a much lower level than now, and when the marine conditions were somewhat similar to what now prevails off the West Coast of Ireland. The fineness of the clay at these two localities, and their freedom from stones, the perfect condition of some of the *Leda* shells, the profusion of Foraminifera, and the large size of some of the specimens, would support the view that the clay at these two localities was deposited in deep and quiet water, and below the disturbing influence of ice action. Boulder clay with many stones in it usually contains few Foraminifera, and would be characteristic of deposits formed near exposed sea coasts, as such situations are not favourable for marine forms of life.

Reference may be made to the slow downward movement of glaciers by gravity, and that when they terminated in the sea, as they frequently did in the Arctic regions, they sooner or later broke off into large masses, floating away as icebergs, carrying with them any stones or other material which they had accumulated in their course. As ice when submerged beneath the sea diminishes far more rapidly than when in air, so the bergs quickly melted away, depositing their burden over the floor of the ocean; and to this cause, as also to the action of shore ice, may be largely attributed the formation of boulder clay.

Should at any future time the sea bed between Labrador and Greenland be raised above the sea, one can readily imagine such a place to present a very similar appearance to that which we now find in boulder clay. There would be rock fragments and stones striated and scored by ice action, with shells more or less broken, and other material which had been dropped there by bergs floating southward from Arctic places. With these would be found associated mud and stones from the wearing of rocks in the vicinity, and also marine organisms that lived at the place.

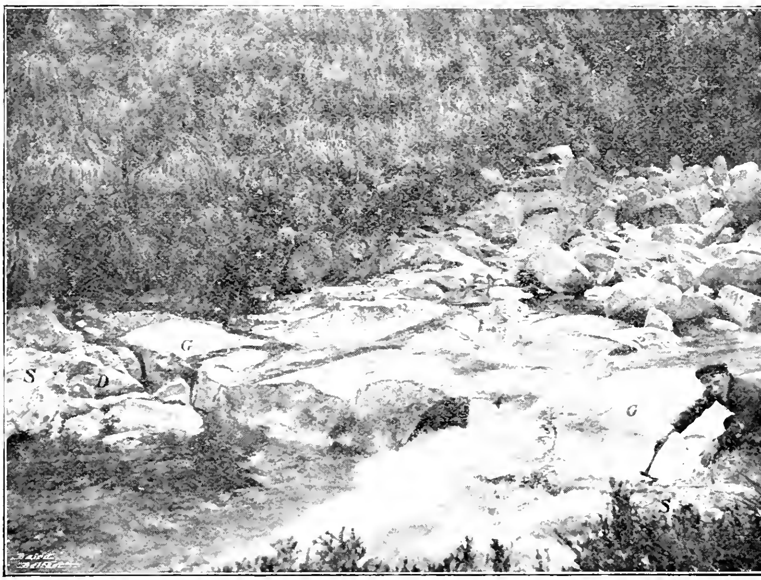

PLATE I.

JUNCTION OF GRANITE AND SILURIAN ROCK, GLEN RIVER, NEWCASTLE, CO. DOWN.

To the left a lamprophyre dyke, cut off by the granite. G—Granite: S—Silurian shale; D—Dyke of Dioritic lamprophyre. (From a photograph by Miss M. K. Andrews: *copyright*).

NOTES ON SOME IGNEOUS ROCKS IN DOWN AND ANTRIM.*

By Miss Mary K. Andrews.

(*Abstract.*)

The following brief notes refer to rocks exposed in the bed of the Glen River at Newcastle, Co. Down, to certain dykes on the Mourne Coast, north of Glasdrumman Port, to a few of the rhyolites of Co. Antrim, and to one or two points of interest connected with its Basaltic Plateau.

Beginning with the granite of the Mourne Mountains, attention may be drawn to its well known resemblance in miarolitic structure and other characteristics to some of the granite of Arran, and to the probability that both are of Tertiary age. Direct evidence is still wanting, but one of the many points that support this inference, is that in its intrusion into the surrounding grits and shales, the Mourne granite has cut off a number of basic dykes, possibly belonging to the Tertiary "Lower Basalts," and is itself penetrated by a less numerous later series, probably representative of the "Upper Basalts." In the first lantern slide (reproduced in Plate I.), one of these older dykes is seen cut off by the granite. This very interesting section occurs at an approximate height of 550 feet above sea level, and about 300 yards from the second stone bridge in Donard Lodge Park. The photograph shows the junction of the granite and Silurian rock in the bed of the Glen River. The head of the hammer is on the line of

* The paper was mostly illustrated by lantern slides from the author's geological photographs, and by microscopic sections of specimens she had collected.

junction, where the two rocks are united into so hard a mass, it was difficult to obtain specimens. Towards the middle of the river granite veins penetrate the sedimentary rock, whose normal colour becomes lighter in its vicinity. Microscopic sections of the granite obtained at and above this junction show beautiful examples of the micrographic intergrowth of quartz and felspar characteristic of granophyres. At the left side of the photograph, close to the right bank of the river, a dyke of dioritic lamprophyre is seen traversing the Silurian rock in a N.N.W. direction, and is cut off by the granite. The shale in contact is greatly indurated, and so similar in colour to the dyke, that it was not easy to trace the exact line of demarcation. In microscopic section, the intermingling of the green hornblende bands, probably of igneous origin, with the brown clastic patches of the sedimentary rock is very striking.* (Plate 2.) When the river is exceptionally low a continuation of one of the granophyric veins already referred to, can be seen crossing the dyke.

Donard Tunnel passes close to this junction, and there are large specimens from it on the table—baked sedimentary rock, penetrated by eurite bands. In the course of its construction, I had in September, 1897, an opportunity of seeing dykes of the later series. A very interesting section was then temporarily exposed in the "cut and cover" to this tunnel, about a quarter of a mile south of the Bloody Bridge River. The normal granite of the district was here seen to about six feet in depth, capped by four feet of drift deposit. Two basalt dykes traversed the granite at an interval of forty yards from each

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* This microscopic section, with one of the dyke itself, was submitted to Professor Cole, to whom I am indebted for the following interesting remarks. "Your 'dioritic lamprophyre' is a curious rock, with its sparse triclinic felspars, and its groundwork of biotite and green hornblende. It looks as if a magma capable of making biotite and pyroxene had remained as a groundwork after the felspar had developed, and then this magma crystallised out, the pyroxenic matter finally passing into granular amphibole. But the Silurian contact-rock shows similar patches of granular hornblende, and an abundance of the same brown mica. Is this rock permeated by the igneous one in intimate streaks, or does the igneous one owe some of its matter to absorption of the adjacent sediment? The former view looks to me more probable."

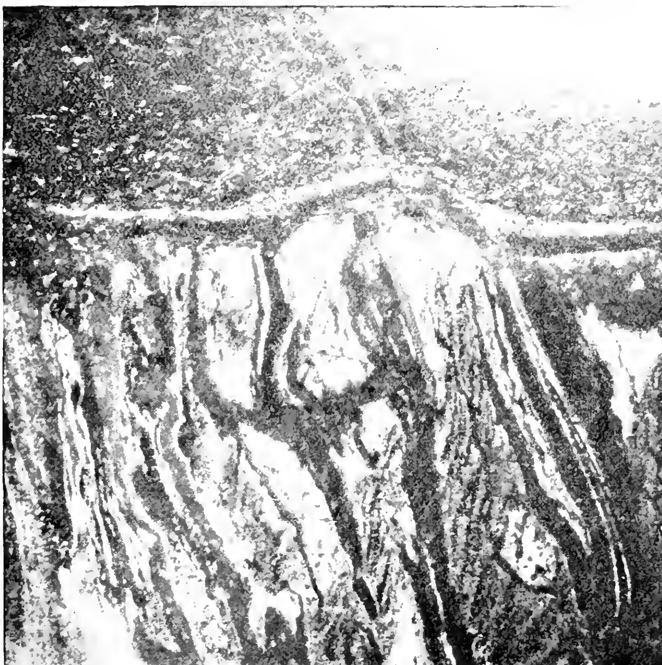

Photo and Process Block by Bemrose & Sons, Limited, Derby.

PLATE II.

MICROSCOPIC SECTION showing junction of Dioritic lamprophyre dyke, with indurated Silurian shale. The lamprophyre is at the top. Intermingling of igneous and sedimentary rock below. The hornblendic bands are the darkest. The lighter parts are sedimentary, traversed by short dark bands composed of biotite (X $4\frac{2}{3}$.)

other, and thirty yards further south, it was also traversed by a conspicuous greenish granite band about five feet wide. A microscopic section of the more southern basic dyke shows it to be a true basalt. Newer than the granite which it penetrates, it probably represents the Tertiary "Upper Basalts." The greenish granite is a handsome rock, with fairly large crystals of quartz and felspar, coarser in texture than the normal granite, but the difference microscopically is not very great.

The next slides show dykes on the sea coast, and in connection with these, I may refer to Major Patrickson's paper read before the Geological Society of Dublin in 1835, entitled, "A descriptive list of the dykes appearing on the shore which skirts the Mourne Mountains." His list includes 76 dykes. One of these, No. 48, he mentions as a porphyritic dyke, a quarter of a mile North of Mullartown, and describes Nos. 47 and 49 as hornblende dykes in parallel contact with it. These have been identified by Professor Cole with the now well known composite dyke at Glasdrumman Port, minutely described by him in a paper "On derived crystals in the Basaltic Andesite of Glasdrumman Port," * in which he shows that "crystals may be floated away into a pre-existing rock of a low degree of fusibility from one of a higher degree which has intruded into it." The igneous contact described by Professor Cole is illustrated by the next two lantern slides, from Mr. Welch's series of "Irish Geological Views." Hand specimens from this interesting dyke are on the table.

Passing on to Dunmore Head it may be of interest to note that this is one of the few localities in the British Islands where variolite has been found, and with specimens of the Dunmore variolite, there are others from Annalong, Anglesey, and Australia, the latter particularly interesting as being the first variolite discovered there. It was found in the bed of the Saltwater River, near Sydenham, upon an excursion, conducted

* Trans. Roy. Dublin Soc. Vol. V., Ser. II., Aug. 1894.

in April, 1902, by Dr. Gregory. For this specimen I am indebted to Mr. Chapman, Palæontologist of the National Museum, Melbourne.

The next slide shows the position of a large porphyrite (altered andesite) dyke, about a quarter of a mile south of Green Harbour, apparently No. 23 of Major Patrickson's list. In the main central part of the dyke there are very numerous and large crystals of labradorite, and in microscopic section, the schillerization of the labradorite, and the "strain shadows" have a very beautiful effect.

In the little creek, called "Goat's Cove," shown in the next slide, there is a small composite dyke I have not seen noted elsewhere. The quartz-porphyry in the centre has an average width of three feet, and is bounded on both sides by a basic dyke into which the acid rock has probably intruded. A few dark inclusions are found in the quartz-porphyry, which in microscopic section appear to be altered shale. The position of this creek is a little south of Bloody Bridge, almost immediately below the interesting old ruin of Ballaghanery church, popularly known as St. Mary's. Another composite dyke occurs at Dullisk Cove, just north of this creek.

The next two views show parts of a very interesting dyke on the sea coast, a little north of Bloody Bridge, in front of a low hill known as Rock-a-bill. It traverses Silurian strata in a north and south direction, and at the northern end, considerable patches of the Silurian beds are seen at the surface. The rock appeared at first sight to be a typical quartz-felsite, but microscopic examination of the first slide made, revealed certain characteristics of rhyolites, which indicate the intermediate position it holds between these well marked types. Dr. Cullis, to whom it was shown, described it as a "stony rhyolite approaching quartz-felsite." * Other microscopic sections show the base in various stages of devitrification. This dyke cuts

* Mr. H. J. Seymour asked for the loan of this microscopic section to exhibit before the Dublin Microscopical Club, and the details he then gave are published in "The Irish Naturalist," Sept., 1897, p. 248

through one of basalt, which may be seen in the bottom of a deep gully. Between this and Newcastle there are several basic dykes, one large one occurring just below the houses known as the "Widow's Row."

As the granite of the Mourne Mountains is now regarded as probably contemporaneous with the rhyolites of Co. Antrim, I have selected for the first two views in that county slides showing the rhyolite at the east and west ends of the quarry at Templepatrick Railway Station. It was here that Mr. M'Henry obtained the interesting evidence which led him to the conclusion that the rhyolite had intruded in the form of a laccolite into the Lower Basalt series, now regarded as of Eocene age, while further evidence obtained at Ballypalady and Glenarm, showed it to be older than the Upper Basalt sheets, or, so to speak, of mid-basaltic age.* It is interesting to note that, in this respect, these later observations bear out the view of Sir Richard Griffith, who in his address to the Geological Society of Dublin in 1836, placed the relative age of the "Sandy Brae Porphyry" between that of the "Lower" and "Upper tabular trap."

The chief localities in Co. Antrim for rhyolites, besides Templepatrick, are Tardree, Sandy Braes, and Ballymena. Specimens from these districts are on the table, for several of which I am indebted to Mr. Robert Bell, whose fine collections of fossils and rock specimens are well known.

The next lantern slide shows an exposure of beautifully banded rhyolite in a quarry between Tardree and Sandy Braes, and it will be followed by two slides showing a small protrusion of rhyolite at Cloughwater. "The whole mass," Professor Cole writes, "is so small, that it might possibly be a displaced portion of a lava-stream, as it stands we must regard it as representing a volcanic neck." †

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* "On the Age of the Trachytic Rocks of Antrim," by A. M'Henry, M.R.I.A. Geol. Mag., Dec. 4, Vol. 2, p. 260.

† The Rhyolites of the Co. of Antrim. By Grenville A. J. Cole, M.R.I.A., F.G.S. Sc. Trans. Roy. Dublin Soc., vol. VI., Ser. II., p. 112.

The second view of this rhyolite boss includes the moorland behind, and Slemish, the finest example in our district of a volcanic neck, in the extreme distance.

In connection with the dolerite of which Slemish is composed, I may mention that it was in this rock that my father, Dr. Andrews, by a magneto-chemical process, discovered native iron widely diffused in microscopic particles. The observation was unexpected, as except in meteorites, native iron is of very rare occurrence. Dr. Andrews detected it also in various basalts, in the indurated lias of Portrush, and in a trachyte from Auvergne, but the largest indications were obtained from the olivine dolerite of Slemish.

The next lantern slides show views of Kenbaan, one of the most striking headlands of our coast. The intrusion of basalt below the chalk anticline is of special interest in connection with the well known controversy between "Neptunists" and "Vulcanists" in regard to the origin of basalt and other igneous rocks.

My last slide is of Scrabo Hill, which although in Co. Down, is regarded as an outlier of the Antrim Basaltic Plateau. It affords very fine examples of sills and dykes, exposed in its large quarries of Triassic sandstone. The sandstone has been protected on the top by a capping of dolerite, and the lantern slide shows a typical section with intrussive sills, cut through by a vertical dyke of later age.

The economic importance of the igneous rocks of Antrim and Down is well known, and in regard to this it is sufficient to note the employment of Castlewellan granite in the Albert Memorial, Hyde Park, and to refer to the important inquiries, instituted by Mr. Wilkinson, into the qualities of the various kinds of stones used for building purposes in Ireland. The results of his experiments are given in his work, entitled, "Practical Geology, and Ancient Architecture of Ireland," published in 1845.

In addition to the ordinary tests, I wish to draw attention to the great value of microscopic sections in determining the qualities of building stones, and in this connection the following quotation from a letter just received from the eminent geologist Professor Judd, is of much interest. "Microscopic sections" Professor Judd writes, "are not infrequently employed to discriminate between the hardness and durability of different kinds of building materials, and of other rocks used for economic purposes.

There are two kinds of observations that can be made, 1st, as to the nature of the cement between the grains of a rock; 2nd, as to the amount of incipient decomposition the particles of a rock have undergone."

I have only now, in conclusion, to add—we are all justly proud of our coast scenery, do not let quarrying operations mar its beauty nor accelerate its erosion. On the other hand, geology may be largely aided by quarrying, and may we not hope that, especially in the inland rhyolite districts, further sections, as interesting as the classic section at Templepatrick, may yet be revealed.

Note on some Experiments on Irish Stone for Street Paving by H. Gullan.

Mr. H. Gullan, Superintendent of Works to the Corporation, referring to the use of Irish stone for street paving, informed the members present that the Works Department were about to lay down a series of lengths of sett paving in Corporation Street with stone from several Irish quarries, with a view of testing the quality of the various stone for the purpose of street paving. He also mentioned that a similar experiment was being carried out in connection with road metal in Upper Townsend Street.

These experiments, he pointed out, would be of great value in determining the relative qualities of the stones, and he also trusted would result in the further development of Irish quarries.

Professor Redfern moved, and Mr. R. Patterson, seconded, a vote of thanks to the lecturers, which was heartily passed.

3rd March, 1903.

Mr. J. Brown, F.R.S., President in the Chair

THE ARMADA WRECKS ON THE IRISH COAST.

By Rev. W. S. Green, M.A.

(*Abstract.*)

Rev. W. S. Green said that during the last dozen years a great deal of his life had been spent in the West Coast of Ireland. In the early part of that time he had to make a survey of the fishing grounds when Mr. Arthur Balfour was Chief Secretary for Ireland. It was natural that his interest should be awakened in the history of the past. There were a great many periods pressed on their attention when they were wandering round those places and had time to think, and there was no time more remarkable or striking when they tried to picture it than those days when the galleons of the great Spanish Armada were drifting ashore on all the bays of the West of Ireland.

At first it was difficult to get at any history on that point, but all the time he had been wandering in the West a good deal of publishing had been going on, publishing of the State papers not only British, but Spanish and Venetian, and all those documents had been made accessible by order of the Master of the Rolls. Anyone who took the trouble could find out in those pages the facts he would tell them, though a good deal of digging was required to get at the ore.

From days long before the dawn of history traffic appeared to have existed between the Iberian Peninsula and Ireland. It might have commenced when the Phœnician colonists were exploring the Western ocean. When history opened they found trade with Spain thoroughly established. Several incidents in the histories of Galway and of Waterford formed good illustrations of this, as Spanish ships bearing wine and other commodities were constantly coming, and taking back hides, tallow, and fish. The fishing banks of the Irish coast were annually visited by Spaniards, who had permanent establishments in the harbours and creeks. In the early days of Queen Elizabeth as many as 600 Spanish fishing vessels were reported on the Irish coast in a single year, and Spaniards had permanent curing establishments.

Turning from peace to war, they read of a great sea fight in the Harbour of Kinsale in the year 1380, when Spanish and French galleys were attacked and destroyed by English and Irish. Later on, when Europe was convulsed by the wars resulting from the Reformation and the breaking up of the great empire of Charles V., Ireland came in for her share of disturbance, but in those times Spanish experiences in Ireland were almost a series of terrible disasters. The first act of invasion was followed by the massacre at Fort Del Ore in 1580, in Smerwick Harbour, in Kerry.

This, however, paled into insignificance when compared with the loss of the ships of the great Armada, which took place eight years after. In Connaught alone Sir Richard Bingham reported between 6,000 and 7,000 men drowned, and that he had executed 1,100 wretches who had escaped from the sea, many of them being notable grandees of Spain. Besides these losses thousands were drowned or slain in Ulster, while others perished on the coast of Kerry.

Though they had read long ago in their story books that the English fleet which went to attack the Armada was a small fleet, and that the vessels were small, yet when they came to look up the State papers they found that the vessels were fairly matched, and at least in the battle fought at Calais the English fleet outnumbered the Spanish considerably. There were about 100 Spanish vessels engaged against 140 ordinary English ships, with 9,000 English sailors. The Spaniards had 7,000 seamen. The largest guns in those days were the 42-pounders, and the English had a great many more of those heavy guns in that fight. The Spaniards always wished to come into close quarters, but the English kept them at arm's length.

When the Spaniards were beaten they had to retreat round the North of Scotland and down the West of Ireland back to Spain, which the remainder of them reached starving, sick, and in a miserable plight.

The largest ship in the Armada was 1,300 tons, and carried about 40 guns. The largest English ship was about 1,100 tons, so that there was only about 100 tons difference in size. The poops of the Spanish vessels were very high; the English cut their ships lower, and had an advantage in sailing. The English ships had been greatly improved in rigging. They were able to sail within five points of the wind; the Spanish ships could only sail within six points of the wind. There was about one point of difference, and it made all the difference in the world. It enabled the English ships to keep the Spaniards to leeward. The reason why the English ships sailed closer to the wind was described in a book by Sir Walter Raleigh. The Spanish and English vessels carried big sails, and the English adopted bowlines, which were a great invention of that day, and enabled the English to sail round the Spaniards.

Some of the Spanish vessels, the lecturer pointed out, were propelled by three hundred rowers each, the idea being that they should be able to attack when they liked, and in the calm weather that no vessel could stand an attack from them. Unfortunately there was very little calm weather. The galleys, with hundreds of slaves chained to the oars, were always worsted.

The lecturer then gave an account of the battle and the retreat of the Spaniards up the North Sea and down the West Coast of Scotland and Ireland. Out of 131 vessels only 65 returned. Large numbers of the vessels perished on the Irish coasts. He gave a resumé of what had been learned of the adventures of the following vessels, illustrating his discourse by old maps, charts, and photographs, for the most part taken by himself, on the Irish coast :—The Gerona, lost at the mouth of the River Bush, in Antrim ; the Valencera, in Glenagivney Bay ; the Duquesa Santa Ana, in Loughrosmore ; the Juliana and La Via, also in Donegal ; the San Juan de Sicilia, on the Sligo coast ; the Rata Encoronada, in Blacksod Bay ; El Gran Grin, on Clare Island ; the Falco Blanco Mediano, in Connemara ; and Nuestra Senora de la Rosa, in the Blasket Sound, County Kerry. The lecturer devoted special attention to the story of the Rata and to the adventures of Captain Cuellar, whose letter, recently translated from the Spanish, has proved so interesting to Irish readers.

So far as the literature of the subject was concerned, he referred specially to Mr. Froude, Professor Lawton, Major Hume, Mr. Allingham, and to the British, Spanish, and Venetian State papers. In relating Captain Cuellar's adventures after his miraculous escape from drowning in the wreck of the Spanish galleon on which he sailed, he told the story of his wanderings through the country. He made himself very agreeable to the people, and stopped for some time with a certain M'Clancy. One day when sitting in the sun M'Clancy's wife asked him to tell her fortune. He stated that he manufactured ten thousand falsehoods, which pleased her so much that all the country round were coming to him, and a special guard had to be appointed to protect him from these people. M'Clancy was so delighted with him that he insisted upon him marrying his sister, but that was too much for the Spanish grandee, and he asked to be shown the shortest way to Donegal. Eventually he managed to get to Scotland and round home.

The lecturer, having referred to some relics of the Armada, hoped in conclusion that he had been able to give them some points that would make the reading of that very interesting time in Irish history a little bit more interesting.

Professor Boas moved a vote of thanks to the lecturer. He said that the admirable address to which they had listened that evening was a most interesting exhibition of what he might call the new historical method. The older school of historians had been content to base their narratives on the literary records of the past. But the newer school, while not neglecting these, drew upon two additional sources of information. Firstly they went to the State papers, and other first-hand documents. It was plain from his lecture that Mr. Green had made abundant use of these—not only of the English State papers bearing on the Elizabethan period, but of those belonging to foreign countries. Secondly, the new school of historians, headed in this respect by J. R. Green, called topography into their service, and were not content without surveying, as far as possible, the actual localities of the events which they described. The value of this method had been illustrated in the clearest possible way by the lecture that evening. Mr. Spotswood Green had gone carefully over all the localities associated with the wrecks of the Armada, and had used his camera to the best advantage. He had thus been able to fill in with vivid detail the narrative of events which they all knew in outline, and no one could come away from the lecture without a heightened historical sense, and a fuller grasp than before of the tragic story of the Armada.

Professor Fitzgerald seconded the motion, which was heartily carried, conveyed by the President, and suitably acknowledged by the reader of the paper.

Note on some Effects of the Cyclone of February, 27th, by R. Welch.

Photographs illustrating the effects of the cyclone of February 27th, at the Eastern intake at Limavady Junction were shown by Mr. R. Welch. The intake was flooded to the depth of eight feet in some places as the result of the embankment giving way, the railway line being submerged also three feet at each high tide.

7th April, 1903.

MR. J. BROWN, F.R.S., President in the Chair.

A LOST PRINCIPLE IN ART.

BY GEORGE COFFEY, M.A., M.R.I.A.

(*Abstract.*)

MR. GEORGE COFFEY said the actual subject of the lecture was really certain requirements, optical and artistic, which were practised by old artists, and which had actually perished out of art. Those discoveries, the great majority of them, were chiefly due to Mr Goodyear, curator of Brooklyn Fine Art Institution, who had made a tour in the North of Italy examining mediæval architecture, and he reported certain refinements. He had met Mr. Goodyear in England, and was in the position of being able to show them that evening a number of views of those buildings, many of which would be seen on this side of the Atlantic for the first time.

English architects had pooh-poohed those discoveries, but he was glad to say, because he believed in those theories, that on the Continent those views were rapidly extending, and in America they were being put into practical operation, so that he had no doubt that in a very short time they would have extended to this side of the water. They knew the ordinary Greek temple. Taking the Parthenon, it had been supposed that the columns were perpendicular, that lines which appeared horizontal were horizontal, and that it was laid out mathematically correct, and it had been assumed that the intervals between the columns were equal. Mr. Penrose, who died a few years ago, discovered that it was filled with the most wonderful refinements. The columns, which appeared to be erect, leaned in slightly. The platform on which the temple was built, instead of being flat, was delicately curved. A delicate rhythm was given through the whole of the spacing of the columns. There were a number of other refinements. A sense of touch was given to the whole building, and every line of it was considered with a view to its effect.

The curves were first discovered by an Englishman named Pennythorn, and the general idea was that the curved line was to give a greater appearance of strength. Since Penrose's time it had been discovered that every Greek temple had its refinements, and Goodyear's discoveries went to show that not only did Egyptians and Greeks employ those refinements, but that they passed on to Roman and came down to mediæval times. The principle was called assymmetry, and he thought they would find that the principle of symmetry was death and the principle of assymmetry life.

Repetition was part of a tendency in the world towards uniformity, and there could be no manifestation of power except there was difference, and unless there was something vital and human in art there could be not relation between art and them. In those commercial days, when they turned out prints mechanically, commercial men had actually found it necessary to devise machines with eccentricities to try and imitate the life that was not in them.

In conclusion, he wanted to say let them not imagine this was an artistic age. They had for the present done with art. It died about 1600. But let them not imagine that by crowding their rooms by a whole lot of manufactured art that they were adding to the pleasure of life. Let them have plain and comfortable rooms, and let them purchase at least if they could one work of art.

The Chairman thought that, except in a few cases, they could not call the architecture of Belfast art. It was rather of the nature of a hereditary utilitarianism.

Sir Otto Jaffe moved a vote of thanks to the lecturer, and believed if they should have the good fortune to visit any of the places touched upon they would be able to recall the instruction they had received that night with particular pleasure.

Mr. Gray said that variety was an element of beauty in architecture, as it was in nature. In his opinion the departures from perpendicular, horizontal, and straight lines detected in the ruins of ancient Grecian and other buildings, were the result of pressure, heat, and natural decay, and not to the intentional design of the architect. Symmetry and not assymmetry seem to have been the rule with the Greeks.

Mr. W. J. Fennell offered his tribute of thanks to the lecturer for his valuable paper. He took exception to the praise bestowed on the irregular designs of Pisa, and considered the attempt of its builders to enhance the perspective defeated its object, and compared its "crossing" and heavy looking dome to that of Ely, considered that the latter was immeasurably superior, and without laboured attempts at perspective. He also considered that the irregular arcading of Pisa had not the same good effect as the more regular design of Gloucester. That the art was not altogether "lost" he instanced that the modern classic columns always bore evidence of the "swelling" required for the perfect harmony that the eye demanded.

Mr. R. May said that it was a well known rule and principle in all good carving shops in the executing of freize ornament or good panels, where it was desired that the ground should appear flat, a fulness of over a sixteenth of an inch to the foot was left in the centre, where, had the ground been finished quite flat, a weak or hollow appearance is the result. This principle must have been handed down from very early times.

Mr. R. A. Dawson desired to add a word of thanks to the lecturer for coming amongst them, and pointing out the various refinements in architecture which were so easily neglected. With the lecturer he believed in the unity of the arts, and that all the arts clustered round architecture. He was glad that this was being more and more recognised in our schools of art. In their own school at Belfast they had special classes for architecture, and in order to get this unity in art work architectural students were encouraged to study other branches of work, and students in other classes were encouraged to study architecture, so as to see its bearing on their own special craft. No doubt we lived in a mechanical and material age, tending to a loss of refinement, and the stamping out of humanity and life in art. What we wanted nowadays to bring back the refinement mentioned by Mr. Coffey, was more recognition of the human element in art work, as against the merely mechanical; more hand work as against machine work; more work in situ as opposed to that worked out entirely in the studio or office, and more craftsmen who were also designers, and not mechanical copyists of designs by other men, with which they had no sympathy. He had pleasure in supporting the vote of thanks.

The motion was heartily passed, and the lecturer, in replying, said he had only been able to touch the fringe of the subject, and he referred those who would like to study the subject to the Brooklyn Institute of Fine Arts' memoirs on the subject, which they would probably find in the library.

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Macassey, Lyndon, C.E., B.A., LL.B.,	London
Malone, John, Brookvale House, Cliftonville,	Belfast
Morrow, W. A. G., Clifton Street,	do.
M'Laughlin, W. H., Macedon,	do.
Parr, William, St. Marks, Ballysillan,	do.
Redfern, Prof. Peter, M.D., F.R.C.S.I., Lower Crescent,	do.
Pullman, S. H., Claremont, Knock,	do.
Scott, Conway, C.E., Annaville, Windsor Avenue,	do.
Storrar, W. Morrison, L.R.C.P., Mountcharles,	do.
Swiney, J. H. H., B.A., B.E., Bella Vista, Antrim Road,	do.
Tate, Alexander, C.E., Rantalard, Whitehouse,	do.
Thompson, John, J.P., Mount Collyer,	do.
Turpin, James, Waring Street,	do.

Report and Proceedings

OF THE

BELFAST

NATURAL HISTORY & PHILOSOPHICAL SOCIETY

FOR THE

SESSION 1903-1904.

BELFAST:
PRINTED BY ALEX. MAYNE & BOYD, 2 CORPORATION STREET.
(PRINTERS TO QUEEN'S COLLEGE.)

1904.

CONTENTS.

Belfast Natural History and Philosophical Society.

ESTABLISHED 1821.

CONSTITUTION.

The membership of the Society consists of Shareholders in the Museum, Annual Subscribers (Associates), Honorary Members and Honorary Associates.

Shares in the Museum cost £7 each. A holder of one Share pays an annual contribution of ten shillings; a holder of two Shares (in one certificate) an annual contribution of five shillings; while a holder of three or more Shares (in one certificate) is exempt from annual payments. Shares on which the annual payments as above are in arrear are liable to forfeiture. The Council retain the right to decline to consolidate two or more share certificates into one certificate.

Annual Subscribers (Associates) pay £1 1s. (one guinea) due 1st November in each year in advance.

A General Meeting of Shareholders in the Museum is held annually in May or June, or as soon thereafter as convenient, to receive the Report of the Council and the Statements of Accounts for the preceding year, to elect members of Council to replace those retiring by rotation or from other reasons, and to transact any other business incidental to an annual meeting. Shareholders only are eligible for election on the Council.

The Council elect, from among their own number, a President and other officers of the Society.

Each Member has the right of personal attendance at the ordinary lectures of the Society, and has the privilege of introducing two friends for admission to such; and he has also the right of access to the Museum and Library for himself and family residing under his roof, with the privilege of granting admission orders for inspecting the collections in the Museum to any person not residing in Belfast or within five miles thereof. The session for lectures extends from November till May.

The Museum, College Square North, is open daily for the admission of visitors, for such hours as the Council may from time to time decide; the charge for admission to non-members is sixpence each. The Curator is in constant attendance, and will take charge of any donation kindly presented to the Museum or Library.

Any further information required may be obtained from the Honorary Secretary.

Belfast Natural History and Philosophical Society.

ANNUAL REPORT, 1903-4.

The Annual Meeting of the Shareholders was held on 20th June, 1904, in the Museum, College Square North. Professor Symington, M.D., F.R.S., F.R.S.E., President, occupied the chair, and amongst those present were—Rev. Dr. Hamilton (President Queen's College); Dr. John MacCormac; Messrs. John Ward, J.P., F.S.A.; Geo. Kidd, J.P.; R. M. Young, J.P. (Hon. Secretary); John Horner, J.P.; J. H. M'Ilwaine, John Carson, Robert Patterson, M.R.I.A.; W. Gray, M.R.I.A.; W. H. F. Patterson, R. A. Kyle, W. Swanston, F.G.S.; J. E. Magill, and H. C. Montgomery.

The Hon. Secretary, Mr. Robert M. Young, M.R.I.A., J.P., read the Annual Report, which was as follows:—

The Winter Session was opened in the Museum on the 3rd November, 1903, when the President, Professor Johnson Symington, M.D., F.R.S., gave an inaugural address, subject, "John Grattan: an Appreciation of his Scientific Work," with illustrations. The second meeting was held on the 1st December, when Professor J. W. Byers, M.A., M.D., delivered a lecture, subject, "Sayings, Proverbs, and Humour of Ulster." The third meeting took place on the 28th of January, 1904, when Mr. John M. Finnegan, B.A., B.Sc., gave a lecture on "Radium," illustrated by experiments, &c. The fourth meeting was held on 17th February, when a lecture was kindly given by Mr. R. Lloyd Praeger, B.A., B.E., M.R.I.A., subject, "A Historic Trial: the Limavady Gold Ornaments Case." Fac-similes of the gold objects were exhibited. Mr. W. Swanston, F.G.S., Vice-President, occupied the chair in the unavoidable absence of the President. The fifth meeting took place on the 22nd March, when Mr. Seaton F. Milligan, M.R.I.A., delivered a lecture, subject, "Around Youghal and the Blackwater with the Royal Society of Antiquaries," illustrated with a special series of lantern views. The closing meeting was held on 26th April, when two papers were read—1. "The National Expenditure on the Maintenance of Gulls," by Mr. John Brown, F.R.S. 2. "Blinking or Ill-wishing," by Mr. John M'Kean, B.A. (Oxon.). Professor Gregg Wilson, D.Sc., then gave an account of the work done as our delegate of the allied societies at the last British Association meeting.

The attendance of members and of the general public at all these meetings was good. The various societies holding their meetings in the Museum continue to do so, and the Ulster Amateur Photographic Society have taken over the rooms on ground floor formerly occupied by the Naturalists' Field Club.

At the Easter holidays the Museum was opened as usual at a nominal charge and the attendance was fully as numerous as in recent years.

On the occasion of the Royal Visit to Belfast in last July your Council prepared a loyal address, which was presented to their Majesties, King Edward VII. and Queen Alexandra, by Sir R. Lloyd Patterson, D.L., and the Honorary Secretary, on behalf of the Society, and was graciously acknowledged.*

Since the last Annual Meeting the Society has to deplore the loss of several of its oldest members. Sir James Musgrave, Bart., was a warm friend of the Society and his time and purse were always at its disposal when required. Messrs. D. B. Lytle and Walter H. Wilson also took a lively interest in its welfare. Dr. John Purser, a former president and for many years on the Council, will also be much regretted, as until his removal to

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* The text of this address is appended below.

Dublin he took much interest in the work of the Society. Mr. James O'Neill, M.A., and Mr. H. H. Bottomley, who passed away during the year, were both valued members of long standing, while Mr. Davys Bowman had more recently joined the Society. The death of Mrs. Bryce, in August last, severed another link with the past history of the Society, as her husband, Dr. James Bryce, was one of the early members and a former secretary. His portrait was presented by his widow to the Museum some years ago.

Your Council were much gratified to know that your Curator's scientific researches have received well-merited recognition from the Linnean Society of London, of which he has been elected an Associate. Advantage was taken of the occasion by some members of your Society and of the Belfast Naturalists' Field Club to present Mr. Stewart with a testimonial at the last meeting on 26th April.

During the year a good number of plants have been mounted for the local herbarium. Many of these are to replace unsatisfactory specimens already in the collection, but many are of the rarer Irish species, including the set recently presented by Mr. R. Lloyd Praeger. These were collected lately in Antrim and Down, and are additions to the lists of those counties. Some progress has been made in remounting and labelling the large collection of foreign mollusca and echinodermata, and a considerable amount of time has been occupied in replacing the labels in the different rooms of the Museum.

Amongst the donations to the Society of special interest are two fragments of papyrus from Oxyrhynchus presented by the Egyptian Exploration Fund, through the good offices of Mr. John Ward, J.P.

In accordance with the constitution of the Society, five members of Council now retire from office, four of whom are eligible for re-election.

Mr. W. H. F. Patterson, Honorary Treasurer, submitted the financial statement, which showed that the accounts for the year ending 30th April, 1904, had been closed with a balance on hand of £15 3s. 3d.

Mr. John Ward, in moving the adoption of the Report and Statement of Accounts, said that on his recent visit to Egypt he was requested by Professor Maspero to obtain photographs of any existing portraits of the late Dr. Edward Hincks, the great Egyptologist, in order that a distinguished sculptor might be employed to make a bronze bust which would be erected along with those of Mariette and Champollion in the Museum at Cairo. Professor Maspero said that as Hincks was one of the pioneers of the knowledge of Egyptology he considered it right that his bust should be enshrined in the greatest Egyptian museum in the world. As Dr. Hincks was one of the founders of that Society, and as their Museum was full of his works, especially the translation of the inscriptions upon the Egyptian mummy, he (Mr. Ward) thought this information must be very interesting to his admirers in his native town.

The President of Queen's College, who seconded, said it seemed to him it was very important that Belfast should have a society like that, for it provided for men who were engaged in different pursuits in natural history, philosophy, and other departments of science, an excellent medium for the promulgation and discussion of their views. The Society had now been in existence for a great many years, and had had connected with it not a few distinguished men. The reports laid before them that day show that, although it was getting older it was still bringing forth fruit in its old age. Indeed the proceedings of last session could scarcely have been other than successful. On the bridge of the vessel they had a most excellent commander in Professor Symington, and in the Secretary they had a most experienced and capable man at the wheel. They all lamented that day that they had lost by death so many old and respected members. Their removal had been referred to from time to time at the winter meetings; but he thought they ought again that day to pay another passing tribute to their memory. They would not see their familiar faces again, but he could not help expressing the hope that their places would be supplied by others able and willing to do something for the advancement of science. The financial position of the Society seemed to be fairly satisfactory, although the balance was rather less than last year. He was perfectly certain they were all delighted at the mention in the Report of their old friend Mr. S. Stewart, a man whose modesty prevented him from being as well known as he deserved to be. In his knowledge of botany he was unsurpassed by anyone in the North of Ireland. Indeed, he was entitled to be classed among the most eminent botanists in the United Kingdom. He happened to know that in a few days there would be made known another well-deserved honour which was to be bestowed on Mr. Stewart, but of that he was not at present at liberty to say more. He was sure they would all congratulate their old and esteemed friend on the well-deserved distinction he had achieved during the past winter, and they sincerely hoped he might long be spared to help forward the work of the Society and of the Museum.

The motion was carried.

The Secretary then said there were five vacancies on the Council of Management, and the following gentlemen, who were retiring members, were eligible for re-election:—Sir R. L. Patterson; Messrs. J. H. Davies, John Horner, and R. Young. The other vacancy was caused by the retirement of Mr. Joseph Wright, who did not seek re-election, and in his place the Council had nominated Professor Morton, who had been a very warm friend of the Society, and had given one or two lectures, which were much appreciated.

On the motion of Mr. Gray, seconded by Mr. George Kidd, these gentlemen were unanimously elected.

The Secretary said since the last meeting the Society had received gifts as follow:—From Mr. Robert Bell, a specimen of the rare mineral dopplerite, recently discovered by the donor at Randalstown; a large fossil nautilus from the lias at Waterloo, near Larne; and a very fossiliferous block of lias limestone from the same place. From Mr. R. Lloyd Praeger, M.R.I.A., a number of the rare plants recently found by the donor, mainly in Down and Antrim. From Mr. T. S. Hall, M.A., Melbourne University, a number of Australian marine shells. From Mr. J. R. Bristow, a number of geological specimens.

Mr. W. Gray, in proposing a vote of thanks to these gentlemen, said the principal gifts to the Society in former times had come from intelligent citizens who had travelled abroad, and he was glad that the practice still survived, as was evidenced by the travels of their old friend, Mr. John Ward, who had been in Egypt, where he had done good work. Mr. Ward had remembered the Society in his travels, and had been the means of obtaining very valuable contributions, for which they were much obliged.

Mr. J. H. M'Ilwaine seconded, and said if it were better known that such donations were acceptable they might get more of them. He would undertake to give a tomtit's nest built in an elm tree, which, judging from the marks, had been there for twelve years.

The motion was agreed to.

Dr. MacCormac next moved a vote of thanks to the Chairman, who, he said, had done much in the cause of science, and was an honour to the Society. He need not attempt to give expression to any feelings of his own concerning Professor Symington's merits, as they were known to all of them, and he would therefore content himself by moving a hearty vote of thanks to him for the manner in which he had discharged his duties during the year.

The motion, seconded by Mr. John Horner, was carried with acclamation, and, in responding,

The President said he did not propose to detain them at any length by reviewing the present condition or the future prospects of the Society. He thought their presence there was an evidence that it was doing a good and useful work, and was worthy of their support. It behoved all of them, however, to endeavour to secure for the Society a greater amount of support than it had yet received. Practically that was the only Society of the kind which they had in Belfast, and it certainly ought to receive from the inhabitants of the city a very much larger measure of assistance. There were various duties devolving on the Society, such, for instance, as the maintenance of the Museum and the diffusion of general information with regard to scientific progress. No one could be at all familiar with the character of museums in other towns without feeling that they really required, not exactly to put their house in order—a considerable part of it was already in order—but undoubtedly they still wanted more means to further improve the character of the Museum. That institution must form a very interesting record of the conditions of nature and the social state of the people in future times. It would undoubtedly some day or other form the nucleus of a very large and important museum, and if the specimens there were not taken proper care of their loss would be irreparable. It would be quite impossible to replace many of the existing specimens. He would like to direct their attention to the fact that the Museum was threatened with some damage owing to the erection of the municipal building on the opposite side of the road. They all recognised the importance of that institution, and wished it all success, but they trusted that they would receive some compensation from the city for any injury that the Museum might suffer by its construction. Another matter he might refer to was the noise caused by passing vehicles on the street. He thought that if wood pavement were laid down it would do a great deal to do away with the present cause of complaint. Personally he could only thank them for the honour they had done him in electing him as their President, and for the support they had given to him during his term of office.

At a subsequent meeting of the Council Mr. W. H. F. Patterson resigned his office as Hon Treasurer, and Mr. John Horner, J.P. was appointed to succeed him. Professor Symington, M.D., F.R.S., F.R.S.E., was re-elected President, and the following Vice-Presidents were also chosen for another term :—Rev. Dr. Hamilton, M.A., D.D., LL.D. (President of Queen's College), Sir R. L. Patterson, D.L., J.P., F.L.S., Mr. W. Swanston, F.G.S., and Mr. Robert M. Young, J.P., C.E. For the position of Hon. Librarian, Mr. J. H. Davies was selected, and for Hon. Secretary Mr. R. M. Young, B.A., J.P., M.R.I.A.

To their Most Gracious Majesties Edward VII., by the grace of God of the United Kingdom of Great Britain and Ireland, King, and Queen Alexandra.

May it please your Majesties—In the name and on behalf of the Belfast Natural History and Philosophical Society, we, the members of Council, desire to express the pleasure and satisfaction we so cordially feel at your Majesties' visit to Ulster, and to offer our most respectful and sincere welcome to the city of Belfast. We fully recognise the importance of your Majesties' Royal progress through Ireland, and entertain the most sincere conviction that it will be productive of much permanent good to our country. Our Society was formed in 1821 for the cultivation of geology, botany, and mineralogy in all their branches, more especially the investigation of the natural history and antiquities of Ireland. In later years our efforts have been more especially directed to the advance of science and the spread of knowledge among the people. We cannot but feel encouraged to greater zeal by observing the practical interest your Majesties take in the social and intellectual improvement of your subjects, and the encouragement your Majesties accord to the progress of scientific research at home and abroad. In conclusion, we would again assure your Majesties of our devotion to your Majesties and to all the members of the Royal family. Wishing your Majesties long life and every prosperity, we have the honour to remain your Majesties' most humble, loyal, and devoted servants.

(Signed on behalf of the Belfast Natural History and Philosophical Society.)

JOHNSON SYMINGTON, President.
ROBERT M. YOUNG, Secretary.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT. 1885, 48 & 49 Vict. ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended 30th April 1904.

Dr. **Cr.**

CHARGE.

	£	s.	d.	£	s.	d.
To Balance as per last Account				£58	13	0
,, Amounts received during the period in respect of Donations, Bequests, or other Endowments				2	12	6
,, Subscriptions				107	7	0
,, Dividends				17	2	0
,, Rents				26	16	6
,, Fees				0	1	6
,, Realized by Sales				0	1	6
,, Miscellaneous Receipts, viz.;—						
Cash refunded	£0	1	6			
Admission Fees during year	23	0	0			
,, ,, at Easter	19	13	2			
				42	14	8
Total				255	8	8

DISCHARGE.

	£	s.	d.	£	s.	d.
By Amounts of Payments under the following headings:—						
Maintenance of Premises, &c	£19	6	10			
Rent and Taxes, &c.	28	3	10			
Salaries	109	7	10			
Advertising	5	12	5			
Postage and Carriage	4	7	10			
Fuel and Gas	16	2	2			
Printing and Stationery	5	2	2			
				188	3	1
Other Payments, viz.:—						
British Association Committee—Refund ...	4	9	8			
Commission on Cheques	0	0	9			
S. A. Stewart—Donation	5	0	0			
J. Vinycomb, for address to King	2	12	6			
Typewriter ,, ,, ...	0	2	6			
Insurance—£2 12s. 6d.; £1 19s. 9d.; £1 19s. 9d.	6	12	0			
Stamping Two Agreements	0	3	0			
Cheque Book	0	4	2			
Mayne & Boyd—Printing Report	17	18	2			
W. & G. Baird—for Blocks	1	18	9			
Lizars—for Lanterns	0	14	0			
Mayne & Boyd—Printing Guide	6	10	0			
Subscription—*Irish Naturalist*	1	1	0			
Expenses at Easter	4	15	10			
				52	2	4
Total Payment				240	5	5
,, Balance in favour of this Account as on the 30th April, 1904				15	3	3
Total				£255	8	8

N.B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., 4½ per cent, Debenture Stock

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.

W. H. FERRAR PATTERSON, Accounting Officer.

Dated this 14th day of May, 1904.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

2nd day of June, 1904.

DONATIONS TO THE MUSEUM, 1903-1904.

From Mr. R. Lloyd Praeger, M.R I.A.

A number of rare plants found in the North of Ireland.

From The Egyptian Exploration Fund.

Second Century Document, and Homeric Fragment ; also carving in limestone, and various specimens from the recent excavations at Abydos, Egypt.

From Mr. J. R. Bristow.

Vegetable Ivory, and Geological specimens.

From Mr. Henry Craig.

Specimen of *Sphinx convolvuli* captured in a house in Belfast.

From Mr. Lionel L. Fletcher, Caterham, Surrey.

Plaster-cast of an Irish token, the "Belfast Ticket," in the possession of Mr. L. L. Fletcher.

From Mr. Robert Welch.

A number of the rarer recent Irish shells.

From Mr. Robert Patterson, M.R.I.A.

Contents of a Pellet, cast up by a Herring Gull.

From Lord Shaftesbury.

Ancient Leaden Trunkhead of a Spout, from John M'Cracken's Cotton Mill, Donegall Street.

From Mr. Robert Bell.

Specimen of the mineral *Dopplerite*, from Sluggan Bog, near Randalstown. Specimen of a fossil *Nautilus*, from the Lias, at Larne, also a fossiliferous block of Lias Limestone from Carr's Glen, Belfast.

ADDITIONS TO THE LIBRARY, 1st May, 1903, till 1st May, 1904.

Adelaide.—Transactions of the Royal Society of South Australia. Vol. 27, parts 1 and 2, 1903.
From the Society.

Albany.—Fifty-fourth Annual Report of the New York State Museum. Vols. 1—4, 1900, and 55th Annual Report, 1901; also Index to Publications, 1903.
The Director.

Austin.—Transactions of Texas Academy Science. Vol. 3, 1900, and vol. 4, part 1, Nos. 1—8, 1900-1901.
The Academy.

Basel.—Verhandlungen der Naturforschenden Gesellschaft in Basel. Vol. 15, part 2, 1904. *The Society.*

Belfast.—Report and Proceedings of the Belfast Naturalists' Field Club. Ser. 2, vol. 5, parts 1 and 2, 1904.
The Club.

Berkeley.—University of California Publications. Vol. 1, part 1, 1902. *The University.*

Bergen.—Bergens Museum Aarsberetning for 1902, and Aarbog for 1903, parts 1—3, 1903-1904; also Crustacea of Norway. Vol. 5, parts 1 and 2, 1903.
The Museum Director.

Birmingham.—Records of Meteorological Observations for 1902 and 1903, by A. Cresswell, Curator of the Observatory. *Birmingham Institute.*

Boston.—Memoirs of the Boston Society of Natural History. Vol. 5, No. 8, 1902, and No. 9, 1903. Proceedings, vol, 3, Nos. 3 and 7, 1902, and No. 1, 1903,
The Society.

BOULDER.—University of Colorado College Studies. Vol. 1, Nos. 3 and 4, 1903. *The University.*

BREMEN.—Abhandlungen herausgegeben vom Naturwissenschaftlichen Verein zu Bremen. Vol. 17, part 3, 1903. *The Society.*

BRESLAU.—Zeitschrift für Entomologie vom Verein für Sclessiche Insektenkunde zu Breslau. New series, part 28, 1903. *The Society.*

BRIGHTON.—Report of Brighton and Hove Natural History and Philosophical Society, 1903. *The Society.*

BROOKLYN.—Science Bulletin of the Brooklyn Institute of Arts and Sciences, No. 2, 1902, and Monographs, 1 and 2, 1903. *The Institute.*

BRUSSELS.—Annales de la Société Royale Malacologique de Belgique. Vol. 37, 1902. *The Society.*

,, Annales de la Société Entomologique de Belgique. Vol. 46, 1902. *The Society.*

BUENOS AYRES.—Anales del Museo Nacional de Buenos Aires. Ser. 3, vol. 1, parts 1 and 2, 1902. *The Director.*

BUFFALO.—Bulletin of Buffalo Society of Natural Sciences. Vol. 8, Nos. 1—3, 1903. *The Society.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 34, part 3, and vol. 35, part 2, also General Report and Index, 1903. Palæontologia Indica, ser. 9, vol. 3, part 2, No. 1, and ser. 15, vol. 1, part 5, 1903. *The Director of the Survey.*

CAMBRIDGE.—Proceedings of the Cambridge Philosophical Society. Vol. 12, part 3, 1903, and parts 4 and 5, 1904; also List of Fellows, 1903. *The Society.*

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Anatomy. Vol. 39, Nos. 6—8, 1903; vol. 40, Nos. 6—7, 1903; vol. 41, No. 2, 1904; vol. 42, Nos. 1—4, 1903, and No. 5, 1904; vol. 43, No. 1, 1904, and vol. 45, No. 1, 1904; also Annual Report, 1903. *The Keeper of the Museum.*

CARDIFF.—Transactions of Cardiff Naturalists' Society. Vol. 34, 1902, and vol. 35, 1903. *The Society.*

CASSEL.—Abhandlungen und Bericht der Vereins für Naturkunde zu Kassel. Vol. 48, 1903. *The Society.*

CHRISTIANIA.—Forhandlinger i Videnskabs Selskabet i Christiania, 1902.
The Royal Norske Frederiks University.

CINCINNATI.—Bulletin of the Lloyd Library, No. 6, 1903; also Mycological Notes, Nos. 10—12, 1902, and Nos. 13 and 14, 1903. *The Messrs. Lloyd.*

COLORADO SPRINGS.—Colorado College Studies, 1903.
Colorado College Scientific Society.

DUBLIN.—Scientific Transactions of the Royal Dublin Society. Ser. 2, vol. 8, Nos. 2—4, 1903. Scientific Proceedings. New Series, vol. 10, part 1, and Economic Proceedings. Vol. 1, part 4, 1903.
The Society.

EDINBURGH.—Proceedings of the Royal Society of Edinburgh. Vol. 22, 1889-1901. *The Society.*

,, Proceedings of the Royal Physical Society. Session 1901 1902. *The Society.*

EMDEN.—Jahresbericht der Naturforschenden Gesellschaft in Emden, 1903. *The Society.*

GENOA.—Rivista Ligure di Scienze, Littera ed Arti. Anno 25, fasc. 2—6, 1903, and Anno 26, fasc. 1, 1904.
Societa Letture e Conversazione Scientifiche.

GLASGOW.—Proceedings of the Royal Philosophical Society of Glasgow. Vol. 34, 1903. *The Society.*

GOTHENBURG.—Goteborg's Kungl Vetenskaps Och Vitterhets Samhalles Handlingar. Parts 5 and 6, 1898.
The Society.

HALIFAX.—Proceedings and Transactions of the Nova Scotian Institute of Science. Vol. 10, parts 3, 1902, and 4, 1903. *The Institute.*

HAMBURG.—Abhandlungen aus dem Gebiete der Naturwissenschaften herausgegeben vom Naturwissenshaftlichen Verein in Hamburg. Vol. 18, 1903; also Verhandlungen, 1903-04. *The Society.*

IGLO.—Jahrbuch des Ungarischen-Karpathen Vereines, 30th year, 1903. *The Society.*

INDIANOPOLIS.—Proceedings of the Indiana Academy of Science, 1901. *The Academy.*

KHARKOW.—Proceedings of the Society of Physico-Chimiques of Kharkow University. Nos. 25—31, 1901-1903. *The Society.*

LAUSANNE.—Bulletin de la Société Vaudoise des Sciences Naturelles. Ser. 4, vol. 39, Nos. 146—148, 1903. *The Society.*

LAWRENCE.—Bulletin of the University of Kansas. Vol. 3, Nos. 6—8, 1901-02. *The University.*

LEICESTER.—Thirteenth Report of Leicester Museum and Art Gallery, 1902. *The Director.*

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig, 1902; also Wissenschaftliche Veroffentlichungen. Vol. 6, 1904. *The Society.*

LIMA.—Boletin del Cuerpo de Ingenieros de Minas del Peru, No. 2, 1902, and Nos. 3 and 4, 1903. *The Director.*

LONDON.—Report of the British Association Seventy Second Meeting, Belfast, 1902. *The Association.*

,, Quarterly Journal of the Geological Society of London. Vol. 59, Nos. 2—4, 1903, and vol. 60, No. 1, 1904; also List of Fellows, 1903 *The Society.*

,, Journal of the Royal Microscopical Society. Parts 3—6, 1903, and parts 1 and 2, 1904. *The Society.*

,, Transactions of the Zoological Society of London. Vol. 16, part 8, and vol. 17, parts 1 and 2, 1903. Proceedings for 1902, vol. 2, part 2, and vols. 1 and 2, 1903; also List of Fellows, 1903. *The Society.*

MADISON,—Bulletin of Wisconsin Geological and Natural History Survey. Economic Series, Nos. 5 and 6, 1903, and Educational Series, No. 2, 1902.
The Director.

MADRAS.—Bulletin of Madras Government Museum. Vol. 4, No. 3, 1903, and Administration Report for year, 1902-1903. *The Superintendent.*

MANCHESTER.—Journal of the Manchester Geographical Society. Vol. 18, Nos. 4—12, 1902, and vol. 19, Nos. 1—3, 1903. *The Society.*

„ Transactions of the Manchester Geological Society. Vol. 28, parts 4—8, 1903, and parts 9—12, 1904. *The Society.*

MARSEILLES.—Annales de la Faculte des Sciences de Marseille. Vol. 13, 1903. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria. Vol. 16, part 1, 1903, and part 2, 1904.
The Society.

MEXICO.—Boletin Mensual del Observatorio Meteorologico Magnetico Central de Mexico. 3 parts, 1902; also Informe, Obs. Astronomical, 1 part, 1903, and Anuario for 1904. *The Director.*

„ Instituto Geologico de Mexico, Parergones. Vol. 1, No. 1, 1903. *The Institute.*

MILWAUKEE.—Bulletin of the Wisconsin Natural History Society. Vol. 3, Nos. 1—3, 1901; also Annual Report of the Public Museum, 1903. *The Society.*

MISSOULA.—Bulletin of the University of Montana. Biological Series, No. 3, 1902 and Nos. 5 and 6, 1903. Geological Series No. 1, 1903, and President's Report for 1902-03. *The University.*

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ADDRESS BY THE PRESIDENT,

PROFESSOR JOHNSON SYMINGTON, M.D., F.R.S., F.R.S.E.

JOHN GRATTAN: A SKETCH OF HIS WORK AS A CRANIOLOGIST.

LADIES AND GENTLEMEN,—My first duty is to offer my warmest thanks to the Council for the honour they have conferred upon me in electing me President of this Society. It is certainly an honour to be identified with the government of an Institution which has existed for more than 80 years without state aid or municipal support, whose object is the extension of a knowledge of nature and of art, and the encouragement of learning and research, and which during this period has received not only the sympathy, but the active support, of such men as Thomas Andrews, William Thompson, Robert Patterson and Wyville Thomson. I am fully aware that I have done but little to deserve this honour, and that the invitation so cordially extended to me was intended quite as much as a compliment to the College which I have the honour to serve, as to myself personally. Indeed, it was the consciousness of this fact that led me to accept a position for which my other duties leave me but little time to discharge as I should wish.

Many of those who have contributed to our proceedings have been engaged in some industrial or professional occupation, but have found a change of thought and a relaxation from their ordinary work in the study of some department of the physical, or of the biological sciences. They have been the fortunate possessors of a scientific hobby, which they followed without any idea or hope of material gain. Fortunately for the progress of science, and the prospects of a general recognition of the intellectual and material value of scientific research, such men have always existed in our midst, and this Society is justly proud of having enrolled amongst its members not a few who have made important and valuable contributions to the sum of human knowledge. During its earlier history our Society was singularly fortunate in this respect. The work of some of these pioneers is well known locally, and has received general recognition in scientific circles, while the labours of others have not only failed to gain that amount of credit to which they are justly entitled, but are even in danger of being entirely ignored. Amongst the latter I would place the investigations of John Grattan, and I desire to take this opportunity of attempting an appreciation of his scientific work. I do so with the more confidence, since it involves questions to which I have personally devoted some attention.

John Grattan was born in 1800 in the neighbourhood of Dublin and he obtained the diploma of the Apothecaries' Hall about 1823.

The reasons, given to me on excellent authority, for his starting business in Belfast may be of interest to some, although not entirely creditable to the state of pharmaceutical science at that time in this city. It appears that Grattan had decided to settle in some provincial town in Ireland, and with this object in view he visited various places accompanied by his employer's son. In the course of their travels these young men came to Belfast and going into a druggist's shop in the centre of the town one of them asked for a pennyworth of Epsom's salts. The attendant took down a bottle from one of the shelves, extracted a handful of the salt which he placed on a fragment of a newspaper and secured by gathering up the edges of the paper ând twisting them round one another. As soon as they left the shop Grattan's companion turned to him and said "Belfast is the place for you."

Grattan came here in 1825, and at that time there were, of course, no railways to the town, while the population was only about one-tenth of what it is now. According to tradition he arrived on a stage-coach with a large bottle, similar to those still shown in many chemists windows, between his legs. Grattan was not only the founder of the well-known firm which still bears his name, but he also started the manufacture of the now celebrated Belfast aerated waters, which for many years were exclusively manufactured by his firm. I mention these facts to show that his scientific tastes and pursuits did not prevent him from conducting his business with marked ability, enterprise and success.

During his long residence here, Grattan took an active interest in the existing literary and scientific societies. Thus he was President of the Belfast Literary Society during the session 1843-4, and read two papers on phrenology—one on the 2nd May, 1842, entitled, "Phrenological Ethics," and the other on 12th February, 1844, "Phrenological observations on the treatment of criminals." For many years he was an office-bearer in our Society, to which he contributed three papers. His first communication "On the importance, to the Archæologist and Ethnologist, of an accurate mode of measuring human crania and of recording the results,—with the description of a new Craniometer," was read on the 6th April, 1853, and was published in the *Ulster Journal of Archæology*, Vol. i., 1853, illustrated by 5 plates. Again, on the 20th January, 1858, he read a paper "On some ancient Irish skulls, and on an exact method of taking and recording cranial measurements." Part of this communication was published in the *Ulster Journal of Archæology*, Vol. vi., 1858, with 3 plates, under the title, "Notes on the human remains discovered within the Round Towers of Ulster, with some additional contributions towards a Crania Hibernica." This appears to have been his last contributions to Craniology at our meetings, but in 1860 he gave an interesting demonstration on the oxy-hydrogen light and its uses for illuminating the microscope and throwing pictures upon a screen.

We have just seen that his last published paper on craniology appeared in 1858; but after that date he was engaged in the preparation of another contribution to this subject. He went so far as to print 16 pages of letterpress and to prepare a number of plates. After his death his daughters, the Misses Grattan, bound into a single volume the various portions of his unfinished work, along with "Notices of the Round Towers of Ulster," by Edmund Getty, M R.I.A., and presented copies to a number of his friends. It was a specimen of this volume, which I obtained from a second-hand bookseller, that first directed my attention to his methods of skull measurement. On enquiry I found that Grattan's work was unknown to many of our leading anatomists and to others interested in physical anthropology, as it had previously been to myself. The cause of this is easily explained. The earlier part of Grattan's investigations appeared in a journal which is not readily accessible to, and is rarely consulted by, the great majority of those interested in craniology, while the later unpublished portion, issued privately, was still less likely to fall into the hands of such workers.

Before proceeding to discuss the nature and value of Grattan's scientific work it is advisable that I should explain, as briefly as possible, the circumstances that led him into this line of research and the problems that were then engaging the attention of anthropologists and ethnologists.

About the time when Grattan came to Belfast, phrenology was at the zenith of its popularity. It is evident from his writings that he was a convert to the theories of Gall and Spurzheim, and indeed he appears to have been personally acquainted with the latter. He collected a large number of skulls and casts of heads, and naturally became interested in the variations in their form.

Further, the long period during which Grattan pursued his craniological investigations witnessed the rise of a scientific ethnology.

Anthropologists began to collect material from barrows, caves and other ancient burial grounds to determine the physical characteristics of their remote ancestors; and to procure specimens and make observations in all parts of the world to ascertain the structural peculiarities of existing races. It soon became evident that for anthropological purposes the skull was the most important part of the skeleton, and attempts were made to utilise certain differences in the form of the skull for purposes of racial classification.

Towards the end of the 18th century Blumenbach had drawn attention to the significance of variations in the form of the skull in different races, but it was reserved for Anders Retzius to place this subject upon a scientific basis. In 1840 he made his first communication to the Academy of Science of Stockholm. Blumenbach had attached special importance to the shape of the anterior part of the skull, such as the forehead and jaws, but Retzius showed that it was even more important to examine the cranium, or that part of the skull which contains the brain. It is to him that we are indebted for the division of skulls into long, or dolichocephalic, and short, or brachycephalic, according to their relative length and breadth. He maintained that the Caucasian race of Blumenbach was a mixed one, since it consisted of both short and long-headed people, the proportion between these two varying in different places according to the degree to which the primitive stock had been invaded, or replaced, by a foreign element. Anders Retzius devoted himself with great energy to the determination of the distribution throughout Europe, both amongst the living races and prehistoric remains, of these two types of heads. His work slowly, but surely, gained general recognition, and before his sudden death in 1860 craniology was engaging the attention of many distinguished workers. Several events which happened about this time tended to create a more general interest in this subject. Thus the discovery in 1857 in a limestone cave in the Neanderthal of the remains of an extinct race whose skulls had a very remarkable form, and in some respects ape-like appearance, raised a keen discussion as to the significance of certain cranial characters, while the publication two years later of Charles Darwin's work "On the origin of species by means of natural selection," inevitably turned men's attention to all biological problems with wider interest and renewed energy.

Grattan's work was almost cotemporaneous with that of Anders Retzius, and nearly all of it was done before the German and French Schools had elaborated their schemes of skull measurements.

The general plan which he devised for this purpose is given in his paper published in 1853, and it is not essentially altered, but only more fully elaborated in his subsequent contributions to the subject.

The spirit and aims of Grattan's work are so admirably expressed in a paper he published in the *Ulster Journal of Archæology* for 1858 that I cannot refrain from quoting it. After discussing the craniological methods then in vogue he wrote as follows:—

"So far, we look in vain, therefore, for that uniformity of method and that numerical precision, without which no scientific investigation requiring the cooperation of numerous observers can be successfully prosecuted. The mode of procedure hitherto adopted furnishes to the mind at best nothing but vague generalities which it cannot by any intellectual effort reduce into general shape and form; and until we can accomplish something more than this—until we can record with something approaching towards accuracy the proportional development of the great subdivisions of the brain, as indicated by its bony covering, and by our figures convey to the mind determinate ideas of the relation they bear towards each other we shall not be in a position to do justice to our materials, or to interpret faithfully or profitably the natural hieroglyphs thus submitted to our examination. What we specially stand in need of is some method of measuring cranial forms and magnitudes which by combining perfect simplicity and facility of application with rigid scientific accuracy shall command our confidence; so that the ethnologist may be able to record his own observations, and to profit by the recorded observations of others without the risk of misinterpretation, and the phrenologist possesses a sound numerical foundation upon which to base his special measurements. But although an improved method of taking and recording cranial measurements would admittedly be of great importance to the phrenologist, to the ethnologist it is absolutely indispensible. The phrenologist can pursue many of his enquiries and test the soundness of most of his inferences, by the aid of detached or isolated specimens, each head itself affording the necessary data by which its mental capabilities may be determined. But the ethnologist has to deal with tribes and nations. He stands somewhat in the position of the actuary who has to deduce congruous and general laws from an extensive collection of apparently incongruous and heterogeneous facts. In every age, and amongst all races, special individuality of character must necessarily have been accompanied by considerable modifications of typical form so that no single cranium can, *per se*, be taken to represent the true average characteristics of the variety from which it may be derived. It is only from a large deduction that the ethnologist can venture to pronounce with confidence upon the normal type of any race, or reasonably expect to attain in his craniological investigations that measure of completeness necessary to rescue them from their present objectless character, and to impart to his conclusions scientific definiteness and value. If an improved method of measurement be thus desirable when treating of existing races whose crania form but one, though by no means the least important, element for determining the influences that may have contributed to their development and progress, still more necessary does it become when we endeavour to investigate the moral, social and intellectual condition of our remote predecessors, of whom we possess few, if any, records, save such as remain to us in their rude structures and works of art, and in their own osseous remains. These latter are, necessarily, few in number, widely scattered, singularly frail and perishable, and are, day by day, irretrievably disappearing before the unavoidable encroachments of extending civilization. If we are to indulge, therefore, in any well-grounded expectation of our being able to render the fleeting records of the past available for contrast with the more accessible materials of the present, it is of the first importance that our description of such should be as accurate and as free from ambiguity as the nature of the subject will permit—the paucity of our material affording but little prospect of our accumulating the necessary data, unless we can succeed in concentrating upon some recognized scientific plan the detached labours of every competent observer."

Grattan's attention to these questions appears to have been due to the action of his friend Edmund Getty who had collected a considerable number of skulls during his well-known researches on the Round Towers of Ulster. At Getty's request Grattan agreed to describe these skulls, but like the most of us he found it easier to promise than to perform. As we have just heard, Grattan was convinced that the various methods of measuring skulls then in vogue were too indefinite and incomplete to admit of a thorough and scientific description of individual specimens, or of a comparison of groups of skulls with one another. Accordingly he set to work to frame a new plan of skull measurements, and in so doing he found it necessary to construct a suitable instrument with which to take these measurements. For a number of years Grattan worked at this subject, modifying his methods and improving his instrument, until they were not only greatly in advance of those then in use, but in many respects will bear favourable comparison with those now generally employed.

Through the kindness of Professor Haddon I am able to show you what I believe was the latest and most improved form of Grattan's Craniometer. No account of this instrument has been published, although Grattan prepared a fine illustration and wrote an excellent description of it for a paper which was not completed at his death. He appears to have used this instrument in the preparation of his "Notes on the Round Towers of Ulster, with some additional observations towards a Crania Hibernica," which appeared in the *Ulster Journal of Archæology* in 1858, and it was probably shown before the Society on the 20th of January of the same year. An instrument constructed on much the same principle as the one before you, but differing considerably from it in appearance, was described and figured in the *Ulster Journal of Archæology* for 1853.

I will now endeavour to explain, in a manner as simple and as free from technicalities as possible, the problem with which Grattan had to deal and the main peculiarities of his methods and instrument.

As the cranium is an irregular ovoid box we can obtain data for a rough estimate of its size and general form by measuring its greatest length, breadth and height. Further, by taking its length as 100 we can express the proportions of length to breadth and of length to height by indices. This plan is adopted in distinguishing between round and long, or flat and high heads. Such a method is simple, and in practice has been found useful in classifying skulls and in distinguishing races. It is obvious, however, that two skulls differing considerably from one another both in capacity and shape might have the same length-breadth and length-height indices. If we examine the median longitudinal arc of the vaulted portion of the skull we find that it passes from the root of the nose upwards and backwards to the vertex forming two curves, with their convexities directed forwards and upwards, it then turns downwards and backwards to the most posterior part of the skull, and finally forwards and downwards to end at the posterior margin of the large hole at the base of the skull through which the brain becomes continuous with the spinal cord. Now, the form of these curves from the nose to the vertex, and from the vertex to the back of the head, may differ greatly in two skulls which have the same length and height. Thus, in one the forehead may be high and protruding, the roof of the skull be directed nearly horizontally for a considerable distance and then descend abruptly to the occiput, while in the other the forehead may be low and retreating, and the longitudinal arc only gain the same height as the other skull for a very short distance before it begins to descend again. The problem was, and indeed still is, How can we best give numerical expression to these differences? The plan often adopted of measuring the length of the three portions of this arc, viz., frontal, parietal, and occipital, gives the respective share the bones so named take in the formation of the arc, and hence may be supposed to show the relative development of the anterior, middle and posterior parts of the vault of the skull. In some skulls, however, owing to irregularity in, or disappearance of, the lines of union between these bones, their respective lengths cannot be definitely ascertained, and in any case such measurements do not show the contour of the arch. For this purpose I believe that the best method yet devised is that of Grattan's. By means of his craniometer the skull is firmly fixed in position by passing two pegs into the external openings of the ears and pressing another screw against the base of the skull. The skull can then be rotated along with the stage to which it is fixed, round an axis passing through the external auditory openings, or it can be rotated along with its stage round an axis perpendicular to the first. In each case the exact amount of rotation is indicated by a dial. The instrument has a brass carriage, a brass slide and a curved tracer, all suitably adjusted, so that the distance of any part of the median line of the skull from the point where the axis passing from the centre of one ear-opening to the other crosses the median plane, can be read on a graduated scale marked in inches and tenths of inches. Grattan selected as his starting-point, or zero, the distance from this point on the auditory axis to the nasion, or depression just above the root of the nose. After this is ascertained the brass slide is withdrawn, the skull rotated 10°, the brass slide carrying the pointer again pushed towards the skull and the distance measured in the same way as from the nasion. This process of skull rotatiou through 10° and of measurement is repeated along the entire extent of the arc. From such a series of measurements a profile drawing of the skull can be made showing the position of the external auditory meatus and the coutour of the vault at intervals which, in an ordinary skull, are less than an inch apart. If necessary, the skull can be measured at shorter intervals by rotating the skull between each measurement a smaller number of degrees. By other adjustments the same instrument can be used to make a tracing on paper of the external contour of this arc. After the vault has been measured the rotation of the skull can be continued so as to determine the amount of projection of the nose, jaws, and teeth below and in front of the cranium. Grattan measured a number of skulls in this way and compared them with one another in a series of tables showing the proportion of the radial diameters at 10° interval from zero to 180° with the length of the skull estimated at 100°.

It is difficult to imagine a more ingenious and accurate method of measuring this part of the skull.

The length-breadth index expressed by comparing the greatest length of the cranium with its greatest breadth is open to the same objection as the length-height index which we have just discussed. Thus, in some skulls the greatest transverse diameter is high up on the parietal bones, this means that the sides of the skull have a slight inclination outwards from the base until near the top; in other specimens the lateral walls begin to slope inwards from near the base, so that the greatest transverse diameter is much lower. Further, the maximum transverse diameter may be the same in two skulls, but towards the anterior or smaller end of the oval one of these skulls may be much narrower than the other. To correct these sources of fallacy the transverse diameter is often taken in the frontal as well as the parietal regions, and the level of the greatest transverse diameter is roughly indicated by stating whether this occurs high up between the parietals, or nearer the base between the temporals. It is interesting to see how Grattan recorded these variations of the transverse diameter at different points from before backwards and from below upwards. With his craniometer lines are drawn on the skull from one external ear, opening to the other, opposite selected angular intervals from the nasion. The cranium is thus blocked out into a series of wedges, each having a convex base on the vaulted part of the skull and a sharp straight edge at the auditory axis at the base of the skull. The arched lines over the surface of the skull from one ear opening to the other he called coronal arcs, and he selected for special examination the arcs at intervals of 10°, 30°, 60°. 90°, 120° and 150° from the ear-nasion arc. He divided each of these arcs into three parts of equal vertical elevation, by two lines parallel to their bases, and the extremities of these lines and the base line furnished so many fixed points between which the transverse diameters could be taken.

I must admit that this part of Grattan's method looks somewhat complicated, but it is not so laborious in actual practice as it might at first sight appear. Grattan's own remarks on this point are very characteristic. He writes as follows:—"It may possibly be objected to this method that it involves too large an array of arithmetical figures and demands too great an expenditure of labour; but what was ever yet accomplished, of any value, without some labour? And if it be desirable to furnish measurements at all (and from the fact that almost every writer upon the subject gives them after some fashion this is manifestly the case), surely it is of some importance that they should be adequate to accomplish the object in view, and at least be so taken and recorded as to convey truthful and intelligible impressions to the mind."—*Ulster Journal of Archæology*, Vol. vi., p. 35.

An examination of present-day craniological methods will show that various attempts are made to amplify and check the data afforded by the greatest length, breadth and height measurements of the cranium. Thus, the transverse diameter is taken between several different points, the chords of the frontal, parietal and occipital arcs are measured, and the lengths of radii drawn from a point on the base of the skull to various spots on the median longitudinal arc of the vault are recorded. The points selected in many cases correspond to the union of certain of the skull bones. These, however, may vary without affecting the general shape and dimensions of the skull, and have not the mathematical precision of Grattan's points. On the whole, it appears to me that for completeness and accuracy, and for facility in making a thorough comparison between the external form of different skulls, Grattan's method, devised about 50 years ago, when craniology was in its infancy, can hold its own against any scheme yet formulated. Curiously enough he made no attempt to measure the diameters of the cranial cavity, or to ascertain how far the inequalities of the outer surface of the skull correspond to those on its inner aspect. Possibly his phrenological view led him to suppose that this question had been settled.

There is one feature in Grattan's method to which I must allude, viz., his selection of the middle of the auditory axis as a starting point from which to measure the various radii and diameters of the cranial vault. The point usually selected for this purpose is the anterior edge of the foramen magnum and on morphological grounds there is much to be said in its favour. It represents, as Huxley long ago pointed out, the posterior end of the true base of the skull, and he used this point from which to start in measuring the length of the basi-cranial axis and comparing it with the vaulted portion of the cranium. At certain times, however, craniologists have recognised the fact that the external auditory opening presented certain advantages over the anterior edge of the foramen magnum as a basal point from which to measure the cranial vault, and curiously enough this view was adopted very strongly by the late General Pitt-Rivers, who in the last volume of his celebrated "Excavations in Cranborne Chase" wrote as follows in discussing this question :—

"There are other considerations which may perhaps operate in ultimately bringing about a change of system. Mr. Busk, F.R.S., was a strong advocate for measuring from the meatus auditorius and contrived an instrument for this purpose, but it was somewhat clumsy in use and was not generally adopted on that account. His method, however, was sound in principle. No comparison between the skull and the living head can be made by any measurements other than those taken from the meatus. Three profils of living heads taken by my instrument are given in Plates 290 and 292 and they are recognised as striking likenesses of the originals. This instrument is made of aluminium and the legs are movable so as to be light enough for use with a living head. The profile can be taken much more quickly than with Mr. Busk's instrument. There is also this great objection to the anterior margin of the foramen magnum as a base for measurement that in ancient skulls which have been buried for ages it is one of the first parts of the skull to decay, whereas the meatus auditorius is much more frequently preserved and a larger number of skulls can be measured by this method, a point of great importance when it is considered what a small number of the ancient skulls found in tumuli and other places are sufficiently perfect to be available for measurement."

I have been assured by an old friend of Grattan that he had a remarkable aptitude for the construction of mechanical instruments, and his craniometer affords ample proof of the correctness of this opinion. Grattan endeavoured to base his measurements upon mathematical principles and to avoid as far as possible the selection, as points between which to measure, those liable to vary from irregularities in the sutures on the vault of the skull. Thus in taking the height he did not choose the spot where the frontal and the two parietal bones join, but one on the vault 60° from the nasion. His preference for definite angular intervals is again shown by the fact that he took the length and breadth of the cranium at a horizontal plane passing anteriorly 10° and posteriorly 150° from the nasio-auditory plane as zero. He found such a section usually intersected the cranium at its longest and broadest diameters.

The capacity of the cavity of the cranium is obviously of importance as an index of the size of the brain, but the determination of its amount is subject to various fallacies. The cavity is filled with some material made up of small solid particles, and the quantity needed for this purpose is then measured. Many of the earlier estimates of cranial capacities are very inaccurate owing to the use of unsuitable substance and the absence of proper precautions when filling the cranial cavity and the measures. Grattan's remarks on this subject show the care and thoroughness with which he pursued his investigations. Thus, he states that he tried sand, sago, and mustard seed, but they all gave unsatisfactory results, since none of these indicated the same capacity when the same experiment was repeated. He found, however, that small round shot gave reliable results, and it is interesting to note that this is the material now generally used. Davis & Thurnam, in the first part of their great work, entitled *Crania Britannica*, published in 1856, state that they employed sand. Grattan refers to this fact, and expresses his regret that they did not use a more reliable material.

In addition to devising instruments and methods for taking skull measurements he employed them in the study of numerous Irish skulls. Thus, in the *Ulster Journal of Archæology*, Vol. i., 1853, he had a "Notice of an Ancient Sepulchural Mound." From this Mound which was apparently a pre-christian burial place, he obtained 8 skulls sufficiently well preserved to admit of satisfactory measurements. These specimens were probably all interred about the same time, and yet they exhibit considerable variations in cranial form. Again, in the same Journal, Vol. vi., 1858, p. 241, he gives a chronological classification of 104 skulls from various Irish sources which he had measured. From an examination of some prehistoric Irish skulls he came to the conclusion that they were divisible into two distinct groups. The majority were long-headed like the majority of the existing inhabitants, and he considers them Celtic. The minority were round-headed, and Grattan agrees with Retzius in holding that these were of "Turanic" origin, had preceded the Celtic population, and have their living representatives in the Fins or Laplanders. He further concluded from the cranial testimony that the Celtic population of Ireland, no matter by how many immigrations introduced, must be originally from one part stock.

It will thus be seen that Grattan belonged to that group of scientific investigators who have endeavoured to ascertain the physical characteristics of the prehistoric races of this country and that his own researches and inventions were calculated to aid in the accurate determination of the differences between the various races of mankind and the zoological position of man himself.

Grattan was an active member and an important contributor to the Proceedings of this Society about half a century ago, and his researches may serve as a typical illustration of the general character of the work of some of its early supporters.

This Society was not founded upon any narrow and merely utilitarian basis and has not limited itself to any one department of scientific work. It has welcomed contributions from those interested in any of the physical or biological sciences, and while glad to receive contributions illustrating the practical application of scientific discoveries to the improvements of our arts and manufactures it has shown an equal appreciation for observations and experiments tending to increase our knowledge of nature and its workings, irrespective of whether or not they were likely to increase our wealth or contribute to our material comfort.

Natural History, Botany, Geology and Ethnology have been favourite departments of study amongst our members. The gradual accumulation of carefully recorded facts by a multitude of humble workers in these subjects, no less than the capacity for broad generalisations possessed by a few brilliant minds, have taught us the great antiquity of this earth and the gradual evolution of its organic life. Darwin's work on board the "Beagle" and his studies amongst his flowers and his domestic animals must have appeared to many as a useless, if harmless, amusement, and yet what department of human thought and activity has not been influenced by them.

It not unfrequently happens that in the attempts to solve a difficult and complicated scientific problem a frontal attack is as ineffectual, if not as disastrous, as our Generals found it to be at Colenso. The foundations of the science of bacteriology were laid by botanists who probably never dreamed that in the hands of such men as Pasteur it was destined to create a revolution in the treatment of many diseases and in our views of sanitation and preventative medicine.

In these times when the steam engine is disappearing to be replaced by the electric motor we ought not to forget what we owe to such men as Galvani with his apparently trivial experiments with frogs, muscles, and bits of copper and iron. It will be an unfortunate day for our material prosperity, no less than for the progress of science, when the scope and nature of our scientific work is limited to what at the time may appear of practical utility and when the pursuit of truth for its own sake can no longer claim its devotees. Let us hope that this Society will always maintain its high traditions, and will continue to produce members as able, industrious, and energetic in scientific research as John Grattan.

APPENDIX.

The following appendix consists of reprints from some of Grattan's unpublished work. Plate (I) is a drawing of Grattan's craniometer. The explanation of this plate and the description of the method of using the craniometer are reprinted from the paper prepared by Grattan, but unpublished at the time of his death.

Plate II. is reproduced from one made by Grattan to illustrate his method of cranial measurements. It has been reduced to about $^2/_3$rds of the size of the original figure. A somewhat similar illustration will be found in the Ulster Journal of Archæology, Vol. VI., 1858, showing a profile view of the dimensions of Spurzheim's skull.

A table has also been added showing Grattan's scheme of skull measurement; some facial measurements have been omitted.

EXPLANATION OF PLATE I.

Grattan's Craniometer.

A.—A flat Board, 20 inches square, and $^3/_4$ths of an inch thick, forming the stand of the Instrument.

B.—A movable wooden foot, 9 inches long, 3 broad, and 1 thick. It narrows to $^1/_4$ of an inch in front, where it has affixed to it a brass mounting, which carries the Pivot P.

C.—Nut and screw for securing B to A.

D.—A wooden upright, $12 \times 3 \times 1$ inches, firmly mortised into the foot B.

E.—A brass frame attached to D by means of pivot F, upon which it can be made to rotate in a vertical plane. Its centre (the pivot F), is 9 inches above the board A; and its arms project forward $7\frac{1}{4}$ inches from D, and are $7\frac{1}{2}$ inches apart.

F.—The pivot and nut which secure E in its place, and allow of its being fitted and rotated at will.

G.—A second brass frame or stage, attached by its extremities to the extremities of E.

HH.—Two screws, passing through the extremities of E and G, constituting the axis upon which G revolves, in a plane always perpendicular to the plane of rotation of E. The inner ends of these screws terminate in smooth cylindrical pivots, of suitable dimensions, to permit of their being introduced into the external auditory foramina. They can be screwed backwards or forwards with the utmost facility; and when adjusted to a skull, are fixed in a postion by means of the nuts II.

II.—Binding nuts, for fixing the stage G firmly to the screws HH, in order that they may rotate with it in its progress.

J.—A brass semicircle, divided into degress, and firmly secured by screws upon the upper arm of E. Its centre coincides with the axis of G, and it is traversed by an index K, secured upon H by the binding-nut L, so as to insure its accompanying H and G in all their movements, the extent of which can thus be read off in degrees.

K.—The index attached to the screw H. When E stands in the position in which it is placed in the diagram, the faces of J and K lie horizontally, and consequently only their edges can be seen; but a detached diagram of them is set out separately.

L.—A binding-nut, for fixing the index K in position when adjusted.

M.—A piece of whalebone 3¾ inches long, 1½ broad, and 2-10ths thick, securely, but slackly attached by twine to the upper surface of the short projecting arm of G, so as to allow it a sort of hinge-like motion. It is imperfectly visible in position in the diagram, but a detached outline of it is given; two dots upon it, and upon G, respectively, indicating the holes by which they are secured to each other.

N.—A thumb-screw passing through G, and pressing against the back of M, by means of which the distance of M from G, and the pressure exerted upon M can be regulated.

O.—A binding-nut, for securing the stage G in position when its adjustments have been completed.

P.—A pivot, rising vertically from the brass mounting of the foot B. Its centre coincides with the axis of the stage G, when the poles of the latter are placed perfectly vertical, and if extended vertically, would exactly bisect the same axis when adjusted horizontally.

Q.—A brass carriage, 12 inches long and 2¼ broad. One of its extremities is perforated to make it fit pivot P, round which, resting upon B, it moves horizontally; the other extremity resting upon a brass foot, R, which raises its under surface to the level of the top of B. When moved round P, it describes a circle, of which P is the centre, and its left limb is graduated to permit of the distance from P to U being read off in inches and tenths.

R.—The foot upon which Q rests, secured to it by screws.

S.—A brass slide, which travels backwards and forwards in a slot upon the carriage Q, carrying at one end the upright T, and having at the other end a tube for receiving the pencil U.

T.—A perpendicular triangular brass upright, 12½ inches long, attached to S.

U.—A pencil, passing freely through S, which it accompanies in all its movements, with its point resting on the paper Y.

V.—A spring slide, fitting accurately upon, and moving freely up and down T. It carries in front a horizontal pivot, upon which rotates the curved tracer W: and at the back, a binding-screw, to fix it in position when requisite.

W.—A curved tracer, so adjusted as always to have its points in the same perpendicular line as the point of the pencil U.

X.—A pointed steel pin, furnished with a wooden handle. It passes through the exact centre of P: pierces the paper Y: and indicates the precise point from whence all the measurements are taken.

Y.—A sheet of paper, extending under a portion of the foot B: which, when screwed down, holds it firmly in its place.

a 1, and a 2.—Two lines scribed upon the board A. a 1, passing transversely through the central point, indicated by X: and a 2, backwards therefrom, and perpendicular to a 1. They enable the paper Y, when correspondingly marked, to be removed, and accurately replaced, if requisite.

To employ this instrument, let the frame E be turned upon its axis, until the axis of G shall be perfectly horizontal, indicated by the mark upon the edge of E; touching the point of the arrow upon D; and by the graduated semicircle J, standing perpendicularly at the left hand of the operator as he faces the upright D: then let the stage G be turned upon its axis, until it depends vertically from the extremities of E, when its projecting arm, carrying the thumb-screw N, will be underneath—the whalebone lever M lying loosely upon it above. If a skull be now placed upon its base, centrically on the stage G, with its face towards the operator, and the screws HH be introduced into the external auditory foramina, the bony palate will rest upon the hinge-end of M; whilst, by means of the thumb screw N, the forked extremity of M can be pressed upon the occipital condyles, with any amount of force requisite to keep the skull fixed and steady. The binding-nuts, II are then to be screwed home, after which the stage G may be rotated completely round its axis, carrying with it the skull, which will not require to be shifted upon the stage in any subsequent operation. Let the carriage Q be now moved, until, upon sliding S backwords and forwards, the point of the pencil U exactly traverses the line A 2. Let it be fixed in this position by passing the pin X through a hole in the foot R, into a corresponding hole in the board beneath, and let the point of the tracer W be adjusted precisely upon a level with the axis of E, which will be when the under edge of the slide V touches the point of the arrow upon T. It will now be manifest, that by rotating the stage G, any portion of the median periphery of the skull may be brought into immediate contact with the point of the tracer W, and the distance of any part of it from the axis of the auditory foramina be read off in inches and tenths upon the graduated scale in Q: the angular distance of any one point from

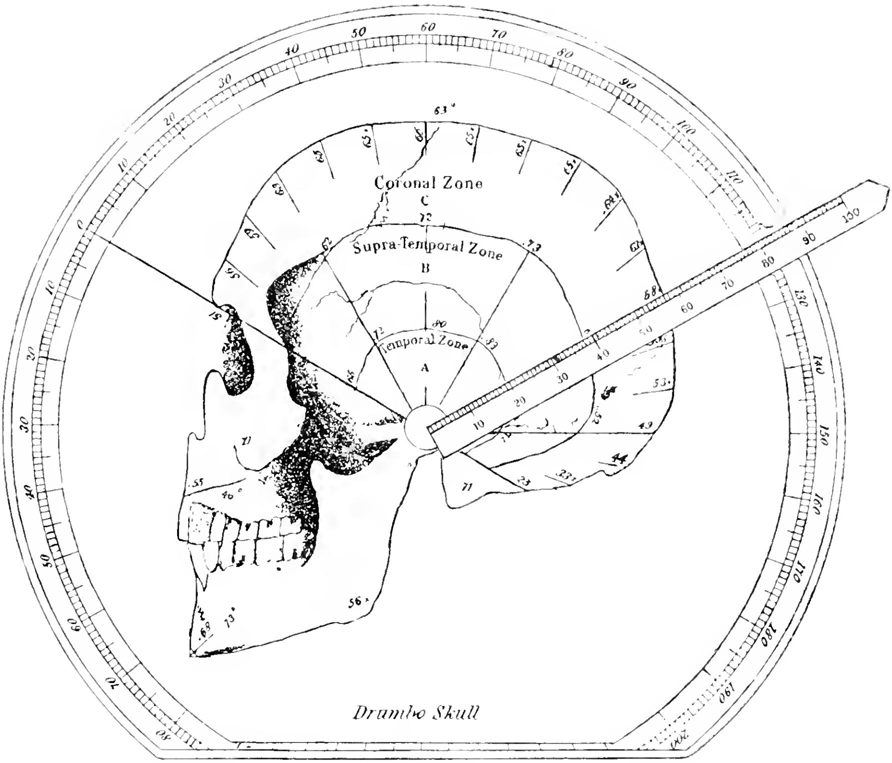
Coronal Zone
C
Supra-Temporal Zone
B
Temporal Zone
A
Drumbo Skull

PLATE II.

another, adopting the same axis as a centre, being indicated upon the graduated circle J by its index K. In this manner mesial measurements, mathematically accurate, both as regards extension and position, may be taken with surprising facility. For the reasons already advanced, however, it has been found to be much preferable to make outline tracings instead, which may be accomplished with very little additional trouble. To do this—replace E in the position it occupies in the diagram; set A free by removing the pin from R, and then carefully move Q round P as a centre: keeping, at the same time the tracer W in contact with the skull, and tracing upon the paper Y, with the pencil U, the course the latter takes, which will coincide exactly with the line described by the point of W in its progress; the position of sutures, and other important points, being indicated as we proceed by short lines perpendicular to the skull. By this means we shall succeed in producing a faithful outline of the entire median section of the skull; and may, in like manner, produce transverse sectional outlines at any desired point, by simply replacing E in the horizontal position, and by rotating G, bringing the section to be outlined into the same horizontal plane as the point of the tracer W. A series of outlines thus taken (see Plates 2 and 3), affords permanent and unimpeachable materials from which measurements may be taken with perfect accuracy and facility; and I shall now proceed to explain how the exact dimensions, and the more prominent characteristics of the skill, may be expressed numerically, with the precision and fidelity necessary for scientific purposes.

GRATTAN'S TABLE,
Showing his Scheme of Skull Measurements:—

SECTION I.

DIMENSIONAL MEASUREMENTS.

Capacity in cubic inches
Length in inches and tenths
Breadth
Vertical height at 60 degrees
Circumference
Occipito-frontal Arch
Transverse Arch at 90 degrees

Capacity in cubic Centimètres
Length in Millimètres
Breadth
Vertical height at 60 degrees
Circumference
Occipito-frontal Arch
Transverse Arch at 90 degrees

SECTION II.

PROPORTIONAL MEASUREMENTS in 100ths of Long Diameter of Cranium. Group I.

Length
Breadth
Vertical height at 60 degrees
Circumference
Occipito frontal Arch
Transverse Arch at 90 degrees

SECTION II.

MESIAL RADII. Group II.

At Angular Intervals of 10 degrees from the Naso-frontal Suture as Zero, and with the Axis of the Auditory Foramina as Centres.

0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

To posterior edge of F. Magnum
,, anterior do. do.
,, front edge of Upper Maxilla
,, Symphysis Menti

SECTION II.

CORONAL ARCS. Group III.

Mesial:
Frontal
Parietal
Occipital
Total of, or Occiptio Frontal

Transverse:
At 10 degrees
30 ,,
60 ,,
90 ,,
120 ,,
150 ,,

SECTION II.

TRANSVERVE DIAMETER, Group IV

Mastoidal
Meatorial

Temporal (A) Zone at 10 degrees, 30 ,, 60 ,, 90 ,, 120 ,, 150 ,,

Supra-Temporal (B) Zone at 10 degrees, 30 ,, 60 ,, 90 ,, 120 ,, 150 ,,

SECTION III.

MISCELLANEOUS MEASUREMENTS.

Long Diameter of F. Magnum
Transverse do. do.
Cerebellar Depression below 150°

Angular Position of—
Coronal Suture
Lambdoidal do.
Posterior edge of F. Magnum
Anterior edge of do.
,, Upper Maxilla
Symphysis Menti

1st December, 1903.

PROFESSOR JOHNSON SYMINGTON, M.D., F.R.S., F.R.S.E., PRESIDENT, in the Chair.

SAYINGS, PROVERBS, AND HUMOUR OF ULSTER.

By PROFESSOR JOHN W. BYERS, M.A., M.D.

(Abstract.)

THE lecturer pointed out how sayings, proverbs, and humour were characteristic of a distinct race, and that a study of these features enabled us to form some opinion of the history and character of the people, to understand their habits and peculiarities, to investigate their methods of speech, and in some measure to explain why they have exerted such an influence in the world's history.

For three hundred years there had existed in Ulster (and mainly the north-eastern part of that province) a race of people who by their power of work, their level-headedness, and thorough self-reliance, have made Belfast the great centre of Irish industries, have contributed to all parts of the British empire men distinguished in commerce, science, literature, statesmanship, and the arts of war; and, as pointed out by President Roosevelt in his great work "The Winning of the West," have done so much in colonising what was formerly called the Western States of America—those lying beyond the Alleghanies.

The Northern Irish are a mixed people, and the Ulsterman from his heredity is a product by himself. Through his veins there courses a stream of Scotch, English, French Huguenot, and Irish blood, and so in the same individual you may sometimes find the pluck and grit of the Englishman, the tenacity and forethought of the Scotch, the industry of the Huguenot, with the keen

sympathy, pugnacity, and ready wit of the native Irishman. The characteristics of a race so constituted find expression in the quaint sayings, proverbs, and humour of the people of the Northern Province of Ireland, which are inspired more by a shrewd observation of men and nature than by mere book-learning. They are met with in their most pronounced form in the country districts as distinguished from the towns, and the clergy and the medical profession who are brought into intimate relationship with the people hear them most frequently.

The explanation of some of these sayings is at times difficult, and, as examples, the following were discussed:—"The rale M'Kay," "A Morgan Rattler," "Tibb's Eve," and "Paying on the Nail." A large variety of other phrases and proverbs having been considered, attention was called to the folk-lore, superstition, and fairy-lore of Ulster, and illustrations were given from the writings of "Moira O'Neill," Allingham, W. S. Drennan, as well as from personal observation.

Various "omens" were mentioned, the "Banshee" was discussed as well as terms and phrases used, indicating the power of observation possessed by the Ulster race.

Finally, reference was made to the "Humour" of the Northern Province of Ireland, which differs from that of the South in not being so apparent and spontaneous, and not so topsy-turvy; it was of a drier kind, but at the same time could be as sparkling as that met with in any other part of the country. One feature about the Northern humour was that while it is not so much on the surface and in many cases was not so evidently prepared beforehand as is found in the South of Ireland it is not so readily exhausted. In driving through Dublin the jarvey will at once when you mount his vehicle fire off some humourous saying; in the North of Ireland, the carman, on the contrary, waits until you draw it out of him by some remark, but while the carman in the South shows by the twinkle in his eye that he is amusing you, his Northern confrere never exhibits by any emotional evidence that he is poking fun at you. Examples were given to illustrate the Ulster Humour.

[The lecture of which the above is a very short abstract appeared in the March number (1904), of the "Victoria College Magazine," and has since been published, along with "Ulsterisms," in book form.]

Rev. Professor Todd Martin said he thought they should not separate, whatever was their custom, without tendering their hearty thanks to Professor Byers for that lecture, which no other man in the North of Ireland could have given them. Professor Byers had a full acquaintance with Ulster, and that evening he had brought before them some of the traits of the Ulster people in a wonderfully interesting way. They were under a deep obligation to him for that lecture. He was sorry to see that the distinctive characteristics of the Ulster people seemed to be vanishing. The spread of education was driving out a good deal that was distinctive of the province, and it was a great pity that some of the traits of the people could not be seized upon before they passed away. They had unfortunately not been provided with a picture of the province as other parts of Ireland had been presented. Professor Byers, he hoped, was on the way to do something of that kind. He moved the vote of thanks heartily, and hoped it would be heartily supported.

Mr. William Crawford seconded the vote of thanks. The lecture had been extremely interesting in every part, and he had the greatest pleasure in seconding.

The Chairman said the lecture was a singularly appropriate one to a society like theirs. Their Museum contained numerous memorials of the work of the ancient inhabitants of this province, and Professor Byers had brought before them that evening not less interesting points that they ought to preserve and treasure as very interesting historical facts.

The vote of thanks was passed by acclamation.

28th January, 1904.

PROFESSOR JOHNSON SYMINGTON, M.D., F.R.S., F.R.S.E., PRESIDENT, in the Chair.

RADIUM.

BY JOHN FINNEGAN, B.A., B.Sc.

(Abstract.)

THE meaning of Ionisation was first explained, then the nature of Kathode rays, canal rays and X-rays. Becquerel's discovery that Uranium and its salts are continually emitting rays that affect the photographic plate was discussed.

After the discovery of the uranium radiation only one other chemical element—thorium—was found to possess similar powers. About the close of 1897 Madame Curie began the study of Becquerel rays. She soon found that the emission of rays by the compounds of uranium was strictly proportional to the quantity of metal present, and must be an atomic property of the element uranium and independent of its chemical or physical state.

Uranium is chiefly obtained from pitchblende, a velvety black mineral found in the Erzgebirge and in Cornwall. M. and Madame Curie resolved to investigate the radio-activity of pitchblende, and they discovered that some specimens had a radio-activity four times greater than metallic uranium itself, and they immediately set about separating chemically from pitchblende one substance after another, testing each portion for radio-activity. In this way they discovered that, with the separate bismuth, there came away a very active substance which they named polonium, and with the barium another intensely active substance, which they called radium.

A third highly radio-active substance was discovered in pitchblende by M. Debierne, and called by him actinium; it accompanies certain bodies of the iron group, and is a near neighbour of thorium. All these radio-active substances occur in pitchblende in absolutely infinitesimal quantities. A ton of the uranium residue —that is the dross of the pitchblende after the uranium is extracted—yields about two or three grains of radium salt. The radiation from radium is extraordinarily intense—it emits constantly all the different rays produced in a vacuum tube—and a specimen of a pure radium is more than one million times as active as an equal weight of uranium. A few centigrams of radium bromide discharge an electroscope four or five metres distant, and one can easily discharge an electroscope through a screen of lead or glass three inches thick. Photographic plates placed near radium are almost instantly fogged. Radium can be used like X-rays for the production of radiographs.

Rutherford, Becquerel, and others have shown that radium radiations comprise three different classes of rays. (1) The "Alpha" rays, formed of material particles, atomic in size, charged positively, thrown off with a velocity about one-tenth that of light, easily absorbed by thin sheets of aluminium foil, or by a few millimetres of air. About 90 per cent. of the discharging effect is due to those rays. They resemble the canal rays of Golstein, but have much greater velocity. According to Rutherford, these resemble closely helium. (2) The "Beta" rays, absolutely analogous to Cathode rays, are swarms of flying corpuscles, strongly active and much more penetrative than the Cathode rays of our tubes, moving with enormous velocities, many as fast as light. (3) The "Gamma" rays, not deflected by a magnet, traversing thick sheets of lead, are generally believed to be etherical pulses of the Rontgen ray type.

Radium radiation has an intense physiological effect, producing skin sores that heal slowly. M. Curie allowed an impure radium salt for ten hours to rest upon his arm ; immediately a red spot appeared, and a sore was produced that required some months to heal, leaving a very marked scar.

M. and Madame Curie observed that every substance which remains some hours near a radio-active salt becomes itself radio-active, possessing induced radio activity. Professor Curie found that the zinc, iron, and lead fittings, the air of his laboratory, the clothing of the workers, their very persons, in presence of radium, start into activity, and give out rays capable of affecting a photographic plate and discharging electricity. Sometimes he himself could not enter his laboratory or approach his electrometer for days. It has been found that these substances are continually giving out a kind of gas, and this is called elimination ; the radio-activity is caused by particles from this emanation depositing on the surrounding bodies. We have five disintegration products of radium—(1) a very active substance continually produced called radium X : (2) the luminous emanations arising from it ; (3) the resulting precipitate of this, also self-luminous ; (4) Cathode rays ; (5) "Alpha" rays, and accompanying these a continuous emission of heat.

Rutherford explains the phenomenon of radio activity by the theory that radium atoms are disintegrated, producing others of less intrinsic energy.

He supposes that a small number of atoms, perhaps one in one hundred thousand millions, becomes unstable every second, and explodes, a part the "Alpha" particle is violently expelled.

The remainder is the radium exonation. This is also unstable and expels another "Alpha" particle, becoming emanation X, which behaves like a solid.

This again is unstable, disintegrating with production of "Alpha," "Beta," and "Gamma" rays. All these are lost to the original radium, and the loss is continuous, but so small that we cannot detect it by weighing. Radium, then, cannot survive indefinitely, and the wonder is that it has survived so long.

Early last summer Professor Ramsay discovered that the fresh emanation from radium does not show the helium spectrum, but, with its decay, helium is produced in ever-increasing quantities, and if this very important conclusion is confirmed it will verify Rutherford's idea that radium is being constantly transformed into helium, and a proof will exist that a transmutation of the elements is possible. Assuming the truth of these laboratory results, we find ourselves in presence of quite startling phenomena.

No one has hitherto observed the transition from one form of matter to another, although everyone knows that such a transmutation was the dream of the alchemists. In recent times skilful observers have suspected such changes from spectroscopic details of solar and stellar spectra. Some chemists have maintained the evolution of matter on the strength of Mendelejeff's law that the elements form a kind of family or related series, and suspected that the barriers between the members were not impassible. All this was the speculation of the very boldest ; but in radio-active substances the process appears going on before our eyes. Radium thorium, and uranium are only extreme cases. Atoms of all sorts are reservoirs of energy, and have no guarantee of absolute durability ; and Strutt finds that most ordinary materials are slightly radio-active. If we allow ourselves to use our scientific imagination and to push the electronic theory of the construction of matter to its logical limits we may be witnesses of the spontaneous disintegration of radium, and we commence to doubt the permanent stability of matter. The chemical atom may, in fact, undergo a transformation, but so slowly that if one million atoms escape per second from a gramme the weight would hardly diminish one milligramme in one century. A well-known scientist says :—"This fatal quality of atomic dissociation appears to be universal, and operates whenever we brush a piece of glass with silk ; it works in the sunshine and raindrops, in lightning and flame ; it prevails in the water fall and stormy sea. Matter is doomed to destruction. Sooner or later it will have dissolved into the formless mist of protyle, and the hour hand of eternity will have completed one revolution." Of atoms, as of men, it may be said with truth, "Quisque suos patitur manes."

Among the experiments which Mr. Finnegan conducted during his lecture was the discharging of an electrometer by bringing near it a tube containing three-fortieths of a grain of radium, the tube enclosed in a metal match-box, and that again in a wooden box.

The Lord Mayor, in moving a vote of thanks to Mr. Finnegan, said they had to thank that gentleman for an evening which he felt sure they had all enjoyed very much. During the last twenty years there had been from time to time scientific discoveries which had sent a thrill of wonder and admiration through them, and of these none was more admirable and wonderful than the new discovery—radium. The world was to be congratulated that it was a lady who had been the means of making them acquainted to some extent with one of nature's greatest secrets. For the welfare of humanity they hoped that these grand discoveries of modern science would continue.

Mr. John Brown, in seconding, congratulated Mr. Finnegan on the attractive manner in which he had treated his subject. To old chemists like himself it was hard to have some cherished belief shattered, but, though he bowed to some of the more modern scientists on some of the points, he positively declined to accept the dissociation theory, which he took leave to say was all humbug. He did not refer to gases, but to electrolytic dissociation. It was a theory made in Germany, and built upon a most unsubstantial basis. He agreed with the Lord Mayor that they ought to do all honour to the great French woman, Madame Curie, whose work had been so attractively put before them by Mr. Finnegan.

The Chairman, in putting the motion, endorsed all the mover and seconder had said in praise of the lecture, which, however, was given under certain disadvantages owing to the want of equipment in the room. Two names had been specially mentioned that evening—Madame Curie and Professor Rutherford. To the former all honour was due. The latter, as they knew, held a chair at Montreal, and it was fortunate that he did so, for in no laboratory in Ireland would he have found the equipment necessary for the conduct of his experimental work. He might be regarded as somewhat fanatical on this point, but he must say that it appeared to him a national disgrace to any country not to provide adequate opportunities for research into problems which were of interest to every intelligent man, and which had a practical bearing upon almost every department of work. They knew that many of the discoveries of modern science were already largely employed in medicine, and there was hope that some of them might be of even greater utility to suffering man than they had yet been. They ought, he thought, to all try and do their best to remove what he considered a standing disgrace to the country—the want of proper equipment for scientific research. If all their public men in Belfast were as energetic and active in support of scientific research as their present Lord Mayor, who took the keenest interest in scientific work, especially in physical and electrical research, the reproach would soon be wiped out.

The vote was passed with acclamation.

Mr. Finnegan, in acknowledging it, endorsed what Professor Symington had said about their poor equipment in Belfast. In going about the scientific appliance shops in London he had more than once been shown a splendid scientific apparatus which was going out to Mr. Rutherford at Montreal. It was a standing disgrace that up to the present there was no physical laboratory at the Queen's College, Belfast. However, they had been promised such a laboratory by Mr. Pirrie, and when they obtained it he hoped it would be more perfectly equipped with men as well as good appliances.

17th February, 1904.

Mr. William Swanston, F.G.S., Vice-President, in the Chair.

A HISTORIC TRIAL: THE LIMAVADY GOLD ORNAMENTS CASE,

By R. Lloyd Praeger, B.E., M.R.I.A.

(Abstract.)

Mr. Praeger, in the course of his lecture, pointed out that the Limavady gold ornaments case had been in many respects a most remarkable one: The action had been at the suit of the Crown against the trustees of the British Museum for the delivery up of certain ancient golden Celtic ornaments. The matter had originated through the finding by a ploughman named Nicholl in April, 1896, on a farm near Lough Foyle, of the following articles :—(1) A hollow collar, in two sections, with elaborate repoussé ornamentation of eccentric curves; (2) a model boat, with eight thwarts (originally nine) and a number of oars and spars; a hemispherical bowl of thin metal, with four rings at the edges for suspension; (4) a solid gold torc of stout wire, with a thin wire twisted round it; (5) one half of a similar torc; (6) a necklace, formed of three-plaited chains, with a peculiar fastening; and (7) a thin single chain of same plaiting.

The articles were found some fourteen or fifteen inches below the surface of the earth and packed together within a radius of nine inches, showing that they had been deposited there.

The lecturer proceeded to describe how the ornaments were exhibited at a meeting of the Society of Antiquaries of London, in January, 1897, when a paper was read about them, and how the British Museum subsequently purchased them for the sum of £600. The Royal Irish Academy took action, claiming that all such articles should be deposited in the national collection, and five years of agitation ensued. The Government agreed to have the question thrashed out in a court of law, and ultimately the action was brought in the name of the Attorney-General on behalf of his Majesty the King, the trial taking place before Mr. Justice Farwell in June of last year.

The evidence for the Crown and for the defence was fully dealt with, and some of the most interesting extracts therefrom were read by the lecturer.

The questions opened up by that portion of the defence which urged that the articles constituted a votive offering made to a deity at a time when the site was still below the sea, were extremely varied and interesting. Witnesses were examined as to the customs pertaining to votive offerings at all times and in all countries, and a court of law heard quotations from Herodotus, Strabo, and Tacitus, and particulars relative to votive offerings found in Danish bogs, or made at the present day in the Malay Peninsula. The theory of votive offerings was also dealt with by the lecturer.

The geological evidence was also interesting. The fluctuations of level of our coasts since the glacial period were fully dealt with, and descriptions given of the post-glacial series at Belfast, Larne, and elsewhere. The evidence of the age of these movements was argued out, in the light of contemporary human remains.

The result of the trial was that the Judge finally made a declaration that the articles were treasure-trove, belonging to his Majesty by virtue of the Prerogative Royal, and accordingly ordered delivery of them. The final scene in connection with the matter was enacted in the rooms of the Royal Irish Academy at their first meeting this session, when the Academy formally received the articles, and they were now in the National Museum in Dublin.

Professor Boas, in moving a vote of thanks to the lecturer, said the lecture had been a most admirable one, and he was sure he spoke for everyone present when he said they had listened to it with intense interest. Indeed, he had not heard anything so interesting of its kind since he heard Mr. Evans in Oxford give an account of his discoveries in Crete. They had all derived added interest from it by the fact that facsimiles of the gold ornaments had been exhibited that night. He (Professor Boas) had not the shadow of a doubt that the proper home for the ornaments was the Museum in Dublin, where there was a marvellous collection of Celtic ornaments.

Mr. Wilson seconded the motion, which was heartily passed.

Mr. Fennell said that facsimiles of the ornaments were now in the possession of the Belfast Corporation, and might be inspected by those who cared to see them in the Free Library.

Mr. Praeger suitably acknowledged the vote of thanks.

22nd March, 1904.

Professor Johnson Symington, M.D., F.R.S., F.R.S.E., President, in the Chair.

AROUND YOUGHAL AND THE BLACKWATER WITH THE ROYAL SOCIETY OF ANTIQUARIES.

By Seaton F. Milligan, M.R.I.A., F.R.S.A.I.

Mr. Milligan said they were all aware that the Royal Society of Antiquaries of Ireland had stated meetings quarterly, one held in Kilkenny, two in Dublin, and the Summer meeting which went the round of the four Provinces in rotation.

Last year this meeting was held in Munster, and the place selected was Youghal, a very interesting old town. One of the objects of these meetings was to interest the people of the country in preserving antiquities and creating an interest in archæology, which they have done to a very great extent. Their meeting in Youghal was a very enjoyable one, not alone on account of the antiquities, but also on account of the fact that the scenery everywhere was most picturesque. He would attempt to take them in spirit with him to the South of Ireland.

They would first of all go to the city of Cork, and from thence they came to Youghal. On arriving at the terminus and going up the platform, they observed on one side a bay, something like Belfast Lough as it looked from Bangor, but not quite so large, and on their left numerous villas and terraces, usually let as marine residences and lodges for visitors during the summer months, as Youghal was a well-known and largely-frequented seaside resort in the South. The walk from the station to the town proper, fully half a mile or more, afforded a fine view of the bay, the strand, and the town of Youghal lying on the lower ground.

The town, which was picturesquely situated where the Southern Blackwater emptied into the sea, consists of one street fully a mile or more in length, with some small cross-streets at intervals. It has an ancient history, something like that of their own old town of Carrickfergus, but it went further back into the early period of the ancient Celtic Church. Certainly during the Viking period it was an important place, and had a well-authenticated history through the Anglo-Norman period, as its various ancient charters testified. In a town of such a character they naturally expect to find many relics of the past ages, and in this they were not disappointed. The main street was narrow, and about half-way through they passed underneath an arched gateway, on which was erected a building of four storeys, surmounted by a clock tower. The members were welcomed in the Town Hall by the chairman and members of the urban council, who exhibited their ancient charters and various local curios. They were fortunate in having such an intelligent and well-informed guide as Mr. J. C. Buckley, the honorary local secretary of the Society, who was possessed of vast stores of knowledge on all local subjects, and conveyed it to them in most fluent and eloquent language.

Their first, and part of the second, day was passed in examining the antiquities and places of interest, the most important of which was the Collegiate Church of Saint Mary and the warden's house, commonly called Raleigh's House. Portions of the old town hall and the ruins of the two monasteries, called respectively the North and South Abbeys, were still standing. The North was of the Dominican, and the South of the Franciscan order, and the latter was the first house of the order erected in Ireland in the early part of the 13th century by a member of the Desmond family. The Dominican Friary was also founded by another member of the same illustrious family, who owned the town of Youghal and surrounding district. There was also in the main street the ruins of an ancient keep called Tynte's Castle, built in the 15th century, and opposite this was a fine specimen of domestic architecture, built between 1706 and 1715—a fine type of Dutch house of that time.

Youghal was noted for the excellent brick made there, and the bricks in this house may have been of local manufacture, though some authorities said they were Dutch. Hayman in his guide stated that the Church of St. Mary at the north end of the town was founded in the 11th century, and no doubt an earlier church existed on the site and was replaced at that period by a church built in the Hiberno Romanesque or Norman style of architecture. On nearly the same site a new church was erected by Richard Bennett, a knight from Wales, and Ellis Barry, his wife, in 1220. During the rebellion in the year 1579 it was ruined by Gerald, the 16th Earl of Desmond, and lay roofless for a period of 270 years. In the year 1852, the rector, Rev. William Pierce Drew, aided by generous contributions, had the choir roofed and tiled, rescuing it from ruin, but not restoring it to its original beauty. Raleigh's house stood close by St. Mary's Church. It was on record that Sir Walter Raleigh resided here in the years 1588 and 1589, when he was Mayor of the town.

It was from Youghal Edward Spenser embarked when he went to London to publish the first three books of the "Fairie Queen." It was also supposed that the first potatoes planted in Ireland was at Youghal, in the garden attached to Raleigh's house, and also that the first tobacco smoked in Ireland was under the shade of the myrtle trees in the same grounds. The name Youghal was derived from two Celtic words, meaning yew-wood, and certainly the yew seemed indigenous to the place, and grew luxuriantly.

After referring to the industries of Youghal and its history as a trading port, Mr. Milligen proceeded to describe a journey on waggonettes to the interesting places near Youghal. First the Preceptory of Rhincrew, a stronghold of the Knights Templars, said to have been founded in 1183 by Raymond Le Gros, and the ancient castle called Temple Michael, which was erected by one of the Desmond family in the fourteenth century to protect an important ford on the Blackwater. It was battered by Cromwell during his campaign, and the last of the Fitzgeralds who held it assisted Lord Castlehaven in the year 1645 to cross the ferry that he might bombard Youghal. A little further was the ancient Celtic monastery known as the Abbey of Molana.

Driving to Ardmore, Mr. Usher, who is well known in Belfast as local secretary for County Waterford, became their guide. The beauties and the antiquities of this lovely spot would be very difficult to do justice to. Ardmore was a well patronised watering-place for County Waterford and County Cork, and many families from Cork city came there to enjoy the fine sea bathing and splendid air from the Atlantic. The village was built on the high rocky ground overlooking the bay, and at the foot of the rocks was a sandy shore or strand, where the sea was making inroads. On the occasion of his previous visit they were shown as a great curiosity the remains of a crannoge down on the sea shore. The stakes were there, and no doubt that the sea had encroached to where the crannoge was, which was formerly a bog, and some of the peat or turf still remained.

The Holy Well was situated on the top of the cliff, close to the sea side. They usually found an attendant ready to provide them with a drink at this Holy Well. Close to the cathedral was the round tower, St. Declan's Oratory, and the ogham stones. Great uncertainty exists about the date of the birth of Declan, the founder of the Christian Church at Ardmore. Some placed his birth as early as 347 A.D., which would put him before St. Patrick. Be that as it might, at a very early date St. Declan, who was of Royal descent, founded the first Christian Church here, and his oratory, still remaining, was supposed to be the original church. The reputed burial place of St. Declan was within his little church or oratory at Ardmore. It stood about 70 feet from the cathedral, and measured internally 13 ft. 4 ins. by 8 ft. 9 ins., and the walls were 2 ft. 5 ins. thick. The ground had risen from the great number of interments, until it was within a foot of the lintel of the west doorway, which was intact.

The round tower was one of the finest in Ireland, and most graceful in shape. It was 95 ft. 4 ins. high, tapering to the top. At the base it was 17 ft. diameter; at the door sill, internal diameter, 9 ft. 1½ ins.; and the walls 3 ft. 5 ins. thick. The internal diameter at the top storey was 4 ft. 7 ins. It had three projecting string courses, and the internal floors had disappeared. The doorway faced east, and was round-headed, and stood 12 ft. 10 ins. high. There were 4 storeys, an opening to the back storey, and four on the top, facing the cardinal points. The records of the cathedral were scanty. It appeared to have been built originally in the Hiberno-Romanesque or Norman style. The transition from Norman to Gothic appeared in the chancel and its pillars, and, lastly, the east window was of late Gothic.

After describing the interior of the cathedral in minute detail, the lecturer said their concluding excursion was a drive to Lismore, and return by steamer in the evening down the Blackwater from Cappoquin. Lismore, like Ardmore, was a very ancient seat of learning and Christianity, going back to early in the sixth century. The name of a bishop who died in the year 588 was given, but St. Carthagh in the first half of the 7th century was more associated with Lismore as the founder of the cathedral and college. Here was an ancient monkish school similar to Bangor in Down, to which scholars came for general education and to learn the principles of the Christian faith.

The Danes, who came up the river from Youghal, plundered and burnt Lismore in 819, and laid waste the whole country. It was burned again in 869, and plundered in 913 by the Danes. Notwithstanding all it passed through in the Viking period, it arose phœnix-like from its ashes and produced many famous men and great scholars. There were no relics of this early period now remaining, if they excepted the Crozier and the ancient M.S., known as the Book of Lismore, found concealed in a receptacle within a wall of the castle. The crozier was made for a bishop who died in the year 1113.

The only buildings of interest in Lismore were the cathedral and the castle. The cathedral was almost a ruin when Richard Boyle, Earl of Cork, in the year 1633 commenced to restore it. The castle was the most interesting feature in Lismore. Some portions of it were old, but the greater part of it was modern. The site on which it stood was said to have been the monastery of St. Mochuda, and the view from the bay window was one of the finest imaginable.

Having commented on the great beauty of the scenery along the Blackwater, and made some valuable suggestions to intending excursionists to the district, Mr. Milligan concluded by saying the visit of the Society to Youghal was most enjoyable, and they all left feeling the invigorating effect of the fine sea breezes from the Atlantic.

On the motion of Mr. W. H. Patterson, seconded by Mr. Wm. Gray, the best thanks of the meeting were conveyed to Mr. Milligan for his most entertaining and instructive lecture.

26th April, 1904.

Mr. William Swanston, F.G.S., Vice-President, in the Chair.

PRESENTATION TO MR. S. A. STEWART, A.L.S., F.B.S.

The Presentation was made jointly by the Society and the Belfast Naturalists' Field Club on the occasion of the election of Mr. Stewart as an Associate of the Linnean Society.

The Chairman said there was no one in Belfast, or perhaps in Ireland, who had done so much for natural history in its various departments. He had done a great deal for botany and geology, and also, though it was not generally known, for zoology. He stood at the top of the tree in natural history. He (the Chairman) regretted the absence of the President, which was unavoidable, and hoped that Mr. Stewart would long continue to enjoy the honour that had been conferred on him.

Mr. W. J. Fennell said, as President of the Belfast Naturalists' Field Club, he would like to add, on behalf of their members, an expression of the high esteem and regard in which they, one and all, held their old friend and companion. The address was an official one, but no words could justly express their admiration for a veteran who had made no enemies and retained the fast love of a long roll of friends. For forty years he had worked for and with the club, which he helped to found, and now, at last, he had received a high distinction. He was still the living encyclopedia to whom many of them gladly turned when seeking information, which was always cheerfully given. There were comparatively few men whose records were so quiet and so brilliant. Mr. Fennell then read a number of extracts from letters received congratulating Mr. Stewart on his well-earned honour. Amongst the writers were Lady Harland, Sir William Quartus Ewart, Bart. D.L. ; Miss Hodges, Rev. C. H. Waddell, Messrs. James Davidson, Corry, and others.

The Address was read by the Honorary Secretary—Mr. R. M. Young :—

To SAMUEL ALEXANDER STEWART, A.L.S., F.B.S., Edin. ; Curator of the Collections in the Belfast Museum, and Hon. Assoc. Belfast Nat. Hist. and Phil. Soc.

DEAR MR. STEWART,—We the President and Members of the Natural History and Philosophical Society, and the Members of the Belfast Naturalists' Field Club, desire to place on record the high sense of satisfaction with which we have learned that you have been elected an Associate of the Linnean Society, as a recognition of your long and valuable services in botanical research, and we desire to congratulate you most heartily on it. And we trust that you may long be spared to wear your well won honours, and to pursue the studies that have brought you such distinction.

We also request that you will accept this Purse of Sovereigns as a slight token of our friendship and esteem.

We are, dear Sir,
Yours sincerely,

JOHNSON SYMINGTON,
President N.H. and P.S.
ROBERT M. YOUNG,
Hon. Sec. N.H. and P.S.
W. J. FENNELL,
President B.N.F.C.
ROBERT PATTERSON,
NEVIN. H. FOSTER,
Hon. Secs., B.N.F.C.

Belfast, 26th April, 1904.

Mrs. Fennell, amid applause, then presented Mr. Stewart with a purse of sovereigns.

Mr. Stewart, in responding, said it was with feelings of the utmost gratification that he received that complimentary address and its valuable gift. His sense of its value was enhanced by the fact that it came from the officers and members of the two societies which cultivated natural science in Belfast and the North of Ireland. It was a red-letter day for him when he was elected an Associate of the Linnean Society. That the premier natural history association of the country should, without any solicitation on his part, have conferred upon him that distinction came as a surprise, and he could honestly say that it was the most prized of all the honours possible to him. The climax came when the naturalists with whom he had worked so long accorded him the present token of their approbation. He felt that his work had to a great extent now been done. Tate, Robinson, and many others who helped it forward, and who were instrumental in establishing their field club, had gone. They had followed Drummond, Patterson, Templeton, Thompson, and many old-time worthies of the Natural History Society. The associations which they founded, however, remained, and new workers had come and were coming forward. He wished those workers every success, and hoped that in nature studies they would enjoy the same pleasures as had rewarded him.

Mr. John Brown said, he was not a naturalist, but he had for many years been associated with his friend Mr. Stewart in his duties as an official of the Society. He could not allow that occasion to pass without saying that a more sterling man and more careful worker he had never found anywhere.

Mr. Wm. Gray said, he had been associated with Mr. Samuel Stewart since 1863, and could say that that gentleman had maintained the tradition of Belfast for knowledge of zoology, geology, and botany. He was a perfect naturalist, and had always attended to his work with persevering energy, and was in the forefront of anything connected with the literature of botany and the other sciences.

Mr. Joseph Wright also paid a glowing tribute to the merits of Mr. Stewart and the work done by him.

THE NATIONAL EXPENDITURE ON THE MAINTENANCE OF GULLS.

By J. Brown, F.R.S.

(Abstract.)

During most part of last summer I sojourned at a pretty fishing village on our coast where the industry was herrings, the talk was herrings, the very smell was herrings, and when we sailed out of the harbour we were reminded of herrings by the cries of the gulls.

The fishermen said the gulls were playing, but if one knew the views of the baby herrings who were invited to the game, these would probably be comprised in the old saying, "what is play to you is death to us."

The play is thus. The razor-bills and other diving birds with a skill worthy of even a "Bobs" have driven the fry into a little Paardeberg of their own at the surface. The sea has two surfaces, top and bottom. The razor-bill prefers the top for breathing purposes. This suits the gulls admirably, and no quarter is given.

If one stand on the bows of a boat which is rapidly sailed through such a "play" one may see the "ball" of fry a wreathing-writhing semi-solid mass of baby herrings.

Every one of them knows what he is about, and that it is a matter of life or death to him to get as near the centre of the ball as possible. Below the razor-bill awaits him; above the no less pitiless beak of the gull. Truly "Nature is red in tooth and claw."

Let us now become hypothetical and mathematical.

Supposing each bird ate 200 herring-fry in a day, which, considering the activity of the bird and his opportunity and the smallness of the fry, seems a fair estimate, and as his play-time lasts for about two months, it makes 12,000 fry every season. Now let us consider that each of these 12,000 baby herrings would become a mature herring if let alone, and that the average price of herrings on the pier is about £1 per 1,000, we see that the keep of each gull for two months costs the nation £12. What he costs for the other ten months of the year I leave to the officials of the Marine Laboratory at Larne to investigate.

In making this estimate, I would point out that in fishing the product of the business does not, as in the making of shirts and shoes, depend solely on the capital and labour expended. It is chiefly dependent on the available fish in the sea, since the expenditure involved is practically the same, whether the night's take be large or small.

In a paper recently read before the Belfast Natural History and Philosophical Society by Professor Gregg Wilson, the question was asked "Could men over fish the seas?" and, in reply, the learned author said :—Professor Huxley had been of opinion that this was impossible, and that the damage done by man was infinitesimal compared with what was done by other enemies. It was the last straw that broke the camel's back, and if they put on that last straw it made all the difference, and he thought man could play the part of the last straw." Would it not be better to remove the larger part of the whole load, and let man keep, not only his one straw, but more in addition?

Let us consider the amount of the load that might be removed. At a low estimate there might be 100 birds in each play such as I have described, and say 5 plays per mile of coast and taking the coasts of the three kingdoms and adjacent islands, omitting the smaller inlets, as 4,000 miles, we get a total of 2,000,000 birds whose keep for two months in herrings alone would amount to the grand total of £24,000,000 sterling. When magpies and hawks feed on game in the egg or bird, when rats eat the farmer's corn, or mice the housewife's cheese, they are called vermin and destroyed. But when seabirds devour £24,000,000 worth of herrings annually Parliament enacts a law to preserve these seabirds.

In the good old times there was, I believe, a reward of so much each for wolves' heads, and there are now no wolves in these countries. We could hardly hope to extirpate these wolves of the sea, but if the State were to offer $\frac{1}{2}$d. per head, thereby saving £12 worth of herring for each $\frac{1}{2}$d. expended, their numbers might at least be reduced. The shooting of seabirds at $\frac{1}{2}$d each would be a profitable industry, since when crowded in a play a dozen or so might fall to one shot, but even a penny would not be thrown away in purchasing 12,000 herrings.

As to the distribution of the reward, I would suggest that the coastguards have a good deal of spare time on their hands.

Finally, it might not be amiss to add that, as I have been credibly informed, some of these seabirds were quite good eating.

People to whom I had given some hint of the above propositions told me I was a heartless wretch to propose the destruction of the graceful and beautiful seagull. I quite appreciate his grace and beauty, just as I appreciate the glistening gracefulness of the snake or the striped beauty of the tiger, but there were excellent reasons of another kind why I do not encourage those animals on my premises or try to preserve them, as Parliament preserves the gulls about the domain over which it rules.

Professor Gregg Wilson cordially agreed with Mr. Brown that it was far better to destroy the enemies of the food fishes than to limit man in his working; far better to kill a hundred gannets than to starve a few fishermen's families. But it was a very complicated question. If the herrings were allowed to grow unchecked the sea would not be able to contain them, and though he would prefer that the herrings should be eaten by useful fishes rather than gulls, still the gulls did not do so much damage as might appear at first sight. The fuller study of fisheries we had, he thought, the better.

Mr. Wm. Gray said the author of the paper had overlooked one important thing, the utility of gulls' wings, &c., for decorations. He thought the gulls were useful in thinning the multiplication of the herrings, and they should be very careful before they sought their wholesale destruction lest they should injure their fisheries.

Mr. Hamilton said that many seabirds when properly prepared were quite eatable.

Professor FitzGerald pointed out that while no doubt seabirds had fed on herrings for thousands of years and thereby kept a certain balance, in more recent times man had begun to fish also thus disturbing the balance. In order to restore it he presumed some birds would have to be sacrificed.

Mr. W. J. Fennell said by a rather peculiar coincidence he had received a letter that day from an American who had recently paid a visit to Belfast and Portrush, and who wrote protesting against the destruction of gulls.

Mr. Brown in reply, said he felt gratified that the criticism was on the whole favourable, and mentioned that since the paper was written he had observed that the Royal Commission of 1879, appointed to enquire into the Herring Fisheries of Scotland, consisting of Frank Buckland, Spencer Walpole, and Archibald Young, recommended the repeal of the Seabirds Preservation Act so far as it applied to Scotland.

Note added October, 1904.

In the title of this paper it would have been more correct to have put "Seabirds" for "Gulls" since the paper really deals with various kinds of birds.

The numerous notices of the paper published in the press of the United Kingdom would indicate that it dealt with a subject of considerable interest. An article on the subject, revised and enlarged, was prepared for the *Manchester Guardian* of August 8th.

Criticisms for and against were about equally divided. Amongst the latter it was urged that the birds were beautiful, useful as scavengers, and that destroying them was cruel, that if herrings were left unchecked they would multiply till the sea would not contain them, and that the quantity of fry destroyed by birds was exaggerated. The Hon. Secretary of the Society for the Protection of Birds, London, stated also that the cries of the gulls warned the fishermen of hidden rocks and shoals, and quotes some lines in illustration of this idea. It is a pretty poetic fancy, but if the fisherman fled from every collection of screaming birds, he would have a busy time.

It is possible that before the era of lighthouses and steam fog-horns the cries of seabirds may have been a feeble substitute on cliffs on which they were known to breed.

The weakness of these arguments indicates the scarcity of real support for the other side. The amount of scavenging is probably relatively unimportant.

The true objection is doubtless of a sentimental kind, partly based on a feeling that the destruction of seabirds would involve open cruelty. A correspondent of *Truth* points out that this could be obviated by collecting the eggs for consumption as human food.

The author of that trite and obvious statement about unchecked herrings might have chosen a more prolific species, since according to Buckland, the herring has, weight for weight, only one-third the number of eggs of the average of other food fishes, or taking individual fishes, the turbot has 300 times as many. At present navigation is not impeded by any approach to the "stiffening of the sea" by either herrings or turbot.

On the question of exaggeration it is possible that the number of plays per mile may have been overestimated. On the other hand I have not included the fry consumed by the grampus which swallows the whole ball of fry at one gulp, a feat which he can only accomplish after the divers have collected the fry into a ball. Indeed the divers are the chief culprits since they not only consume but also collect for both gulls and grampus, and if a compromise must be made, let us sacrifice them and keep the gulls, if the sentimentalists insist. The question as to whether fish assist in this rounding up of the fry is a difficult one. I have never observed that they do.

In addition there are the depredations of the gannet and the cormorant which devour mature fish. The former will even take the herrings out of the nets as these are being hauled and the fishermen complain, not so much of what they eat, but of what they shake out and lose.

Mr. Herewald Wake, writing to the *Morning Post*, states that for the most part gulls live on crustacea and mollusca, etc., found on mud flats. These, he states, prey on ova and embryos of our food fishes which would almost be extirpated if the mollusca, etc., were not kept in check by the gulls. Mr. Wake appears to base his remark on the old and obsolete theory that fish came into shallow water to spawn. It is now well known that practically all food fishes are known to spawn in the open sea and nearly all kinds of spawn float on the surface, and there appears to be no evidence that ova or embryos are found on mud flats. Moreover, several species of molluscs devoured by the gulls are useful for bait.

As an argument somewhat stronger than any of the above, it was pointed out that if the supply increased the price would fall. But we have to consider that herrings are cured and exported and that the world's population is increasing, and that by better means of transit new markets are opened. Again on the other hand, if catching herrings were easier, less hands and gear would suffice, and so the cost of production be lessened.

It is also stated that gulls devour the eggs of other sea-fowl thus helping toward reducing their numbers.

Several of my critics say that even if the fry escaped the birds they would be snapped up by other fish. The cod, mackerel, gurnet, pollack, etc., being food fishes, may be perhaps forgiven—the dog fish not so easily.

At all events, if the herring has so many enemies the more he needs protection, and as his allies we can best begin with those most easily got at—the birds.

Among the many critics who agreed with my view I may mention Mr. Matthias Dunn of Megavissey, who is evidently well informed on the question of fisheries. Writing in the *Western Morning News* Mr. Dunn takes a view like that of Professor FitzGerald, and points out that a century ago our fisheries were primitive and local, but in the last twentyfour years alone, since the introduction of steam and of cotton nets they have doubled in capacity. As a natural result of this disturbing of the balance the fish are diminishing in numbers, whole areas of the sea are denuded of them, and the fishermen forced gradually to fish farther off, as far north as Iceland, and as far south as Africa.

On the other hand, Mr. Dunn says since the introduction of the close season the birds are increasing. In the interests of mankind they and their associates should be diminished.

Writing to *The Field* Mr. J. Harvie Brown states that certain species of gull, if not all, are far too numerous not only on account of the fish they destroy but other birds eggs and young.

In a correspondence in *The Scotsman* the interest drifts also into the increase of gulls on the upper reaches of rivers and the destruction of trout and salmon fry there and of the young of wild duck and grouse. Four correspondents describe reliable evidence of this and four others express doubts since they have not seen it.

I am informed that the Irish Fishery Board gives already 1/- each for cormorant's heads to save fresh water fish.

It is at all events well to see the subject so widely discussed from many points of view.

J. B.

BLINKING OR ILL-WISHING.

By E. J. M'Kean, B.A.(Oxon.)

The belief in the evil eye is very old and we meet it in diverse forms in Saga and Folktale. Medusa's glance in the well-known Greek story and Balor Beimenach's destructive glare in Irish myth are but instances of it. It is still dreaded, in Italy especially, and in all countries of the world besides. The evil eye is not always destructive: it may be used to divert to its owner things which should have gone to another, and in this it usually is aided by magic ceremonies. This is the form which it generally takes in North-West Europe and which is usually found in Ulster and of this my paper is to treat.

This kind of charming is perhaps the most important department of witchcraft and is possibly the oldest. It involves ideas which belong to an early stage of the human mind. It is simple, another point in favour of its antiquity, and it requires no extraneous aid. The 'blinker' as we call him in Ulster, can act without the help of ghost or devil.

All witchcraft depends on the idea that some men can of their own will alter the courses of nature by dread powers not given to all, and this idea, which long survived the advent of Christianity, fell finally not by persecution but by the fuller knowledge of the universe which science gave. Like drove out like: the new knowledge broke down the older theory of the world.

The English statute against witchcraft was repealed in 1736, and the last condemnation for witchcraft in Ireland took place at Carrickfergus in 1711, yet we still have in our midst a wide-spread belief in 'blinking' and not a few blinkers. The blinker seldom attacks persons but usually seeks to satisfy malice and interest by blinking cattle and "taking the good" of milk or crops. But nowadays the art is degenerating, its outlines are growing dim, and we have to compare what we learn of it with the lore of earlier days, of other nations, or of barbarians and savages, to know fully its meaning.

The blinker may be either a man or a woman and I have not found how he gets his power. Some say he serves an apprenticeship. I have never found any certain way of recognising a blinker. Position is, I regret to say, no security, for in one parish in Co. Tyrone both the collectors in church are blinkers. Undue prosperity is ground for suspicion and it is well to bless the churn and take a 'brash' at it if you happen on butter-making in a house. It is suspicious to smoke when churning is proceeding or to ask a piece of turf out of the fire on such occasions or even to be about if you already have the repute of a 'blinker.' A blinker has power to become a hare at times and this belief is very old and widespread for it is akin to the changes of the werewolf and such like men-beasts and to our enchanted white cats and fox-princes of the nursery stories. Sometimes the blinker uses his powers involuntarily and then we have the evil eye in its simplest and most unmixed form and sometimes it is beyond the will of the owner. So a pedlar assured me that once he saw healthy cattle yield not a drop of blood when bled previous to going to grass, as was the old custom, and this because a blinker was present.

Yet though such is his power to hurt he must generally use some ceremony to get control over his neighbour's kine and their produce. Sometimes he goes to skim the dew of his neighbour's grass, especially on May morning, that day so marked in the Celtic calender when many uncanny things are active. Sometimes he skims the froth off the stream from which the cows drink. Sometimes he takes hairs from the tails of the neighbour's cows and twists them into a rope which he trails over the dewy grass in a neighbour's field. So it is unlucky to lend a blinker anything, especially a piggin or a churnstaff.

All these instances have one thing in common: the blinker wants to establish a connection with his victim, but he is satisfied if he gets something associated in idea with it, and this is the root-fallacy in all witchcraft whether the ill-wisher assaults by the methods above-mentioned or by images of clay or wax or by burning a lock of hair belonging to his victim.

When the spell is done and the cattle are blinked they are distressed and ill and yield no milk, or if they remain healthy and yield milk, no butter comes in the churn. Then either proceed of your own knowledge to cure them or consult a wise man who will probably give you one of two kinds of cure or perhaps both. The first is to watch the suspected person till you are sure of his guilt and then to get him into your house and secretly to cut off a piece of his clothing which is burnt before the cattle. This ends the spell. The blinker is conscious of the burning and will rush out of the house when it takes place.

What has happened is this:—the blinker has something associated with you through which he hurts you: you then get something of his and hurt him through it and you are quits, or it may be you gave his victims strength of the blinker's to make up for their strength taken away.

There is another counterspell which I have not yet met in Ulster but which is so common elsewhere as to deserve mention. The blinker is connected with the milk; well and good! the milk is in connection with him and he shall know it. So take some of the milk and boil it and, if you will, put pins and needles therein. Then he will come bawling to your door and you may make your own terms, for the boiling milk and the pins are causing him most awful agonies. If the cattle yield no milk or have died; burn them or parts of them, and you will easily find and punish the ill-wisher, as is shown in Patrick Kennedy's "Legendary Fictions of the Irish Celts," page 135, and in Rhy's "Celtic Folklore," vol. I., page 304.

The other Ulster cure probably did not once apply to witchcraft but has come from folk-medicine. It consists in transferring the spell from the cattle to a bottle and then burying or hiding the bottle, in one case under a fairy thorn, in another in the suspected blinker's field. Now to get rid of a disease by transferring it to someone or something else is well-known in early medicine, but I never heard of such an idea in witchcraft.

We have many charms against the blinker:—A stallion's shoe, of the meaning of which there is much doubt. Iron is ever a mystic metal, ghosts and fairies may not face it, some say because they are of the Stone Age, but the insistence on the stallion seems to point to more and we may not forget that some races have held the horse sacred. A he-ass is a sure defence, as is a four-leaved shamrock, a holed stone, or in some cases an arrow head of black flint. It is well to milk a heifer at her first milking into a can with a sixpence in it, and it is wise in shooting at a witch-hare to use a silver bullet. Salt is a good counter-charm.

Witchcraft is no new thing and was once in high honour, for in "Irish Magic in the Days of Cormac," an article in the "Dublin Penny Journal," we read that Cormac had invaded Munster and "at last the Druids got new orders from Cormac, and they flung a baleful Druidical breath on the horses, and asses, and cows, and sheep, and goats of Leath Mocha, and their milk was stayed, and nothing was heard through the land but the neighing, and lowing, and braying, and bleating, and sneezing of the cattle." So that blinking is no new thing, and our examination of present day Ulster has thrown light on the Ulster of the distant past when the blinker was a friend of Kings, before Christianity put him under its ban as a servant of the old gods, later identified with the devil.

Yet before we laugh at antiquity for its folly let us look to ourselves. I have heard that one fashionable spiritualist in England, firmly credited by my informant, requires all who would know their future to hold a crystal long in their hands till it is warm and some of their "life-fluid," as she says, has entered it so enabling her to see the inquirer's future in it. Now this is nothing but our old friend the fallacy that Association in Idea is Connection, only that the old hag wears a Worth gown and charges a guinea a séance, which makes a great difference to some people.

REPORT OF DELEGATE TO CORRESPONDING SOCIETIES' CONFERENCE, BRITISH ASSOCIATION MEETING, 1903.

By Professor Gregg Wilson, M.A., PhD., D.Sc., M.R.I.A.

(Abstract.)

I was present as representative of the Belfast Natural History and Philosophical Society, at the First Conference of Delegates of the Societies corresponding with the British Association, on September 10th, 1903. The chief business of that meeting was to hear the President of the Association, Sir Norman Lockyer, and to discuss his proposal for the organisation of scientific workers. Sir Norman advocated the formation of a kind of Guild of Science, whose function should be to promote in every way scientific training. He pointed out that other countries were ahead of us in applying science to industry: that there was urgent need that the claims of science should be pressed upon our government, as many of the responsible authorities knew little, and cared less about science, so that it was necessary to bring home to these the fact that it is the duty of a State to organise its forces as carefully for peace as for war; that Universities and other teaching centres are as important as battleships or big batallions, are, in fact, essential parts of a modern State's machinery.

Sir Norman suggested that the Corresponding Societies working in connection with the British Association might play a great part in infusing a scientific spirit into county councils, town councils, and district councils, and might even control votes in the House of Commons. The future British Association he pictured as a kind of Parliament of Science, dealing with all matters great or small relating to Science.

The discussion that followed was not altogether to the point, but sundry interesting facts were elicited. Principal Griffiths maintained that what we have to do is to educate the man in the street, and convince him that pure science is a good thing for him. The Principal did not seem to think that we could hope to get at the government till the masses were converted. Another speaker advocated commencing with the "boy in the street," and others dealt with their success or their difficulties in working this lowest stratum, rather than with Sir Norman's proposal to force the government to give more help.

Mr. Munn Rankin afterwards read a valuable paper on "The Methods and Results of a Botanical Survey of Counties." He called attention to the great interest of plant-groupings or associations, and showed how new life may be put into the study of systematic Botany by the consideration of plants in relation to their neighbours and their environment. He called upon Natural History Societies throughout the country to do their part in mapping out the areas of the various well-marked associations.

I strongly recommend consideration of this subject to Belfast botanists, and may mention that Mr. Praeger has already taken up the mapping of a district near Dublin in the way suggested.

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Report and Proceedings

OF THE

BELFAST

Natural History and Philosophical Society

FOR THE

SESSION 1904-1905.

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1905.

CONTENTS.

Belfast Natural History and Philosophical Society.

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The membership of the Society consists of Shareholders in the Museum, Annual Subscribers (Associates), Honorary Members and Honorary Associates.

Shares in the Museum cost £7 each. A holder of one Share pays an annual contribution of ten shillings; a holder of two Shares (in one certificate) an annual contribution of five shillings; while a holder of three or more Shares (in one certificate) is exempt from annual payments. Shares on which the annual payment as above are in arrear are liable to forfeiture. The Council retain the right to decline to consolidate two or more share certificates into one certificate.

Annual Subscribers (Associates) pay £1 1s. (one guinea) due 1st November in each year in advance.

A General Meeting of Shareholders in the Museum is held annually in May or June, or as soon thereafter as convenient, to receive the Report of the Council and the Statement of Accounts for the preceding year, to elect members of Council to replace those retiring by rotation or from other reasons, and to transact any other business incidental to an annual meeting. Shareholders only are eligible for election on the Council.

The Council elect, from among their own number, a President and other officers of the Society.

Each Member has the right of personal attendance at the ordinary lectures of the Society, and has the privilege of introducing two friends for admission to such; and he has also the right of access to the Museum and Library for himself and family residing under his roof, with the privilege of granting admission orders for inspecting the collections in the Museum to any person not residing in Belfast or within five miles thereof. The session for lectures extends from November till May.

The Museum, College Square North, is open daily for the admisson of visitors, for such hours as the Councll may from time to time decide; the charge for admission to non-members is sixpence each. The Curator is in constant attendance, and will take charge of any donation kindly presented to the Museum or Library.

Any further information required may be obtained from the Honorary Secretary.

BELFAST

NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

SESSION 1904-1905.

22nd November, 1904.

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TECHNICAL INSTRUCTION IN BELFAST: A RETROSPECT AND A PROSPECT.

By FRAS. C. FORTH, Assoc. R.C.Sc.I., Principal of the Municipal Technical Institute.

(Abstract.)

MR. FORTH began his Address with a short review of the paper he had read before the Society in December, 1901, entitled, "The Municipal Technical Institute: its Aims and Aspirations," touching upon the leading points then discussed, and comparing the work then projected with that which had since been accomplished.

Referring to the class entries for the First Session as compared with the current Session, it was stated that whereas at the end of the tenth week in the First Session the class entries totalled some 3,000, at the end of the tenth week in the present (the Fourth) Session, the class entries totalled over 6,000 (the actual figures being 6,180). The number of students enrolled has proportionately increased, the number now being 4,555, with 103 in the Day (or Trade Preparatory) School; making a total of 4,658 individuals.

With regard to the efficiency of the work of the students it was stated that during the past three years a marked increase had been observed in power of application, in regularity of attendance, and in the interest shown in study; but that comparing the students of the present with those of three years ago, no perceptible improvement was noticeable in regard to the educational preparedness of students taking up science and technical studies.

The evening preparatory classes conducted by the Library and Technical Instruction Committee in the Branch Schools are attended by an earnest body of students, and quite a number of these young people are coming forward to the higher departments in order to study science, technology, or art. The imperfection of training makes itself markedly felt, and to this may be traced a distinct percentage of that falling off in attendance which occurs as the session progresses, more especially in the elementary classes.

Teaching Staff.

A factor which has contributed in a marked degree to the development and uplifting of the Institute's work was the appointment of responsible Heads of Departments. The plan had been followed that as the Institute progressed, and as a Department could fully employ a head teacher, to make the appointment. In this way the chief positions in art, in chemistry, in physics, and in mathematics have been filled; and quite recently a Head of the Textile Department and a Head of the Mechanical Engineering Department have been appointed. The Department of Naval Architecture is not yet provided for; but in view of the immense local importance of the shipbuilding industry it is hoped that the development of the Naval Architecture section of the Institute's work will soon be on so satisfactory a scale as to warrant the appointment of an expert teacher for this section also.

The next point touched upon was the Trade Preparatory Day School, intended for boys who have passed through the curriculum of a national school, and who are intended to enter into industrial occupations. In referring to this the lecturer said he felt on dangerous ground, for possibly no branch of the Technical Instruction Committee's efforts had been more debated and more strenuously opposed than this one, mainly for reasons which it might be said after two years' experience, had been shown to be almost entirely without foundation. Continuing, the lecturer said it was worth devoting a few moments to examining the motives which actuated the Technical Instruction Committee to embark upon this portion of their work. In planning their earlier programme the Committee had recognised that of the 62,000 children on the rolls of National Schools a proportion of boys leave school every year, having no opportunity under the then existing conditions of obtaining a higher education. Of this number a certain proportion must unquestionably enter upon some one or other of the industrial occupations carried on in Belfast and neighbourhood, and the problem was how to provide educational facilities for such boys. The Department of Agriculture and Technical Instruction, as part of its experimental science programme, had arranged a course of instruction in mechanical science, and this course supplied the solution, and enabled the Committee to provide a grade of education not already available. The Trade Preparatory School of the Municipal Technical Institute was accordingly established. Last year some seventy-nine pupils passed through the First Year's course, and this year one hundred and three pupils are entered in the books—fifty-two in the first year and fifty-one in the second year. These boys, after completing their studies, should be found exceptionally useful in industrial establishments, as their training is being made as practical as possible, consistent with due attention being paid to the broader subjects of a general education. It is anticipated that later on these boys will become students of the evening division, and it is hoped to find them carrying their studies further, and incidentally raising the whole standard of the work in the evening classes.

It was stated that at the time of the establishment of the Trade

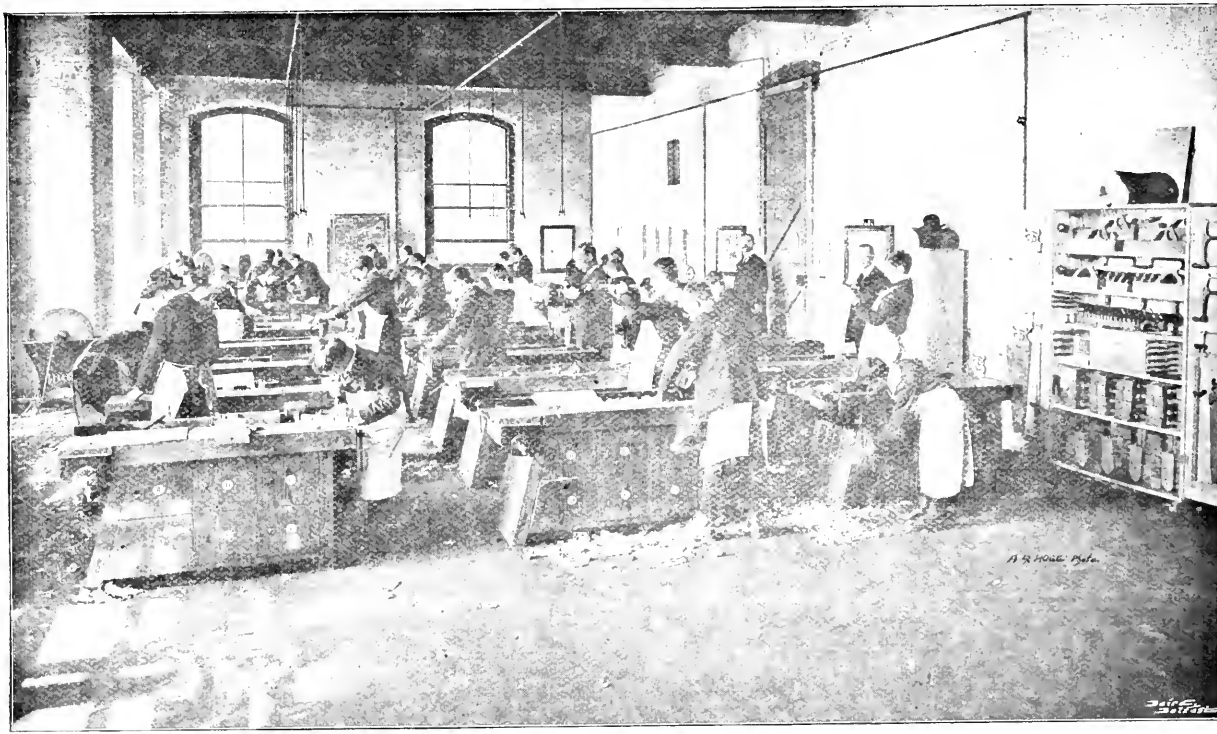
Preparatory School great fear was expressed by those interested in Secondary Schools that the new School would act detrimentally upon existing Secondary Schools; but the question having been looked into with an earnest desire to arrive at the bare facts, it could not be discovered that such injury had resulted, and it was asserted that the fear was rather that it would not be possible within a reasonable time to make up the leeway and fill up the educational gaps which abounded. The view was also given that the Trade Preparatory School, instead of acting detrimentally, is having the very reverse effect, for there are not wanting signs that it has had the effect of stimulating to greater efforts more than one local Educational Institution.

Passing on to the effect of the Technical Instruction Committee's efforts on the life of the city, it was stated that a distinctly increased appreciation was being attached to education in all its phases; as evidence of this it was pointed out that an increasing number of employers are sending their employes to attend classes of the Institute, and are paying the fees, offering prizes, and in other ways encouraging those who have been sent to the School. This interest is shown not only by employers, but is found equally amongst the artizan population, some of the trades societies having gone the length of devoting a portion of their funds to provide prizes to encourage members of their trade to avail themselves of the instruction provided in the Institute. The keenness of the students to secure tangible evidence of their progress is also most noteworthy. The certificates won are greatly valued and the class prizes eagerly sought after. As independent evidence bearing upon these statements and testifying to the general increase of interest in education, the following letters were read. One from Sir William Quartus Ewart as follows:—

Glenmachan, Strandtown, Belfast.

November 19th, 1904.

Dear Mr. Forth,—I am sorry that I cannot be present at your lecture on Tuesday evening. Very few who see the fine



WOODWORKING SHOP TRADE PREPARATORY SCHOOL.

building rising in College Square for technical instruction in Belfast can realise the change that has come over the spirit of the people. For many years a few townsmen—perhaps ten or twelve—who were in earnest on the subject, held their little meetings and gathered in small subscriptions, often with difficulty; they held an annual meeting in the Ulster Minor Hall or other such place, in general thinly attended, and often the little effort was in danger of not surviving for another year. But that small band of men, though disheartened, held on tenaciously. There was the late Sir James Musgrave, Professor Fitzgerald, Mr. R. H. Reade, Mr. John Malone, Mr. H. J. Nicholson, Mr. Loewenthal, Sir James Henderson, Dr. Kyle Knox. There were others equally faithful, whose names do not occur to me at this moment; and my reason for writing this letter at all is to bring forward the fact of how much those who will benefit by the new great School owe to those gentlemen for their foresight and self-denying perseverance.—Believe me, yours very truly,

(signed) WM. Q. EWART.

Another letter was from the Secretary of the Sheet Metal Workers' and Gas Fitters' Union. This letter, after giving infor mation bearing upon the needs of their members in regard to technical education, continued:—"I might also add that the members of above Union have agreed to voluntarily subscribe towards providing a prize for the most successful apprentice."

Referring next to the accommodation provided by the Library and Technical Instruction Committee, a number of lantern views were shown illustrating the extensions and developments which have been planned in connection with the new building in order to keep pace with the growth of the number of students attending the Institute. Particulars were given of the building as first planned by the architect, Mr. Stevenson, in 1900, and these were supplemented with various details in regard to area, &c. It was then shown how in 1901 these plans were found inadequate, and a first extension took place. Another extension was made later, and it was decided to build across the central well and to construct a central hall. Finally, within the past eighteen months, after considerable consideration and examination of the whole subject, the erection of a fifth storey has been decided upon and sanctioned by the Corporation. The total net floor area of rooms as now provided for is 109,000 superficial feet, the gross floor area being 134,000 superficial feet. The total cost of the structure, as now planned, will be about £100,000, exclusive of equipment, furnishing, and lighting. The Committee is making provision for the expenditure upon these additional items.

(Here a number of slides were shown of the site as it stood originally, and also of the different plans prepared for the building, including the present or final scheme.)

With regard to the financial position, it was explained that the Corporation levy a penny rate for technical instruction, and that this rate produces about £4,500 per annum, On condition that this rate is levied, the Department of Agriculture and Technical Instruction make a payment which amounts in the case of Belfast, in round figures, to £11,000 per annum. Added to this there are other sources of income such as fees, science and art grants, interest on sums invested, bringing the total income of the Committee to close upon £20,000 per annum.

It was pointed out that, for each penny raised by the rate, about three pence is received from other sources.

In concluding, reference was made to the day technical department which it is hoped to establish, and also to the development of instruction for apprentices in engineering and other industries.

Mr. J. M. Finnegan proposed a vote of thanks to Mr. Forth for his able and interesting lecture. He said he fully appreciated Mr. Forth's difficulty in regard to the want of preparation on the part of students. Looking back to the time when he was in a national school, he could not find in the higher class of schools at present the same amount of thoroughly good work that used to be done. In many a country national school a boy used to be turned out who had a very good knowledge of algebra, arithmetic, and mensuration. He was afraid in that direction they had gone behind. He had often thought how long must they wait until Belfast got a decent system of national education.

Mr. W. Swanston seconded the resolution.

Mr. Mann Harbison said, at the meeting of the British Association in Belfast, two years ago, they heard a great deal about the co-ordination of education, but they had seen nothing of it yet. With regard to students being properly prepared for entering the Technical Institute, he believed that was quite practicable if it were set about in the proper way. The National Board should look after the matter through their Inspectors, and see that a class of boys in every school was properly prepared in the programme that would be necessary. They might also have co-ordination at the top as well as at the bottom; and if diplomas were given to the technical students, perhaps the Universities might accept from these students one examination, in order to obtain the B.Sc. degree.

Mr. D. B. Elliott said it was admitted that the national system of education was very far from perfect. There was overlapping of Boards, and until the whole system, or series of systems, were swept away, and some national system introduced, they would never have proper education in Ireland. Primary education was most in need of reform. Mr. Forth had justly complained of the want of preparation, but that was not the fault of the teachers. It was the fault of the system.

Mr. William Gray spoke of the necessity of correlation, and advocated the desirability of correlating the Municipal Library, Art Gallery, and Museum, and also the Elementary or National Schools with the other educational agencies embraced by the Municipal Educational Scheme, the ultimate success of which must depend very much upon the efficiency of the Elementary Schools, as the stability of a superstruction depends upon the efficiency of its foundation.

Mr. F. Curley said the success which had attended technical education under the Belfast Corporation was largely due to the course Mr. Forth had pursued from the time he was appointed Principal.

Mr. S. F. Milligan briefly alluded to the efforts made on behalf of technical education before the introduction of the municipal scheme, and said that many more names could be added to Sir William Q. Ewart's list, including that of Mr. William Gray. He also pointed to the warm interest taken in the subject by Sir James Henderson.

Mr. Horner said the work done by the late Sir James Musgrave and others in the old technical school should not be forgotten. As to primary education, unless something was done to free the primary schools from all sectarian control, Mr. Forth could not possibly get into his Institute the class of scholars that he wanted.

Dr. Sheldon made some remarks regarding the correlation of primary with secondary schools. Referring to the Trade Preparatory School, as a ratepayer he objected to maintenance scholarships being provided for other than the clever children of indigent parents. He did not think public money should be provided to keep the child of a man whose salary was, perhaps, much higher than that of the people who paid rates. Maintenance scholarships ought to be given only in cases where the father's salary was decidedly low and the child's talents decidedly high. From personal knowledge he could say that the training given in the Municipal School of Art was highly satisfactory.

The Chairman said, before calling upon Mr. Forth to reply, he would like to refer very briefly to one or two points which had been raised in that discussion. In the first place he certainly thought they ought to congratulate Principal Forth very cordially on the great success which had attended his work in Belfast, and he (Professor Symington) thought that success had been well deserved. Mr. Forth had certainly worked very hard to instil into the minds of a somewhat apathetic public the importance of technical education, and if that Institute did not ultimately turn out a great success, it certainly would not be the fault of Mr. Forth. He was very pleased to hear from Mr. Forth that he attached very great importance, not merely to having a very fine building, but also to having that building properly manned. That was a point on which, he thought, they ought to express themselves in very decided terms, as they knew from the daily papers that objections were made to the supposed high salaries to be given to the heads of departments connected with that Institute. He (the speaker) happened to have had some experience of various Universities in various countries, and he must say everyone who had had experience knew that it was the brains that were required very much more than bricks and mortar. He could point to very finely-housed Institutions which were producing practically nothing on account of the fact that the heads of the departments were not the right kind of men; and he could point to Institutions where the buildings were utterly inadequate for the purpose for which they were designed, but which, through the ability of the men conducting these departments, were of world-wide repute. If the Belfast Institute was to be a success it must be properly manned, and they would not get good men unless they paid for them. It was also necessary that they should not overburden the teachers with work. He trusted time would be allowed to the heads of departments to do some original work. If the Institution was to merely extend knowledge already gained, and had nothing to do with the acquisition of new facts and the evolution of new theories, it would fail in an extremely important function. In conclusion, he would convey to Mr. Forth the thanks of that Society for his extremely interesting lecture.

Mr. Forth, in replying, said he was especially pleased at the very healthy and vigorous discussion which had taken place. He held that the educational question was of such a character that they would only arrive at practical results by free and full discussion. In reply to Mr. Harbison's suggestion, they hoped to issue a certificate that would have a very definite value to students. In conclusion, he thanked them very much for their expression of opinion on his lecture.

20th December, 1904.

Professor Johnson Symington, M.D., F.R.S., F.R.S.E., President, in the chair.

STAINED GLASS.

By James Taylor.

(Abstract.)

This curious and beautiful Art was so long relegated to a position of obscurity and neglect that it may be said to have altogether ceased to exist. In Oxford itself it had so far ceased to interest even Antiquarians that until a few years ago the many beautiful examples of medieval glass in that venerable City had never been so much as catalogued. The modern Revival of Stained Glass as a fine art dates back to the beginning of the XIX. century, the same movement which reawakened interest in Gothic Architecture leading to a corresponding interest in what was supposed to be Gothic Glass. At that time, however, glass was merely welcomed as a helpful accessory in an Ecclesiastical Revival, no idea of developing its use for the legitimate expression of artistic feeling having entered the heads of the Revivalists. The glass worker was neither asked nor expected to utilise whatever talent he may have possessed in his particular craft—the demand was simply for windows which were supposed to resemble those of the XIII. century. That was the first great misfortune which befel the Art; but it was not very long before a still greater misfortune overtook it. Few, if any, real artists were connected with the craft, and as the demand was a growing one, the making of windows fell into the hands of enterprising business houses, who soon began to do a lucrative trade in whatever style happened to be in vogue.

Practically nothing had been done in England until 1838 to raise the standard of Glass painting, or to acquaint the public with its true principles; but in that year, Mr. Charles Winston, of the Inner Temple, who had devoted much time and energy in its study, compiled a treatise in which he classified the various medieval styles on the lines of Rickman's "Classification of Gothic Architecture." This treatise developed into the larger "Enquiry" which was published in 1847, and that work still retains its position as one of the foremost authorities. Winston was one of the first to impress upon the public the self-evident truth that Glass Paintings are likely to rank as works of art only in so far as they are the creation of artists, and he strove incessantly to liberate the craftsmen of his day from the mechanical imitation of ancient workmanship.

Near the close of Winston's career, Mr. Dante Gabriel Rossetti directed the attention of Messrs. Powell, the well-known Glass-makers of Whitefriars, to the work of a young artist—Edward Burne-Jones—whose talents were rapidly obtaining recognition amongst patrons of art. Burne-Jones executed several designs for Messrs. Powell, notably the "St. Frideswide" window in Christ Church Cathedral, Oxford; but his name soon became associated with that of William Morris, who had by this time thrown himself heart and soul into the cause of art, and until Burne-Jones' death, his designs for windows were executed by the little colony of workers at Merton Abbey, founded by Morris. Morris not only brought together a band of gifted men sincerely devoted to art, but he worked in Stained Glass with his own hands, and in co-operation with his friend, Sir Edward Burne-Jones, who, as I have said, furnished the designs, he gave to the world a series of windows which exhibit an originality of thought, a delicacy of expression, and a splendour of colour never before attained by contemporary craftsmen. Old vices die hard, however, and notwithstanding the influence of Winston and Morris, a great deal remains to be done in the furtherance of this attractive form of art. Many popular misconceptions call for correction, and the warfare against the traffic in commercial glass must be carried on almost as relentlessly as ever. The notion that modern craftsmen should model their designs after those of medieval times is still widely held, and although the commercial houses have been compelled to raise the general standard of their work, both as regards colour and design, it still remains true that a large proportion of present-day work is entirely destitute of artistic value. Real progress will only be possible when the public come to understand that stained glass is a decorative art whose expression and application alike are governed by technical conditions, and that the glass painter cannot enter into any sort of rivalry with the painter in oils or water colours. The uninitiated invariably insist on obtaining the effects of pictorial art, but this is exactly what the glass painter cannot supply. The primary object of a window is to admit light and to exclude the atmospheric elements, and the decorative possibilities of the glass are secondary to that object. In so far, indeed, as the glass painter is a genuine artist, his work will frankly recognise and turn to good account the iron bars and lead lines which the untrained mind would so gladly dispense with. Knowing the technical limitations under which his material is applied, his chief concern will be to enhance the beauty of the glass itself. Window decoration of the best kind has always been, and is still, a mosaic art, and the laws of mosaic prevent the glass-worker competing on equal terms with the painter in oil or water colours. To say so is not in any way to despise the power of glass in the hands of a competent artist. Every form of art is more or less limited in its application. The painter in oil or water colours can never attain to the perfection of rounded form produced by the sculptor's chisel, nor can the glass-worker apply his colour with the subtle gradation of tone demanded by the more complicated forms of pictorial art. His composition is executed in innumerable pieces of coloured glass arranged within a framework of arbitrary formation, and such a composition cannot possibly be appreciated or understood if it be thought of as a picture.

Nothing is more striking in ancient glass than the evidence it affords of the primitive worker's grasp of the essential conditions of his art. To him nothing was so priceless as the inherent beauty of the glass itself. All his efforts were directed to bring out the glorious colours of which the material is capable. Window decoration was the object he aimed at—never the making of glass pictures.

Probably the oldest glass to which a definite date can be assigned is to be found in Le Mans Cathedral; but very early windows are to be seen almost everywhere on the Continent (more especially in France), as well as in some of the English Cathedrals. By far the finest ancient glass in existence is in the Cathedrals of Chartres and Bourges; but the student can begin his studies much nearer home. York Minster contains not only a fine example of ancient Grisaille in the famous "Five Sisters" window, but almost the whole field of glass painting from the XIII. to the XVI. centuries is to be found there. Wells Cathedral contains an exquisite "Jesse" window of late XIII. or early XIV. century work, and beautiful XIII. century glass is to be found in Lincoln Cathedral. XVI. century glass may be conveniently studied in the Lady Chapel of Lichfield Cathedral, Fairford Church (Oxfordshire), and King's College Chapel, Cambridge.

But however fascinating the study of ancient glass may be, it must never be forgotten that if the art is to be rekindled into life in our midst, this can only be effected by encouraging the modern craftsman to put whatever individuality he is possessed of into his workmanship. When all is said, the modern worker has many advantages over his primitive rival. He has a much larger range of coloured glass to choose from, and his draughtmanship is incomparably superior. Given a subject suitable to the situation of his window, he is without excuse if he fails to produce an effecting work of art.

Anyone who is inclined to despair of the future of stained glass should see the Morris windows in Manchester College, Oxford, and Oxford Cathedral, or Henry Holiday's "St. Hugh" window in Lincoln Minster. Windows such as these show what the art is really capable of in the hands of artists. They demonstrate conclusively that the chief barrier in the way of progress lies with the public, who go on from year to year filling church windows with the mechanical productions of tradespeople. The charm of stained glass lies in its richness of translucent colour, its tones of glittering contrasts, its solemn splendour and wistful impressiveness. Beautiful, it may be, alike in arrangement and design, but in the final analysis its glory will be found in its colour.

On the motion of Mr. Forth (Principal of the Municipal Technical Institute), seconded by Mr. John Brown, and supported by Dr. Sheldon, a hearty vote of thanks was passed to Mr. Taylor.

4th January, 1905.

THE LORD MAYOR (SIR OTTO JAFFE, J.P.) in the chair.

NATIONAL ANTARCTIC EXPEDITION.

BY HARTLEY T. FERRAR, B.A., F.G.S.

A lecture, illustrated by lantern views, delivered in the Young Men's Christian Association Hall, Wellington Place.

8th February, 1905.

Mr. W. H. Patterson, M.R.I.A., in the chair.

THE WORK OF THE ULSTER FISHERIES AND BIOLOGICAL ASSOCIATION.

By Professor Gregg-Wilson, M.A., D.Sc., M.R.I.A.

(Abstract.)

Dr. Gregg-Wilson said the Ulster Fisheries and Biology Association was started nearly two years ago. It was soon decided to establish a marine laboratory at Larne Harbour with a view to the investigation of local waters. Larne was chosen because the lough offered shelter in almost all conditions of weather and because the neighbourhood was so varied in character that large tracts of sea-bottom covered with mud, sand, gravel, and rocks might be found close at hand. A small house in Ship Street was rented, and fitted with all the necessaries for studying and preserving marine animals. A launch was procured, and collecting apparatus of various kinds. Then Mr. Joseph Pearson, B.S., was engaged as naturalist, and the services of a very efficient boatman were secured. The ordinary work of the Association was largely carried on by means of the dredge and tow-net. With the former the animals that lived on or in the bottom of the sea were captured ; with the latter such creatures as drifted with the tides were obtained. Fishing with larger nets for the more active inhabitants of the sea was practised, and shore hunting with spade or graip or hand-net was also largely pursued. The results of the work of the Association had been many. In the first place, the waters of the Larne district had been sub-divided into areas, and records of all animals found in these had been kept. They were thus gradually getting an idea not only of all the local animals, but of their associations. In the course of this work a considerable number of species not known previously as Irish had been met with, and a few of these had been recorded in the "Irish Naturalist." Further, in connection with the local work it had been found necessary to prepare lists of all known Irish species of some groups, and several such lists had been compiled. One of them—a list of the copepoda of Ireland, by Mr. Joseph Pearson—was now in the printer's hands, and would be published by the Fisheries Branch of the Department of Agriculture. This list would be of great use as showing in handy form the results of all previous work at Irish copepods, besides recording new species obtained by Mr. Pearson. The group was one of the most important for the marine biologist, as members of it were largely fed on by fishes. Besides their lists of marine animals they had now a list of the sea-weeds of Ulster, prepared by a Dublin visitor to their laboratory—Mr. J. Adams. A totally different but equally important kind of work had been carried on by Mr. C. Cunningham, who had undertaken the investigation of the drifts of our waters by means of bottles containing postcards. The bottles were prepared so as just to float, with very little surface exposed to the action of the wind. They were distributed at intervals along definite tracts, and the distribution was repeated with changed conditions of wind and tide. From such work very definite results had already been obtained, and these would soon be published. The facts were important in connection with the drift of floating eggs of fishes, as well as with reference to the movements of minute animals that served as food for fish. A great deal of attention had been given of late by members of the Association to the study of the herring. This fish was increasingly important for Ireland, but very little was really known as to its habits and the reason of its movements. Yet every stage of its life-history offered problems for study. Its eggs were eaten by fishes and destroyed by fishermen, but the numbers of adults were maintained wonderfully. The larval forms and young were consumed in vast numbers by other fishes, by porpoises, and by birds ; and the very interesting question arose as to the wisdom of our not waging war on these enemies of the herring. The migrations for food with a view to spawning were no less in need of study. It was necessary, however, before pronouncing on such subjects to take a broad view of the facts, and the work of the Association would, it was hoped, help them to obtain that. With regard to the future, it might be said that, besides carrying on the present investigations, it was proposed to make a special study of plant associations in their waters, to greatly extend their work at Lough Neagh, where pollan, eels, and mysis all were attractive, and to endeavour to secure for the Association a new and suitable laboratory at Larne Harbour. That would be of the greatest service to workers, and would probably be of great use for future teachers of nature knowledge.

Mr. John Dickson, in proposing a vote of thanks to the lecturer, urged the necessity for a thorough investigation into the question of fish food and spawning. By so doing the Association would confer a great benefit on both Irish and English fisheries.

Mr. William Faren formally seconded the motion, which was passed.

Professor Gregg-Wilson briefly replied.

14th March, 1905.

PROFESSOR JOHNSON SYMINGTON, M.D., F.R.S. F.R.S.E., in the chair.

WITH THE ROYAL SOCIETY OF ANTIQUARIES (IRELAND) ON A CRUISE ROUND THE IRISH COAST.

By S. F. MILLIGAN, M.R.I.A., Vice-President for Ulster.

THE cruise, which commenced on 21st June, 1904, was the fourth inaugurated by this Society, and was a source of undiminished pleasure to all concerned.

There were two previous cruises around portions of the Irish coastline, and another to the Hebrides, but this was the first occasion on which a tour was made all round Ireland from Belfast to Kingston, going by the North, the Western, and Southern shores, and calling at all points of special interest *en route*.

The s. steamer "Magic," belonging to the Belfast Steamship Company, started at 10-0 o'clock a.m. with about 140 members, including a number of the members of the Cambrian Society, who were privileged to join.

The sail along the Antrim Coast was very pleasant, as the course was quite close to the shore until Rathlin was reached, when a stop of about two hours was made. The vessel anchored in Church Bay, close in, and a good view of that part of the Island was obtained.

It had been arranged to land here, but when it was considered how few objects of antiquarian interest were within reach, it was decided by the majority that we should proceed around the North Coast as closely as possible and enjoy the view, the weather being most favourable. Fair Head is always a most striking object on the Northern coast, and looked very fine on this occasion. The headlands of the Causeway soon came into sight, and an extremely fine view of it was obtained, as well as of the White Rocks towards Portrush. After passing quite close to the well-known Northern watering-place, the vessel steamed straight for Malin Head, the most Northern portion of Irish land. There is always, even on the calmest day, a jumble in the water between the Island of Innishtrahull and Malin Head, and the present was no exception. We soon entered Lough Swilly and got into quiet water, anchoring close to the little town of Buncrana. It was a lovely moonlight night, and a large number, after dinner, landed to inspect the town of Buncrana, which is a charming little watering-place, with good golf ground, connected with Londonderry by rail, from which it is distant about 15 miles. The castle of Sir Cahir O'Doherty is the principal object of interest at Buncrana. Sir Cahir was a notable personage in Innishowen in the days of good Queen Bess, and his castle and grounds are now owned by Mr. Richardson, of Belfast. Lough Swilly is notable in Irish history as the place from which the Earls took their flight from Ireland—viz., Tyrone, and O'Donnell. It was also from here that young Hugh O'Donnell was enticed aboard an English merchant ship, and conveyed a hostage to Dublin Castle, from which he afterwards escaped. The scenery of Lough Swilly is very fine, high mountains surrounding it on all sides, and the entrance and some of the islands are strongly fortified, so that it can be used as a naval base in time of war.

We left Lough Swilly early on the morning of Wednesday, 22nd, for a very long sail—viz., for Blacksod Bay on the coast of Mayo. A delightful view of the coast of Donegal was obtained, also of Horn Head, and on to Torry Island, on which, however, we did not land, having visited it before. A view of ever varying beauty was unfurled as the vessel's course lay along the indented coast of Donegal, passing Glen Head, and reaching Slieve Liag, to which we approached very closely, and a fine view was obtained of these noble cliffs, rising 2,000 feet in perpendicular height, and extending for miles in length. The course was now for the Island of Innishmurray, in Sligo Bay, a veritable storehouse of ancient Irish structures, and which we visited in 1895. It contains a cashel, in which are bee hive huts, ancient churches, standing stones, and altars, dating back to Pagan times, all of which have been minutely described in our transactions.

The kindness and hospitality of the people is well known, and many old customs still continue, including the use of stone querns or hand mills, which are still in use.

We left the Island about 6-0 o'clock p.m., and steered for Blacksod Bay, which was reached at 10-0 p.m. Here we anchored for the night in perfectly smooth water, being protected by a long strip of land called the Mullet, about eighteen miles in length, running north and south, and giving perfect shelter from the Western Atlantic. The Island of Achill lay south of us, and the huge mountains of Slieve More and Crohaun rose high in the moonlit sky, and added greatly to the charm of the scenery.

Next morning, mid-summer day, we called at a little village called Falmore, and examined the ruins of an ancient church and a holy well close by the church. The latter possesses many points of special interest. We continued our course around the great cliffs of Achill, and entered Clew Bay, making for Clare Island, which we reached in the afternoon, and landed. We visited a little village where are the ruins of Grace O'Malley's castle, and walked across the Island for a couple of miles to the ruins of a small Monastery of the Cistercian Order, which is probably early 15th century date.

The Congested District Board have bought the Island, and divided it into separate farms, and have in many ways greatly benefitted the inhabitants, who are now fairly prosperous. We procured a pilot at Clare Island, and sailed to the opposite coast of Mayo, and entered the well-known estuary of Killery Harbour, which runs up amongst the mountains for fully seven miles from the sea. The great mountain of Mweelreagh, 3,000 feet in height, guards its entrance on the northern side, and as the vessel proceeded amongst the hills a scene of ever-changing beauty was presented to the view. The Channel Fleet, some nine large vessels, have gone up the channel and anchored almost within sight of M'Keown's Hotel at Leenane.

When we anchored, a steam launch belonging to the "Magic," with a number of life-boats in tow, proceeded and landed us close to the hotel. Being Mid-summer Eve, a number of Baal fires were burning on the high grounds all around, a custom which is not yet abandoned in the Irish-speaking districts of Ireland. Leenane is the finest centre from which to see Connemara; tourist coaches pass to Westport and to Clifden, there is good fishing, boating, and shooting, and splendid mountain and sea air.

The party enjoyed themselves at Leenane, where there were Irish fiddlers, Irish jigs, and Irish songs galore. An early start was made next day, after taking in a supply of salmon fresh out of the water, fresh meat, eggs, &c., which had been previously ordered. The Arran Islands was the next stopping place. Innishmore, or the great Island, was reached early on Friday, 24th, and on the remainder of that, and the following day (Saturday), was spent visiting the points of interest in the three Islands; but as they have been so frequently described, we shall only add that for very early churches and prehistoric forts they stand unrivalled in Europe. On Saturday afternoon we sailed up to Galway City, and anchored at Mutton Island. A number of the members visited the city on Saturday evening, and also on the forenoon of Sunday to worship in the various churches. A special early service was held in St. Nicholas' Church for members of our party, at 8-o a.m., and a great many attended and greatly enjoyed the service.

We left Galway at 3-o o'clock p.m. on Sunday, and sailed direct for Dingle Bay, anchoring for the night in Ventry Harbour. The magnificent panoramic view of the Western coast of Ireland from Galway Bay to Dingle, on a brilliant day in June, sailing close to the coast, is one which will never be forgotten by those who were privileged to see it. We passed close to the cliffs of Moher, and saw Kilkee shining brilliantly in the sunlight, and on southwards past Tarlee Bay, Smerwick Harbour, the vast mountain chains of Slieve Mish and Brandon, ending in Brandon Head. Before entering Dingle Bay the group of islands known as the Blasquets were passed, and then Ventry Harbour. Here we anchored for the night: the moon was full and shining brightly, the little inlet was unruffled, the tide flowing gently in, and on board a choir of ladies and gentlemen singing hymns, being led by a lady at the piano—the whole was soothing and restful after the week's excursions.

Next morning, after landing, a start was made. We had a walk before us of six miles, as no vehicles were obtainable. The walk led along the coast from Ventry to Dunmore Head, and the whole coast line was dotted with prehistoric buildings, bee hive huts, in groups and singly, between Dunbeg and Dunmore. It is an Irish-speaking district, English is not spoken or understood except by some of the children, who speak both tongues. Space will not permit any attempt at describing the unique fort of Dunbeg, which is a fortified headland, or the lovely scenery or the bee hive huts, which have been called the ruined City of Fahan, in the district of Glen Fahan.

The steamer followed us, and we embarked in boats at a pier built by the Congested Board, and rejoined the "Magic," starting at once for the Skellig Rocks. A boat load of about twenty-eight persons got landing on Skellig Michael, of which the writer was one. It was intended others should follow, but when the sailors who landed our party returned to the ship, they refused to bring any more out, saying it was too great a risk. It was a great disappointment, but I believe the sailors acted wisely, as the landing place is very dangerous. The walk up the cliff, cork-screw wise, and then the final climb to the top of 650 steps, or rude stone stairs, required good climbing powers. The view was glorious beyond description. There were birds everywhere, the only occupiers besides the birds being three lighthouse keepers. The smaller Skellig was white as snow with the birds, which are very tame, and would sit on the rock till touched.

We rejoined the ship, happily without accident, and the visit to the Skelligs terminated. Many were disappointed at not landing, but that could not be helped. We continued our course, and entered Bantry Bay, one of the finest, if not the very finest, in the United Kingdom, and sailed past Beare Island, anchoring close to Glengarriff. The Channel Fleet was lying at anchor in the bay—some ten vessels—as we passed, which added very much to the effect, combined with the splendid scenery.

On Tuesday morning we left Bantry Bay, calling at Clear Island, and afterwards at Baltimore, the great fishing village of the South. On an island here is Sherkin Abbey, built for the Franciscan Order. We left Baltimore for Cork Harbour, which we reached after a fine sail along the South Coast, in the track of the American liners, one of which we passed. We stayed at Queenstown for the night, and left the following morning, calling at Ardmore, in County Waterford, to visit the ecclesiastical antiquities of that well-known place—viz., round tower, ancient church, and 15th century cathedral, holy well, &c. We next called at Bag-in-Bun, in County Wexford, the spot where the Anglo-Normans first landed in Ireland, and after examining the earthworks supposed to have been made by Raymond-le-Gros, we proceeded to Kingstown, which was reached as the clock at the harbour was striking 9-0 p.m., the hour arranged in our programme before we started. The English and Welsh visitors remained on the "Magic," which proceeded direct to Liverpool, and the others proceeded homewards by rail. Thus ended the most delightful cruise that the Society have so far carried out.

4th April, 1905.

Professor Johnson Symington, M.D., F.R.S., F.R.S.E., President, in the chair.

RUSSIA: ITS PEOPLE AND POLITICS.

By John Horner.

(Abstract.)

Mr. Horner said at the present time, when Russia was absorbing so much of the attention of the world, it might be considered not unprofitable to initiate a discussion with the object in view of arriving at a better understanding of her people and her politics, and of forming an opinion of the mighty struggle for mastery in Asia with somewhat less of partiality. It was difficult for them to look upon Russia in any other light than that of a hereditary enemy, whose aggression would interfere with their established rights, and it must be confessed that fears of such aggressions were not unfounded, for Russian Foreign policy from the time of Peter the Great had been one of expansion. Up to the 16th century little was known to other European nations of that great country; its intercourse with them was thus of comparatively modern origin. The various events relating to the Russification of Poland and Finland having been referred to by Mr. Horner, he showed that for the absorption of those countries Russia was defended by reasons geographical and strategic. Although they looked with suspicion on her southward march, they must in full justice give credit to her for keeping alive the spirit of Christianity in the Balkans. An impartial study of the history of Turkey and her dealings with her Christian subjects would show conclusively that Russia's interference was not one solely of land-grabbing. Her motives were higher, and those motives seemed to be recognised when in her last war with Turkey Europe stood aside and permitted the Turk to receive the chastisement he so richly deserved. Turning to the acquisitions of Russia in Asia, and tracing them step by step through the vast continent, they found Russia now at the Pacific Ocean and face to face with Japan, a foe more formidable than any she ever faced in Europe. Russia's first advent in Asia began in the early part of the 18th century, although long prior to that time a considerable fur-hunting trade had been established. Her march through Asia had left in its train order and civilisation. It was but natural that a great and civilised Power like Russia should extend her influence over Siberia, bringing under subjection the barbarous hordes which for centuries had run riot. They, therefore, found along the line of the trans-Siberian Railway flourishing towns endowed with universities and first-class educational establishments and technical schools of a high order, and as a natural consequence of those manufacture, trade, and commerce extending. The barbarities which made Central Asia a hell upon earth had passed away, and the horrible tortures perpetrated had been abolished. Russian rule in Mohammedan Asia kept in check any possibility of a pan-Islamic movement of the Crescent against the Cross, which the fierce religious fervour of the Mussulmans was only too prone to bring into great activity. A spark would set the movement ablaze but for Russian power, and start again the vengeful wars and cruel massacres which for centuries were rife in Turkestan. Let them glance at the present war and the probable outcome of its results. Russia, as shown, had marched steadily across Asia. Her work in reducing to subjection the numerous tribes which opposed her path had been fraught with great benefit. A huge railway had been built at a cost of £100,000,000 sterling, which enabled the Atlantic and Pacific to be united across two continents. This work had been done at the cost of valuable life and treasure, and the natural return for all this outlay was a free Pacific seaboard. The trans-Siberian Railway was built politically for Russia, commercially and practically for the whole of Europe. The trade which Russia had opened up in Asia was carried on in a greater degree by Europeans. The railway gave a great stimulus to that trade, and the result of the present war would probably lead to the abandonment by Europe of a commerce which had every prospect of being large and profitable. A momentary look at the commercial relations of the two contending Powers with other nations would serve to explain what was meant. Russia was free to foreign enterprise, as free as Britain or the United States. Most important manufacturing interests were owned by these countries and other nations, notably France, Germany, and Belgium. Flax and cotton manufacturing concerns, machine works, and other commercial and industrial enterprises were owned and controlled by different nationalities, every facility being given and every protection accorded. Besides this, Russia was a good customer to other European States, consuming some £70,000,000 sterling of goods annually. What of Japan? European trade there was very limited. The Japanese were rapidly becoming dangerous competitors. Commercially, Japan was closed to foreign settlement. No foreigner was allowed to own land or engage in industrial pursuits. The natural imitative faculty of the Japanese enabled them to produce goods of European design, stamped with European trade marks, perhaps not yet equal to European standard, but quite good enough for Asiatic consumption. Our vast floating capital, with loss of interest and freight and insurance charges, was saved. A Jap would live at one-fifth the cost of a European. Consider, then, that Japan was making all and more than she needed for herself how enormous were the advantages she had against her competitors in Asiatic markets. They had often heard of the yellow peril and of the possibility of the Mongol race one day dominating the world. Did there not seem a possibility of Asia being commercially dominated by the yellow race at no very distant period of time. Once Corea and Manchuria got into the hands of Japan or under Japanese jurisdiction, the outlets of the trans-Siberian Railway would be theirs at the expense of Europe. The Mongolian Powers were geographically divided. Manchuria stood between Japan and Corea and China. Manchuria in the hands of Japan would remove this impediment, and a victorious Japan, with all the power and prestige gained by war, would be in a position to undertake the regeneration of the Mongolian people. When the countless millions of China were brought under economic and military organisation by Japan they might say good-bye to European prospects, commercially or otherwise, in Asia.

Agriculture was the main industry in most countries, but more especially in Russia, where the peasants numbered 82 per cent. of the entire population a proportion somewhat similar to Ireland, and the agrarian question there, as with us, was the most important question of internal politics. A character sketch of the peasant serves as a sketch of the people. One thing which impresses a stranger was the extreme devoutness displayed by the people. A Holy Shrine was never passed without due reverence being paid to it; the churches were filled with kneeling, prostrate forms. Naturally one asked the question—Was all this real? Tolstoi said it was. On the other hand, a Russian historian stated that the people were remarkable for a state of religious indifference, as to be without parallel in the annals of Christian nations. These opinions appeared conflicting, but if analysed showed a harmony. The Russian peasant was undoubtedly indifferent to religion, as we term it, for the simple reason that he did not understand it; but apart from religious doctrines, he carried with him into his everyday life the moral principles which regulated the relations between himself and others. The want of religious knowledge—of theology—was to be attributed to the relations existing between the peasant and his priest, or pope, as he was called. It was an extraordinary fact that the Russian revered his church and despised his priest. There was undoubtedly no spiritual relation between the Moujik and his pope, the latter had no influence, moral or otherwise, over the masses, and enjoyed no confidence among them. They were looked upon by the people simply as traders, who made a profit by performing the Sacraments. Beyond such functions the power of the priest was not felt. It was said that the Russian Moujik may be called religious if the term is applied to social philosophy based on ethics, and not on theology. There was a system of moral principles dominating the life of the Russian peasant which, from whatever cause it sprang, may be termed religious, although it may be apart from any religious doctrine. The moral principles taught by the church have been inculcated, owing probably to the fact that the people were predisposed to accept them, although they seemed to have little conception of the general structure of their religion. Living in communities as they did, they were loyal to each other, and more than charitable, not alone to members of their own class. One writer spoke of "The wonderful preservation of the purity of the moral character of the Russian people through such a terrible ordeal as three centuries of slavery, which passed over without ingrafting into it any of the vices of slavery 'could find no other explanation than this,' the peasant was never separated from the ploughshare, from the all-absording cares and poetry of agricultural work." There was one vice, however, to which the Russian peasant was addicted—viz., that of imbibing strong drink when he has money enough to give him the opportunity. The Government was now grappling with the question, and had succeeded in mitigating the evil considerably. It was to be wondered that in the midst of all his surroundings the Russian peasant was what he was—good humoured, kindly, sociable, and hospitable. His privations were often great, his earnings at the most scanty. Hygienic arrangements were poor, and disease and death rife, and still he remained working hard for mere existence, and fighting his terrible winter with a dignity all his own. A Russian writer thus spoke of him: "Through all the varieties of types, tribes, and past history, the millions of our rural population present a remarkable uniformity in those higher general ethical and social conceptions, which the educated draw from the divers social and political sciences, and the uneducated from their traditions, which are the depositories of the collective wisdom of past generations." Statistics recently taken showed only 20 per cent. of recruits literate. This is a most deplorable state, but it seemed to point to what the future of Russia must be when some 60 millions of her peasantry received the benefits of an education which would enable them to rise to a sense of their duty to their country and themselves.

President Hamilton said he was not one of those who were possessed by a great admiration of Russia. Mr. Horner, he believed, was, as he knew from personal conversation with him. But it did not seem to him that the Russian Empire ought to be very much an object of admiration. One ought, however, to draw a distinction between the moujik and the empire. The Russian peasant was all, he thought, that had been claimed for him by Mr. Horner—a well-meaning, honest, ignorant man—but, taking the country as a whole, it seemed to him (the speaker) to be a vast, unwieldy mass of semi-educated, semi-barbarous people, governed, he supposed, by one of the worst systems of government which had ever cursed a nation. Mr. Horner had held up before them a picture of what might happen to them from what was currently described as the yellow peril; but he did not know that they need very much dread the ascendency of the yellow race if that yellow race was to be such a people as they had seen in recent years the Japanese prove themselves to be. It might be that Russia could call itself Christian, while Japan was not Christian; but he confessed if he had to make a choice between seeing Asia dominated by a Christian nation of the type of Russia, or by a non-Christian nation of the type of Japan, he should not for a moment hesitate to choose the latter. They had within the last year had a marvellous revelation of what a little nation by means of education, by means of a splendid patriotism, and by means of adapting itself to Western ideas, had been able to accomplish in a short space of time. He very much questioned if throughout the entire audience that evening there could be found half a dozen people who would prefer to see Asia ruled by Russia to Asia dominated by ideas and sentiments such as they had seen put to the test in the case of Japan. He had been very much interested in the latter part of the paper, in which Mr. Horner had described to them so vividly and accurately the internal economy of Russia; and, although many of them differed from the lecturer, they were indebted to him for the mass of information he had placed before them, and for the pains he had taken to give it to them in a manner so succinct and interesting.

Mr. William Armstrong asked if it was not the case that the import duty in Russia was heavier than in Japan.

Mr. Seaton F. Milligan said Mr. Horner had not dealt with a subject which he expected to gain some information upon; that was as to the system of bribery and corruption which was so flagrant in Russia. He believed the Japanese would be a Christian nation before the end of this generation, and that the danger of the yellow peril referred to by Mr. Horner was not so great as he represented.

The Chairman regretted that Mr. Horner's paper had not excited keener discussion. One would have thought it was only necessary to mention the name of politics in this town to provoke very keen discussion, and apparently they had fallen upon very peaceful days.

In replying, Mr. Horner said he had purposely made the paper pro-Russian to evoke discussion. There was a feeling of antagonism to Russia which he honestly believed was not a true one. There was no question, he thought, that the Mongols despised the European races. They had a religion, a philosophy, of their own which was far older than theirs, and they looked upon it with so much reverence that he very much feared that the next generation would not see the Mongol races Christianised. Even the civilisation which Japan had copied showed that that country was open to adopt what she might consider right for her best interests, but she had not copied their philosophy or religion. Mr. Armstrong had asked regarding the duty versus Russia and Japan.

He could not say, but he believed it was a fact that Japan's imports were small in comparison to Russia's. Japan was practically making everything she wanted. Mr. Milligan had alluded to bribery and corruption. He had not referred to that subject owing to the exigencies of time. He had stated that the Government of Russia was one of the worst which ever cursed a nation. He thought the bribery and corruption which came from that system of government could not be defended by him or anyone else. Bribery, which at one time was exceedingly rife in Russia, was largely diminished during the reign of Alexander III., who did much to purify Russian officialism in this respect. Mr. Horner proceeded to defend the Russian Church from the charge of intolerance, and in conclusion referred to certain authorities, the reading of which he was sure would give them a more favourable idea of the Russian people.

IRISH GHOST-LORE.

By E. J. M'Kean, B.A., B.L.

Even the most superficial collector of Irish folk-lore cannot fail to see that in Ireland we have a really enormous number of ghost stories. This statement is true of all parts of the island, and these stories have been greatly neglected.

Our Irish ghost-lore is scattered broadcast through town and country. Perhaps no Irish town is without its ghost or spectre, or at least a phantom carriage. Probably it is not too much to say that every country parish has its "bad spot." A "bad spot" means an uncanny place where eerie things happen, nothing very alarming, but plenty to cause goose-flesh. These "bad spots" are generally on the roadside, and often enough no one knows how they come by their reputation.

There are, too, abundant stories of wraiths. In and round Belfast it is said that to see a wraith in the morning is of good omen, and fortells a long life; but if seen at night it bodes death. W. S. Smith, in one of his pamphlets, says "sudden death," but I have never heard of this belief, if he does not mean "speedy death." A Waterford working-man told me that the wraith is seen seven years before death, during which time the doomed man or woman "is with the fairies."

The stories I am going to narrate all came under my notice as I was collecting folk-lore, and most of them are, so far as I know, quite new. One of the tales is indeed well known, but I think I am justified in telling it once more to a Belfast audience, if only to show that it probably still lives in tradition.

A ghost said to be well-known in several parts of Ireland is Petticoat loose. There is a story that she is a woman who danced her feet off, but this tale I have on no authority, nor do I know whence the account comes. She used to appear at one place near Dungarvan, County Waterford, and the Waterford man above-mentioned told me she haunted a road near the town. So strong and fierce was she that she would kill passers by at her caprice. She also at times jumped up on a horse's back behind butter kegs going to the market, and so heavy was she that she sometimes killed the horse. At last a priest laid her "by his calling," and she is now at the Red Sea making ropes of sand.

Dublin has a copious ghost-lore, but I was unfortunately not much with those who could best tell me it. For this reason I have been obliged to pass over many tales as worthless to me because I know nothing of their origin, or because they are obviously either made or moulded by educated persons. Still, one fine day late in October, 1903, I walked up past Glasnevin Cemetery, and found a labourer leaning against the bridge over the Tolka. He after some time yielded me up the following two stories:—

There was a house near Glasnevin supposed to be haunted. Some people took it, and one evening when a little girl was there alone a man, or woman, in white came out of a door of one of the rooms and blew at her. The child pined and died. The tenants got a priest to come and say Mass in the house, and since then it has been quite safe.

He also told me that his grandfather, who lived to be over a hundred, said that once in his youth he knew a man named Mike (I am not quite certain of the name). This man had a piece of land near Glasnevin, and employed there a labourer named John Byrne, who was with him a long time. This Byrne had a daughter who died. Some four years after her death Mike was going along the road to his field, and, as he thought, passed the girl. He wondered, but went on. On his return he again met her, and said, "In the name of God, is that Maggie Byrne?" "It is," said the girl. "But I thought you were dead." "I have been dead four years: but don't be afraid! Take your boots off, turn them upside down, and stand on the nails." She then asked him to do for her some commission, which he never told; and she further told him that he would be dead within twelve months. 'And sure enough, he died on that day twelvemonth.'

There is a belief in Dublin that to have any dealings with a ghost means death within the year.

Another town of superstitions is Drogheda. There is a ghost in the barracks there, said to be that of the occupant of an old barrow on which part of the barracks is built; and a fairy dog is seen in one of the streets at twelve o'clock each night. The following story was given me by a servant coming from this town: A landlord in the neighbourhood of Drogheda, as he lay dying, had all his live-stock brought under the window of his room, where he could see them. As he died, he exclaimed, "—town, beautiful —town! how can I leave you?" After his death "his spirit" haunted the place for many a day. It attacked men in the grounds and "walloped them so that they never got over it." No one could live about the place, and priests were got to lay the ghost. The first ten or eleven priests were unsuccessful, and none got over their dealings with the fierce spirit. The eleventh or twelfth priest succeeded. When the ghost saw him, "having got leave to speak," he said, "You're the man for me." The priest got him into a "wee red house" that had been built on the hill, and there he remains. He was the great-grandfather of the present owner of —town.

Belfast is a more modern city than any of these three places, yet it has its ghost stories.

Donegall Street has had its ghost, that of a well-known Belfast-man, who was seen after death walking about his office and sometimes coming to the window and looking out. He always appeared after nightfall, and was always in evening dress.

Another ghost came every night for his horse. He was not seen, but at twelve o'clock each night three blasts of a horn were heard, the horse went out of its stable, and was afterwards found covered with mud. This ghost was laid by a priest, as I was told by an old beggarman. The priest—who was afterwards Roman Catholic Bishop of Belfast—laid the ghost by long fasting and prayer. He fasted four days, "reading" all the time, and the ghost appeared to him. He then compelled the ghost to enter a bottle, but without saying a word to him. "The Word" was sufficient, says my informant. The priest then banished him in the bottle to the Red Sea, where he is to remain for the rest of his "natural life," which was explained to mean "as long as there were people living on the earth."

There is said to be a tombstone in Newtownbreda Churchyard laid flat on a grave. This covers the bones of a man who said that whatever was done he would not rest quiet in his grave. His wife was resolved that he should, and laid a heavy stone above him. But the restless ghost is always struggling to escape, and, it is said, has already broken two tombstones, and by this time has succeeded in cracking a third.

A servant girl told me that there is a ghost laid in Ballydrain Lake. She did not know much of the story; but it seems this ghost used to appear frequently to a Roman Catholic girl who lived near the lake. She complained to her priest, who asked her where she would have it laid. She told him to lay it in the lake, and it was laid there. Many are afraid to pass the place after dark.

From the same girl I got an account of the best known of all our local ghosts—James Haddock. She gave me the traditional account; but as she told me she got it "from a newspaper, and also from hearing people talk about it," I cannot be sure that the tradition is still current in the countryside.

James Haddock, of Drumbeg, at his death, told his wife to keep his farm till his son was twenty-one, and then to hand it over to him. Instead the wife remarried, had a second family, and with them continued to live on the farm. At this Haddock came to a man whom he met on horseback on the road, and told him to tell her to do as he had desired. If she refused, the messenger was to tell her "that he (the ghost) would wreck the whole place." The ghost got up behind the rider to tell him this. At first the man did not go, and Haddock appeared to him several times, the second time "at a dinner-party, when he went into a room by himself." The haunted man went at last to the lawyers, who laughed at him and asked him for his witness, refusing to pay heed to the ghost. The disappointed suitor then went back to the ghost, who said, "They were to call him three times, and he would appear in court" as a witness. The triple call was made, and "a hand and part of an arm appeared and struck the table three times," so that the court shook. The lawyers then believed, and gave the lad the farm. The man went back, and the next time he met the ghost asked him if he was satisfied. The ghost said he was, and thanked the man greatly. Some one had put the man up to ask the ghost whether "he was happy," but the ghost told him that if it was any one else he would have torn him in pieces for the question. They have thrown down his gravestone in Drumbeg Churchyard to keep Haddock down, and it remains so to this day.

In the Ulster Journ. Arch. III., 325, W. Pinkerton has an excellent article on this story, giving the tradition and also the old accounts from More's editions of Granvil's "Sadducisinus Triumphatus" and Richard Baxter's "Certainty of the World of Spirits."

It will thus be seen that everywhere about us is a multitude of these stories. They are well worth collecting, if only for the dramatic nature of some of them; but if they are collected at all they should be most carefully committed to paper or they are of no value as folklore.

ANNUAL REPORT, 1905.

The Annual Meeting of the Shareholders of this Society was held on 14th July, in the Belfast Museum, College Square North. The President (Professor Johnson Symington, M.D., F.R.S.) occupied the chair, and there were also present—Sir James Henderson, D.L. ; the President of Queen's College (Rev. Dr. Hamilton) ; Dr. Wm. Calwell ; and Messrs Robert Young, J.P. ; George Kidd, J.P. ; R. M. Young, B.A., J.P., M.R.I.A. (Hon. Secretary) ; John H. Davies ; Wm. Gray, M.R.I.A. ; Seaton F. Milligan, M.R.I.A. ; W. R. Rea ; Wm. Armstrong ; Joseph Wright, F.G.S. ; John Horner ; William Workman ; H. C. Montgomery ; D. A. Maxwell ; Isaac W. Ward, and Nevin H. Foster. An apology for inability to be present was received from Sir Robert Lloyd Patterson, D.L. The minutes of the last meeting having been read and confirmed,

Mr. R. M. Young (Hon. Secretary) submitted the Annual Report, which stated :—

The Council of the Belfast Natural History and Philosophical Society desire to submit their Report of the Working of the society during the past year. The Winter Session was opened in the Museum on the 22nd November, 1904, when an illustrated lecture was kindly delivered by Mr Francis C. Forth, Assoc. R.C.Sc.I., Principal of the Belfast Municipal Technical Institute, on "Technical Instruction in Belfast : a Retrospect and a Prospect", followed by a discussion in which the President and other educationalists took part.

The Second Meeting was held on 19th December, 1904, when Mr. James Taylor kindly gave a lecture on "Stained Glass, Ancient and Modern," illustrated by a series of special lantern slides.

The Third Meeting was held on the 3rd January, 1905, in the Wellington Hall, with the Lord Mayor (Sir Otto Jaffe) in the chair, when an illustrated lecture on "Some Results of the National Antarctic Expedition" was kindly given by Mr. Hartley T. Ferrar, B.A., F.G.S., geologist to the "Discovery" Expedition 1901-04.

The Fourth Meeting was held on 7th February, 1905, when a lecture was given by Professor Gregg Wilson, D.Sc. M.R.I A.; subject, "The Work of the Ulster Fisheries Association," illustrated by numerous lime-light views.

The Fifth Meeting was held on 14th March, 1905, when Mr. Seaton F. Milligan, M.R.I.A., delivered a lecture; subject, "Cruise around Ireland with the Royal Society of Antiquaries, June, 1904," illustrated by lantern views.

The concluding meeting took place on 4th April, 1905, when the following papers were read:—(1) "Russia: Its People and Politics," by Mr. John Horner; (2) Some Irish Ghosts," by Mr. E. J. M'Kean, B.A., B.L.

There was a good attendance of the members, and of the general public at all these meetings. The different societies who hold their Meetings in the Museum continue to do so. As usual the public were admitted to the Museum at a nominal charge during the Easter Holidays, but the attendance was not as large as on some previous occasions, probably owing to the fine weather and various counter attractions.

The Members of the Royal Society of Antiquaries of Ireland attending the Ulster meeting in July were admitted free to the Museum, as on the last occasion of their visit in 1892. Those visiting the Museum expressed their gratification at seeing such a fine collection of Irish Antiquities belonging to a provincial society as contained in the Benn Room, especially such recent additions as the recent inauguration chair of the O'Neils, and other local objects. In regard to the museum collections there have been no changes of any note to report during the past year. The assistant curator has been much occupied in the cleaning, re-labelling, and otherwise looking after the collections in the various rooms. Some valuable donations have been received during the year, especially a set of fine quartzite primitive implements from India presented by Mr. H. W. Seton Karr. A large number of valuable publications issued by the various scientific societies in the United Kingdom, and in foreign Countries have been received. Many of these works are of much interest. In this connection a notable addition is the highly illustrated work of the American Ethnological Survey of the Philipines. The United States Bureau of Ethnology continues to send us their important publications illustrative of the habits and customs of the various aboriginal peoples of America.

In accordance with the constitution of the Society, five members of council retire from office, all of whom are eligible for re-election. These are Mr. John Brown; Sir James Henderson; Mr. S. F. Milligan; Mr. Robert Patterson, and Mr. William Swanston.

Mr. Horner presented the financial statement, which showed that the total income for the year had been £209 5s. 2d, including subscriptions amounting to £97 17s, and that the expenditure had been £199 2s. 5d, leaving a balance of £10 2s. 9d. He regretted to say that during the year the Easter receipts had fallen off nearly £6, which was to be expected owing to the fine weather, and the subscription account had been reduced by £9 5s, principally in annual subscribers. He would like to draw attention to the fact that either more annual subscribers or more members should be introduced for the purpose of keeping up the funds of the Society.

Rev. Dr. Hamilton, in moving the adoption of the Report, said there was nothing very outstanding in the history of the Society during the year. The report was a record of plain, hard good work done in the interests of the objects for which the organisation was founded many years ago, and it was pleasant to them all to find that it continued to prosper. That was the second year during which Professor Symington had presided over the Society, and it was a matter of satisfaction to them all—and he was sure a matter of surprise to no one who knew him—to discover that during those years it had not only held its ground, but had increased in prosperity and usefulness. He only hoped the president would be succeeded by another who would maintain the traditions of the society as honourably as he had done, or it would be still better if for a third year he could be prevailed upon to succeed himself. The Natural History Society occupied in his opinion a very useful place in Belfast. It would be a pity if they had no such organisation to be a rallying place for those who were interested in the subjects which that Society sought to look after, and it would be a still greater pity if the scientific worthies whose portraits hung on the walls of that building, who were the pioneers of their local scientific research—men like William Thompson and Robert Patterson—had no successors in these days when Belfast had reached a height of prosperity of which they in their day little dreamed. Even if the Society did almost no work it would be a good thing to have it there for these reasons, and at the same time for this additional reason—to hold up the torch of science before the inhabitants of their City, and to keep them in continual mind that men had something else to live for than the making of money.

During the past winter many useful papers have been read, and many important discussions had been held, and he had no doubt a great deal of valuable information had been diffused. The Society's collections in zoology, geology, palæontology, and archæology were an honour to Belfast, and ought to be more generally availed of than unfortunately they were. They were exceedingly valuable, and they would be poorer without them. They had a small balance to carry forward, and he hoped the public would not forget the appeal Mr. Horner had made for additional help. The only thing they required was a little more money. The Society was pursuing the even tenour of its way successfully and creditably, and he hoped it would long continue in Belfast, maintaining the honourable traditions of bye-gone days.

Mr. William Gray, in seconding the motion, said he had a great respect for the Society, and he joined Dr. Hamilton in hoping that it would maintain its position for many years to come. It would be a disgrace to the City if it was not properly supported and enabled to continue its good work. There was a field open to the Society independent of making a collection in which they had been so successful up to the present, and now the time had come when it might be judicious to separate the two interests—Natural History Society proper and the collection. He did not think that with all the surroundings the Society could be expected to maintain efficiently the collection of which they had now charge, and there should be some effort on the part of the public outside to come in and relieve them to some extent of that responsibility.

Mr. John H. Davies, in supporting, said it might be of interest to mention that when recently on a visit to Kew he met there some distinguished botanists, one of them being his old friend Mr. J. G. Baker, F.R.S., and the latter informed him that the high standing of Mr. S. A. Stewart—who was so well known to them all—as a systematic botanist, and the value of the wide service he had rendered to the knowledge of Irish Botany, were fully recognised. When his name was brought before the Linnæan Society for election for the distinction of associate the proposal was received with the utmost cordiality and approval and it was considered that the name of no one more worthy of the honour could have been submitted. He thought it would be gratifying to Mr. Stewart's many friends in Belfast to know that.

The resolution was carried.

On the motion of Mr. W. Gray, seconded by Mr. Nevin H. Foster, the five retiring members of the Council were re-elected—Sir James Henderson, and Messrs. John Brown, S. F. Milligan, R. Patterson, and W. Swanston.

Sir James Henderson, in moving a vote of thanks to the chairman, said he wished to endorse all that the President of Queen's College had said regarding Professor Symington. They were all so pleased with the way in which he had assisted in carrying on the work of the Society during the past year that, though they could not forestall what might take place at the Council meeting, they would be glad if he would consent to fill the office for a third year. Personally he thought no man was more entitled to a position of that kind than Professor Symington, and he was very pleased indeed to see him in the chair.

Mr. George Kidd seconded the motion, and it was heartily passed.

The Chairman said he was exceedingly obliged for the manner in which they had shown their appreciation of any small services he had been able to render to the Society. It had been a matter of extreme regret to himself that it had not been possible for him to devote more time to the general interests of the organisation, but his other duties kept him busy, and he had not very abundant leisure for outside work. At the same time he thought it was the duty of himself and of all persons occupying similar positions to do everything they could to maintain that Society. It seemed to him, as had already been stated by the President of Queen's College and Mr. Gray, that it would be a disgrace to a city of the size and importance of Belfast if it could not support a society of that character. In the first place, they started with very high traditions. The Society had, he believed, been in existence for more than eighty years, and for a very considerable time it had possessed an extremely valuable collection of objects illustrating the zoology, botany, geology, and archæology of that district. Then it had enabled the workers in any or all of those branches of knowledge to bring their views before the members and the public generally. They also possessed a very valuable library. It was well known that while text-books of science very soon lost their value, the "proceedings" of learned societes in many cases increased in value as time went on, and it was very difficult to get a complete set of some important journals of that kind. They had in their library very valuable "Proceedings," extending over long periods. It would be a shame if the Society could not find in Belfast sufficient persons interested in the subject to maintain it and to increase its reputation. Perhaps he might be pardoned for referring to various observations that appeared in the newspapers in the spring of this year with regard to the fate—not of the Society he was glad to say—but of its museum. He thought it should be clearly understood that the gentlemen who wrote to the newspapers did so on their own responsibility, and that they had not any special authority from the Council to express any views on that very debatable subject. He occupied the same position—he had no authority from the Council to express any opinion—but they must admit that they were surrounded now by altered circumstances from those which attended the earlier work of the Society. The city—he was not quite certain from what reason, whether from an innate love of the subject or in order to carry out some Act of Parliament—had undertaken to do the work that that Society did to some extent. He was thoroughly in sympathy with the idea of the city undertaking work of that kind. There was no doubt there were many advantages connected with the maintenance of museums either by Government or municipal authorities. At the same time, there were undoubtedly advantages associated with the direction of a museum by persons who had evinced a personal interest in the subject. He presumed that none of the members of the Corporation were elected for their knowledge of archæology or any of the sciences with which that Society was specially identified, though they were perhaps quite qualified to undertake that work. Speaking for himself, it would be with some reluctance, though it might be necessary, that he would see an extremely interesting and valuable collection passing out of the keeping of those specially interested in the subject. Then he would like, with reference to the general affairs of the Society, to say that it seemed to him that it would be a calamity for the organisation to part with its building. Some people thought that a Society like that should dispense not only with its museum, but also with its building, and trust to charity to find the members occasional accommodation for their meetings. He believed it was extremely important to the healthy life of the Society and for the cultivation of the subjects in which they were interested that they should have a building of their own. Whatever might be the fate of their museum, it was essential that for the continued success of that Society a larger number of their citizens should take a more active interest in the organisation. Fifty years ago there were probably a larger number interested in the Society than at the present time and it said very little for their advance in civilisation and their improved methods of education if a society of that kind was as successful half a century ago as it was to-day. They ought to have a very much larger membership and to be engaged very much more actively in the work of the Society. He trusted all the members present would do their best to induce others to join. Whatever might be in store in the future, they had in the meantime to keep the Society going and to add to their collection, as well as to preserve the specimens they had, and they could not do that unless they were adequately supported. He had felt that he should be relieved of the duties of president, but if it was the wish of the Council and the Society generally that he should continue in office for another year he would be very happy to do his best for them.

The Proceedings then terminated.

A meeting of the Council was subsequently held, with the President of the Queen's College (Rev. Dr. Hamilton) in the chair.

On the motion of the Chairman, seconded by Sir James Henderson, Professor Symington was unanimously re-elected President for the ensuing year, and he kindly consented to accept the position.

The other office-bearers appointed were—Vice-Presidents, the President of Queen's College (Rev. Dr. Hamilton), Sir James Henderson, M.A., D.L. ; Sir R. Lloyd Patterson, D.L., F.L.S., and Mr. W. Swanston, F.G.S. ; Honorary Treasurer, Mr. John Horner ; Honorary Librarian, Mr. John H. Davies ; Honorary Secretary, Mr. Robert M. Young, B.A., J.P., M.R.I.A.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict., ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended 30th April, 1905.

Dr. **Cr.**

CHARGE.

To Balance as per last Account			£15 3 3	
,, Subscriptions			97 17 0	
,, Dividends			17 2 5	
,, Rents			29 18 0	
,, Sales			3 8 0	
,, Miscellaneous Receipts, viz.:—				
Easter Receipts	£13 16 1			
Admission Fees	21 0 8			
Birds Sold	10 19 9			
		45 16 6		
Total			£209 5 2	

DISCHARGE.

By Amount of Payments under the following headings:—			
Maintenance of Premises, &c.	£17 1 2		
Rent and Taxes, &c.	28 3 10		
Salaries	93 16 4		
		139 1 4	
,, Other Payments, viz.:—			
Printing and Stationery	8 2 6		
Advertising	13 7 6		
Postage and Carriage	3 6 0		
Fuel and Gas	16 5 7		
Audit Fees	2 2 0		
Insurance	6 12 0		
Hire of Hall	3 3 0		
Hire of Lanterns	1 18 6		
Easter Expenses	5 4 0		
		60 1 1	
Total Payment		199 2 5	
,, Balance in favour of this Account as on the 30th April, 1905		10 2 9	
Total		£209 5 2	

N.B.—Besides the above Balance there is a sum of £400 standing to the credit of this Account in the York Street Flax Spinning Co., Ltd., $4\frac{1}{2}$ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor.
JOHN HORNER, Accounting Officer.

Dated this 5th day of June, 1905.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

9th day of June, 1905.

DONATIONS TO THE MUSEUM, 1904-1905.

From Mr. W. Seton Karr, M.P.

Thirty-three quartzite implements from Cuddapah, India.

From Mr. William Parr.

An ancient Greek coin found near Ligoniel, Belfast.

From Rev. W. C. Cunningham, Ballyrashane.

A beggar's badge of Dunluce.

From Mr. John Brown, F.R.S.

A specimen of the shell of *Tellina balthica* found, sub fossil, in esker gravels, near Dunmurry.

From Mr. Joseph Wright, F.G.S.

A microscope slide of a spicule of Synapta, a rare *Holothurian* from Lias clay at Gloucester, England.

From Mr. Thomas Nolan Murray, Hon. Sec. Ulster Amateur Photographic Society.

A photograph of the gigantic plant, *Gunnera manicata*, which is growing at Narrowater, Co. Down.

From Rev. Canon Bristow.

Thirty-six cameos and two agates.

From Mr. J. H. MacIlwaine.

A tomtit's nest and eggs found in the heart of a large tree when sawn open.

From Mr. Quinton Dunlop.

Letters patent, dated 1869, and massive seal attached thereto.

From Mr. W. Guiney.

A cast of the shell of a fossil Pecten, from Malta.

ADDITIONS TO THE LIBRARY, 1ST MAY, 1904, TILL 1ST MAY, 1905.

ADELAIDE. — Transactions of the Royal Society of South Australia. Vol. 28, 1904. *The Society.*

BASEL.—Verhandlungen der Naturforschenden Gesellschaft in Basel. Vol. 15, part 3, and vol. 17, 1904. *The Society.*

BELFAST.—Report and Proceedings of the Belfast Naturalists' Field Club. Ser. 2, vol. 5, part 3, 1904. *The Society.*

BERGEN.—Bergens Museum Aarsberetning for 1903 and 1904. Aarbog, parts, 1—3, 1904. Also Account of the Crustacea of Norway, vol. 5, parts 3—6, 1904, and parts 7 and 8, 1905. *The Director of the Museum.*

BIRMINGHAM.—Records of Meteorological Observations for 1904. *Birmingham and Midland Institute.*

BOLOGNA.—Rendiconto della R. Accademia delle Scienze. New ser., vol. 4, 1904. *The Academy.*

BOULDER.—University of Colorado College Studies. Vol. 2, Nos. 1—3, 1904. *The University.*

BRESLAU.—Zeitschrift für Entomologie vom Verein für Sclessiche Insektenkunde. New ser. part 29, 1904. *The Society.*

BRIGHTON.—Abstract of Papers and Annual Report of Brighton and Hove Natural History and Philosophical Society, 1904. *The Society.*

BROOKLYN.—Memoirs of Art and Archæology. Vol. 1, Nos. 1 and 2, 1902, and No. 4, 1904: also Memoirs of Natural Sciences. Vol. 1, No. 1, 1904. *Brooklyn Institute.*

BRUSSELS.—Bulletin de la Société Royale de Botanique de Belgique. Vol. 41, part 3, 1904.
The Society.

,, Annales de la Sociétié Entomologique de Belgique. Vol. 47, 1903, and 48, 1904. *The Society.*

,, Annales de la Sociétié Royale Zoologique et Malacologique de Belgique. Vol. 38, 1903.
The Society.

BUENOS AYRES.—Anales del Museo Nacional de Buenos Aires. Ser. 3, vol. 2, 1903. *The Director.*

CALCUTTA.—Memoirs of the Geological Survey of India. Vol. 32, part 4, 1904, vol. 35, part 3, 1904, and vol. 36, part 1, 1904. Palæontologia Indica, ser. 15, vol. 4 (one part only), 1903. Records of the Geological Survey of India. Vol. 31, parts 1—4, 1904, and vol. 32, part 1, 1905.
The Director.

CAMBRIDGE.—Proceedings of the Cambridge Philosophical Society. Vol. 12, part 6, 1904, and vol. 13, part 1, 1905.
The Society.

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Anatomy. Vol. 39, No. 9, 1904; vol. 43, Nos. 2 and 3, 1904; vol. 44, 1904; vol. 45, Nos. 2—4, 1904, and vol. 46, Nos. 1 and 2, 1904.
The Keeper of the Museum.

CARDIFF.—Transactions of the Cardiff Naturalists' Society. Vol. 36, 1903. *The Society.*

CHRISTIANIA.—Forhandlingar i Videnskaps-Selskabet i Christiania, 1903. Den Norske Sindssygelovgivning Forelesninger, 1901.
Royal Norske Frederiks University.

COLORADO SPRINGS.—Colorado College Studies. Vol. 12, Nos. 15—17, 1904.
Colorado College Scientific Society.

DANTZIC.—Schriften der Naturforschenden Gesellschaft in Danzig New Series, vol. 11, parts 1 and 2, 1904; also Library Catalogue, 1904. *The Society.*

DUBLIN.—Memoirs of the Geological Survey—the Geology of the country around Belfast, 1904. *The Survey.*

EDINBURGH.—Transactions and Proceedings of the Botanical Society of Edinburgh. Vol. 22, parts 1, 1901, 2, 1903, 3, 1904, and part 4, 1905. *The Society.*

„ Proceedings of the Royal Physical Society. Vol. 15, No. 2, 1904; vol. 16, No. 1, 1904, and No. 2, 1905. *The Society.*

EMDEN.—Jahresbericht der Naturforschenden Gesellschaft in Emden, 1904. *The Society.*

GENOA.—Rivista Ligure. Vol. 26, fasc. 2—6, 1904, and vol. 27, fasc. 1, 1905. *Societa Letture e Conversazione Scientifiche.*

GLASGOW.—Transactions of the Natural History Society of Glasgow. New ser., vol. 6, part 3, 1905.

„ Proceedings of the Royal Philosophical Society of Glasgow. Vol. 35, 1904. *The Society.*

GORLITZ.—Abhandlungen der Naturforschenden Gesellschaft zu Gorlitz. Vol. 24, 1904. *The Society.*

IGLO.—Jahrbuch des Ungarischen Karpathen Vereines, 31st year, 1904. *The Society.*

INDIANOPOLIS—Proceedings of the Indiana Academy of Sciences. Volumes for 1902 and 1903. *The Academy.*

KHARKOW.—Transactions of the Society for Physico Chimiques of Kharkow University, No. 31, with two Supplements, 1903. *The Society.*

KIEW.—Memoirs of the Society of Naturalists of Kieff. Vol. 18, 1904, and vol. 19, 1905. *The Society.*

LAUSANNE.—Bulletin de la Société Vaudoise des Sciences Naturelles. Vol. 40, Nos. 147—151, 1904. *The Society.*

LAWRENCE.—Bulletin of the University of Kansas. Vol. 2 No. 7 1901, and vol. 4, Nos. 6 and 8, 1903.
The University.

LEIPSIC.—Mitteilungen des Vereins für Erdkunde zu Leipzig. Part 1, 1903. *The Society.*

„ Sitzungsberichte der Naturforschenden Gesellschaft zu Leipzig. 28th and 29th years, 1901 and 1902.
The Society.

LIMA.—Boletin del Cuerpo de Ingenieros de Minas del Peru. Nos. 4 and 5, 1903, 6—18, 1904, and No. 19, 1905. *The Director.*

LONDON.—Report of the Southport Meeting of the British Association, 1903. *The Association.*

„ Memoirs of the Royal Astronomical Society. Vol. 54, and 5 appendices, 1901-4, vol. 55, and appendix, 1904. *The Society.*

„ Quarterly Journal of the Geological Society of London. Vol. 60, Nos. 237—240, 1904, and vol. 61, No. 241, 1905; also Geological Literature for 1903, and List of Fellows, 1904. *The Society.*

„ Journal of the Royal Microscopical Society, parts 3—6, 1904, and parts 1 and 2, 1905. *The Society.*

„ Transactions of the Zoological Society of London. Vol. 17, part 3, 1904. Proceedings, vol. 1, parts 1 and 2, 1904, and vol. 2, part 1, 1904, also List of Fellows for 1904. *The Society.*

„ Guide to the Fossil Mammals and Birds in the British Museum. 8th ed., 1904. Guide to the Gallery of Birds, 1905, and pamphlets on Diptera and Blood Sucking Flies.
The Trustees of the British Museum.

MADISON.—Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 13, part 2, 1902, and vol. 14, part 1, 1903. *The Academy.*

MADISON.—Bulletin of Wisconsin Geological and Natural History Survey. Nos. 11 and 12, 1903.
The Commissioners of the Survey.

MADRAS.—Bulletin of the Madras Government Museum. Vol. 5, No. 1, 1903, and Administration Report, 1904.
The Superintendent.

MANCHESTER.—Journal of Manchester Geographical Society. Vol. 19, Nos. 4—12, 1903, and vol. 20, Nos. 1—3, 1904. *The Society.*

" Transactions of Manchester Geological and Mining Society. Vol. 28, Nos. 13—15, 1904.
The Society.

MARSEILLES.—Annales de la Faculte des Sciences de Marseille. Vol. 14, 1904. *The Librarian.*

MELBOURNE.—Proceedings of the Royal Society of Victoria New ser., vol. 17, part 1, 1904, and part 2, 1905.
The Society.

MEXICO.—Anuario del Observatorio Astronomico de Tacubaya. Ano 25, 1904. Boletin Mensual del Observatorio Meteorologico de Mexico. No. 3 and Nos. 6—8, 1902. *The Director.*

" Parergones del Instituto Geologico de Mexico. Vol. 1, Nos. 2—6, 1904. *The Institute.*

MILWAUKEE.—Twenty-second Annual Report of the Trustees of Milwaukee Public Museum, 1904.
The Trustees.

MISSOULA.—Bulletin of the University of Montana. Nos. 21—23, 1904, and Biological Series, No. 5, 1903, and No. 7, 1904. *The University.*

MONTEVIDEO.—Anales del Museo Nacional de Montevideo. Ser. 2, part 1, 1904. Section Historico Filosofica, Vol. 1, 1904. *The Director.*

MORELIA.—Relacion de los Ceremonias y Ritos y Poblacion y Gobernacion de los Indios de la Provincia de Mèchuacan. ———

MOSCOW.—Bulletin of the Imperial Society of Naturalists of Moscow. No. 4, 1903, and Nos. 2—4, 1904.
The Society.

NANTES.—Bulletin de la Société des Sciences Naturelles de l'Ouest de la France. Ser. 2, vol. 3, Nos. 3 and 4, 1903, and vol. 4, Nos. 1 and 2, 1904.
The Society.

NEW YORK.—Annals of the New York Academy of Sciences. Vol. 14, part 4, and vol. 15, parts 2 and 3, 1904.
The Academy.

,, Bulletin of the American Geographical Society. Vol. 36, Nos. 3—12, 1904, and vol. 37, Nos. 1 and 3, 1905. *The Society.*

ODESSA.—Memoirs of the Society of Naturalists of New Russia. Vol. 25, part 1, 1903, part 2, 1904, vol. 26, 1904, and vol. 27, 1905. *The Society.*

OPORTO.—Annaes de Sciencias Naturaes. Vol. 8, 1903.
Senor Augusto Nobre.

OTTAWA.—Contributions to Canadian Palæontology, part 3, 1904. Canadian Birds, part 3, 1904, and also Dictionary of Altitudes in Canada, 1903.
The Director of the Canadian Geological and Natural History Survey.

PADUA.—Atti della Accademia Scientifica Veneto-Trentina-Istriana. New ser., Anno 1, fasc. 1 and 2, 1904.
The Academy.

PHILADELPHIA.—Proceedings of the Philadelphia Academy of Natural Sciences. Vols. 65 and 66, 1904.
The Academy.

,, Proceedings of the American Philosophical Society. Vol. 40, No. 167, 1901, and vol. 43, Nos. 175 and 176, 1904. *The Society.*

PISA.—Atti della Società Toscana di Scienze Naturali, Processa Verbali. Vol. 14, Nos. 3—5, 1904.
The Society.

RENNES.—Travaux Scientifiques de l'Universite de Rennes. Vol. 2, 1903. *The University.*

RIO DE JANEIRO.—Archivos do Museo Nacional do Rio de Janeiro. Vol. 10, 1899, vol. 11, 1901, and vol. 12, 1902. *The Director of the Museum.*

ROME.—Journal of the British and American Archæological Society of Rome. Vol. 3, No. 6, 1904. *The Society.*

,, Atti della Reale Accademia dei Lincei. Ser. 5, vol. 13, semestre 1, fasc. 7—12, 1904; semestre 2, fasc. 1—12, 1904; vol. 14, semestre 1, fasc. 1—7, 1905, and Rendiconto Adunanza Solenne, 5 June, 1904. *The Academy.*

, Bollettino della Società Zoologico Italiana. Vol. 5, fasc. 1—8, 1904, and vol. 6, fasc. 1—3, 1905. *The Society.*

ST. LOUIS.—Fifteenth Annual Report of Missouri Botanical Garden, 1904. *The Director.*

STAVANGER.—Stavanger Museums Aarshefte. Fourteenth year, 1904. *The Museum Trustees.*

STIRLING.—Transactions of Stirling Natural History and Archæological Society, 1904. *The Society.*

STOCKHOLM.—Kungl Svenska Vetenskaps Akademiens Handlingar. Vol. 37, Nos. 3 and 4, 1903, and Nos. 7 and 8, 1904; vol. 38, Nos. 1—5, 1904. Arkiv for Botanik, vol. 1, part 4; vol. 2, parts 1—4, and vol. 3, parts 1—4, 1904. Also Arkiv for Matematik, Astronomi, och Fysick, vol. 1, parts 3 and 4, 1904. Arkiv for Mineralologi, Kemi, och Geologi, vol. 1, parts 3 and 4, 1904. Arkiv for Zoologi, vol. 1, parts 3 and 4, 1904, and vol. 2, parts 1 and 2, 1904, and Arsbok, for 1904. Also Les Prix Nobel, 1901-1904. *The Academy.*

SYDNEY.—Science of Man. Vol. 7, Nos. 2—7, 1904. *The Anthropological Society of Australasia.*

TOKYO.—Mittielungen der Deutschen Gesellschaft für Natur und Heilkunde Ostasien. Vol. 10, part, 1, and Supplement, 1904. *The Society.*

TORONTO.—Transactions of the Canadian Institute. Vol. 7, part 3, and Proceedings, vol. 11, 1904.
The Institute.

VIENNA.—Verhandlungen der Kaiserlich Koniglichen Geologischen Reichsanstalt. Nos. 5—18, 1904, and Nos. 1 and 2, 1905. *The Society.*

,, Verhandlungen der Kaiserlich Koniglichen Zoologisch-Botanischen Gesellschaft. Vol. 44, 1904.
The Society.

WASHINGTON.—Year Book of the United States Department of Agriculture, 1903.

,, Water Supply and Irrigation Papers, Nos. 80—87, 1903. Professional Paper, No. 9, 1903, No. 10, 1902, and Nos. 13—15, 1903.
The Director of the U.S. Geological Survey.

,, Twentieth Annual Report of the Bureau of American Ethnology, 1903.
The Director of the Bureau.

,, Report of the United States National Museum for 1902, and Proceedings, vol. 27, 1904, also Special Bulletin. American Hydroids, part 2, 1904. Smithsonian Miscellaneous Collections. Vol. 45, parts 1—4, 1904; vol. 47, 1, 1904; No. 1,374, 1903, and Nos. 1,417, 1,441, 1,543, and 1,544, 1904.
The Smithsonian Institution.

YORK.—Annual Report of the Yorkshire Philosophical Society, for 1903. *The Society.*

ZURICH.—Vierteljahrsschrift der Naturfoschenden Gesellschaft in Zurich, 94th year, parts 1 and 2, 1904.
The Society.

From The Author, Mons. Charles Janet, Limoges.—Observations sur Guepes, 1903. Observations sur les Fourmis, 1904. Anatomie du Gaster de la Myrmica rubra, and seven other of his Zoological Papers, 1894-1899.

From Professor Rupert Jones, F.R.S.—His Paper on the Estheriella Shales of the Maylay Peninsula; also Paper on some Palæzoic Ostracoda from Maryland.

From Mons. Emile Boulanger.—Germination de l'Ascospares de la Truffe, 1903.

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

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Report and Proceedings

OF THE

BELFAST

Natural History and Philosophical Society

FOR THE

SESSION 1905-1906.

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1906.

CONTENTS.

Belfast Natural History and Philosophical Society.

ESTABLISHED 1821.

CONSTITUTION.

The membership of the Society consists of Shareholders in the Museum, Annual Subscribers (Associates), Honorary Members and Honorary Associates.

Shares in the Museum cost £7 each. A holder of one Share pays an annual contribution of ten shillings; a holder of two Shares (in one certificate) an annual contribution of five shillings; while a holder of three or more Shares (in one certificate) is exempt from annual payments. Shares on which the annual payment as above are in arrear are liable to forfeiture. The Council retain the right to decline to consolidate two or more share certificates into one certificate.

Annual Subscribers (Associates) pay £1 1s (one guinea) due 1st November in each year in advance.

A General Meeting of Shareholders in the Museum is held annually in May or June, or as soon thereafter as convenient, to receive the Report of the Council and the Statement of Accounts for the preceding year, to elect members of Council to replace those retiring by rotation or from other reasons, and to transact any other business incidental to an annual meeting. Shareholders only are eligible for election on the Council.

The Council elect, from among their own number, a President and other officers of the Society.

Each Member has the right of personal attendance at the ordinary lectures of the Society, and has the privilege of introducing two friends for admission to such; and he has also the right of access to the Museum and Library for himself and family residing under his roof, with the privilege of granting admission orders for inspecting the collections in the Museum to any person not residing in Belfast or within five miles thereof. The session for lectures extends from November till May.

The Museum, College Square North, is open daily for the admission of visitors, for such hours as the Council may from time to time decide; the charge for admission to non-members is sixpence each. The Curator is in constant attendance, and will take charge of any donation kindly presented to the Museum or Librrry.

Any further informatiou required may be obtained from the Honorary Secretary.

BELFAST

NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

SESSION 1905--6.

7th November, 1905.

Professor Johnson Symington, M.D., F.R.S., F.R.S.E., in the chair.

BELFAST CIVIC UNDERTAKINGS.

By Arthur H. Muir, C.A.

(*Abstract*).

As the population of any town grows, the interdependence of its inhabitants increases. The mere fact of a large number of persons living within a comparatively small area necessitates a great number of activities not previously required, *e.g.* Scheme of Drainage and Sewage Disposal, Public Health Precautions, Street Lighting, Policing, Public Parks, &c., and renders possible a number of other activities mutually beneficial, but impossible without a centre of population, *e.g.* Tramways, Public Baths, Gas Manufacture, Electric Light and Power Manufacture, Markets, Free Libraries, and Cheap Concerts for the people.

Under the title of "Belfast Civic Undertakings" are included all undertakings for the good of the Community which are controlled by Local Authorities. These consist of the undertakings of

1. Belfast City Corporation.
2. Belfast Harbour Commissioners.
3. Belfast City and District Water Commissioners.
4. Belfast Poor Law Guardians.

1. Belfast City Corporation.—For the purposes of Municipal Government the City is divided into fifteen wards, which are of various sizes, and in which the number of voters ranges from 2,400 in Smithfield Ward to 5,713 in Pottinger Ward. Each Ward is represented on the City Council by three Councillors and one Alderman, thus making a Council of sixty.

Most of the great English Cities have an Official so far unknown in Belfast, viz: an Elective Auditor. It will be said that the Corporation Accounts are audited by the Local Government Board Auditor, but practically he confines himself to the question as to whether the payments are properly authorised and are legally made. The functions of the Elective Auditor are different. He acts for the ratepayers. He is more particularly concerned with the question of whether the payments are wisely made, and whether the various departments are being worked on an economical and businesslike basis. He reports to the ratepayers on the undertakings of the Corporation from a business point of view, and brings the light of his business experience to the gloomy shades of overstaffed offices, and expensively managed public departments. He also draws up reports on the financial aspects of the aspirations of committees anxious to develop fresh schemes at the expense of the ratepayers, and endeavours to keep the citizens posted up in the true facts of the various matters in hand. The office should be created in Belfast.

The Lecturer then gave descriptions of the following Undertakings: – Public Health, Upkeep of Monuments, Roads and Bridges, Maintenance of Order, Public Baths, Lodging House, Public Parks, Cemeteries, Free Libraries, Municipal Technical Institute, Fire Brigade, City Surveyor's Department—Planning of Streets, Supervision of Drainage and Sewage Disposal, Passing of Plans for New Buildings; Ulster Hall, Scavenging, Markets and Abattoir, Gasworks, Electric Light Station, Tramways.

Referring to the Planning of new streets, the cities of the United Kingdom lack a power which is very necessary, namely, the power of planning out the lines on which the City shall develop, and of compelling all property owners both inside and immediately outside the city boundary to comply with the plan of development. Straight wide streets and roads are laid down on the plan where they do not at present exist. Certain areas are reserved for dwelling-houses, and certain other areas for factories and workshops. The result is a healthy development along the lines of a scheme laid down by the Municipality, under the advice of the most skilled advisers. No landowner, in order to make the most of his little patch, may run awkward streets across his property contrary to the general scheme, nor may he put up a different class of property from that laid down. No fabulous sums are required to be paid for street improvements, or for the pulling down of buildings put up in awkward places. Sooner or later such powers must be obtained.

2. Belfast Harbour Commissioners.—In 1785 an Act was passed appointing a separate Corporation to look after the interests of the Port of Belfast. For the previous forty years the control had been exercised by the equivalent of the modern Town Council. The Commissioners are twenty-one in number, and are elected for a period of three years.

3. Belfast City and District Water Commissioners.—Water is an absolute essential for cities, and for large centres an abundant supply must be procured if the city is to grow either in population or commercial importance. The necessity for an ample water supply has, therefore, caused many cities to spend enormous sums on colossal schemes. In fact the greater the city, as a rule, the more costly the water supply.

The Water Commissioners number fifteen, one from each Ward, and are elected for a period of three years. They were incorporated in 1840, when they took over the water supply as it then existed from the Belfast Charitable Society.

The Lecturer referred to the Water Supply in 1840. Woodburn Reservoirs, seven in number, storing 1515 million gallons, and capable of giving 8 million gallons per day. Stoneyford Reservoirs, two in number, storing 820 million gallons, and capable of giving 4 million gallons per day. Filtration beds, Oldpark and Antrim Road Works, Pumping Station, Ligoniel Storage Tank. Mourne Scheme, when completed, consisting of two reservoirs, capable of storing 3750 million gallons, and of giving 30 million gallons per day through a conduit 35 miles long.

4. Belfast Poor-Law Guardians.—This Board is one elected from the fifteen Wards of the City, together with nine other adjoining districts, making twenty-four divisions in all, each represented by two Guardians. In addition to these forty-eight Guardians six are co-opted.

A very common impression is that the inhabitants of the Workhouse consist of a large number of men who won't work, and who are kept in comparative comfort and ease at the expense of the community. As a matter of fact out of the 3,489 inmates on the night of 3rd November, 1905, only 101 were of this class. The balance was made up of 1,437 infirm old men and women, 1,544 people sick in the Hospital Wards, 275 children, and 132 mothers. The small percentage of healthy out-of-works, who find themselves there, do not get an easy time of it, and usually do far more work inside the Workhouse for nothing, than they do outside for pay. There is, unfortunately, a marked and steady increase in the number of old men, who have been working constantly all their lives until a short time previous to admission. It is thought that the Workmen's Compensation and Employers' Liability Acts have been a factor in this.

A marked feature of all cities during the past 25 years has been the enormous increase in Local Indebtedness. Belfast forms no exception, and Diagram No. 1 gives some idea of the increase during the last 15 years. Along the foot of the Diagram is measured a number of equal spaces, each representing one year, while up the side each space represents one quarter of a million pounds sterling. By placing a point in each year opposite the amount of debt in that year, a series of points result which, when joined by a line, give the best representation of the increase or decrease of debt over a series of years. It will be noticed that the debt of the

DIAGRAM NO. 1.

PUBLIC DEBT OF BELFAST

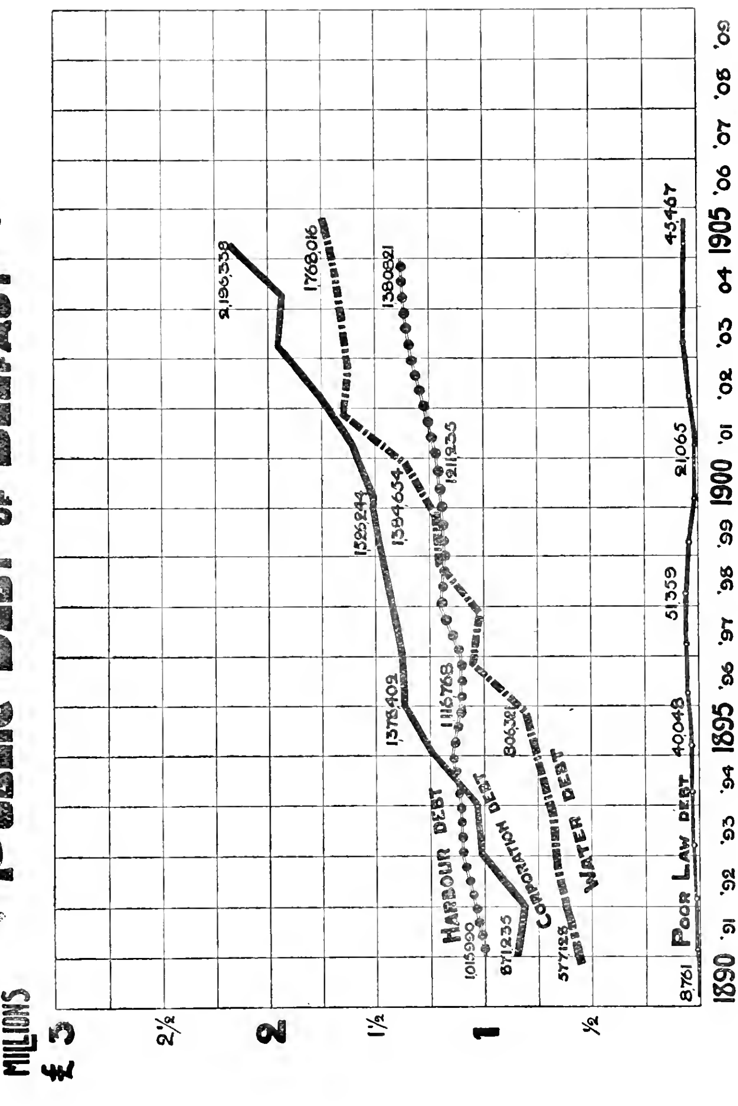
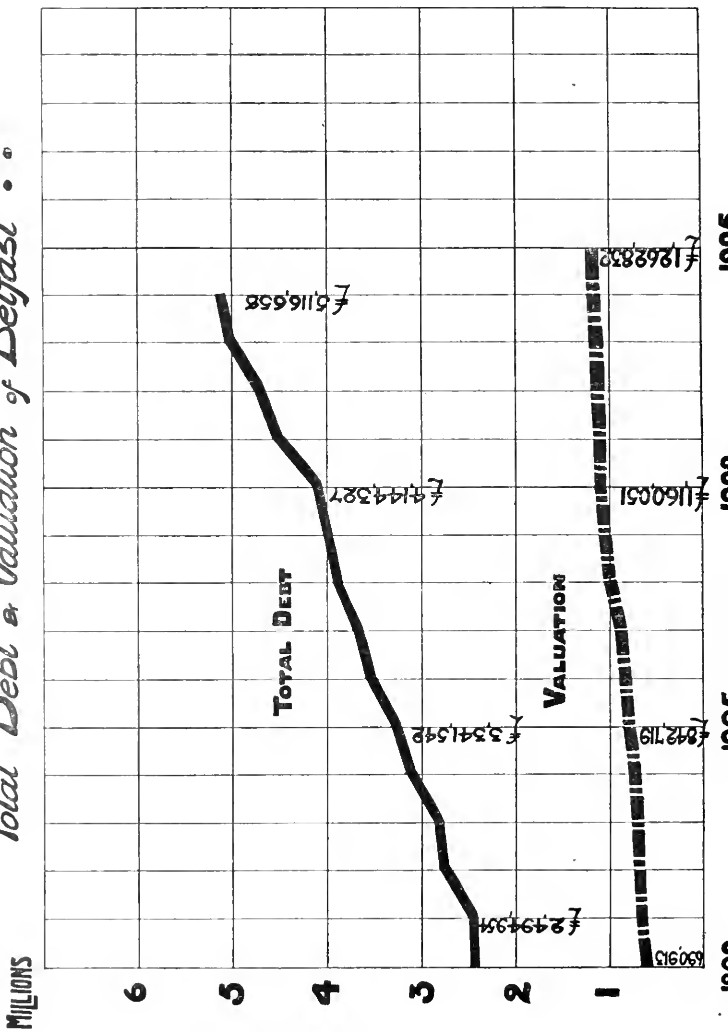


Diagram No. 2.

Total Debt & Valuation of Belfast.



Poor-Law Guardians fell considerably between the years 1898 and 1900, owing to the Public Health Department being taken over by the Corporation, but that it has risen since owing to the Whiteabbey Sanatorium being acquired.

The Water Debt shows a very rapid rise up to 1901 owing to the Mourne Scheme, but since then it has not been going up so much, as that scheme is not going on to completion immediately.

The Harbour Debt has gone up steadily, but not rapidly. The Debt of the Corporation has gone up both steadily and rapidly on the whole, and will show a great leap upwards when the Tramway Debt of £1,000,000 is included. And as the Corporation takes over other undertakings that debt will probably go on increasing as in other cities. With reference to the contention that the assets of the various bodies are of far greater value than the existing debts, it should be pointed out that these assets are not liquid, and that most of the debts have to be repaid in a limited number of years. In some cases this is provided for out of the revenues of these assets, but in other cases it must come out of the rates.

Each step in Diagram No. 2 represents £1,000,000, and the line shows the total of the Debts, which were set out singly on the first chart. The responsibilities of the community have therefore increased from £2,473,114, in 1890, to £5,116,658 in 1904. The lower of the lines shows the increase in valuation of the city during the same period. The somewhat rapid rise of the valuation about the year 1898 is explained by the extended area of the city.

Diagram No. 3 shows the increase in the population of Belfast. The black columns represent the census years, while the light columns are interpolated from 1890 onwards to give a complete series from that year. The sudden rise from 1897 to 1898 is explained by the extending of the city boundary.

It is not fair to take the figures representing the increasing debt of a rapidly increasing city, without also taking into account the increased population. Diagram No. 4 shows the debt per head of population for the period from 1900, and is obtained

DIAGRAM No. 3.

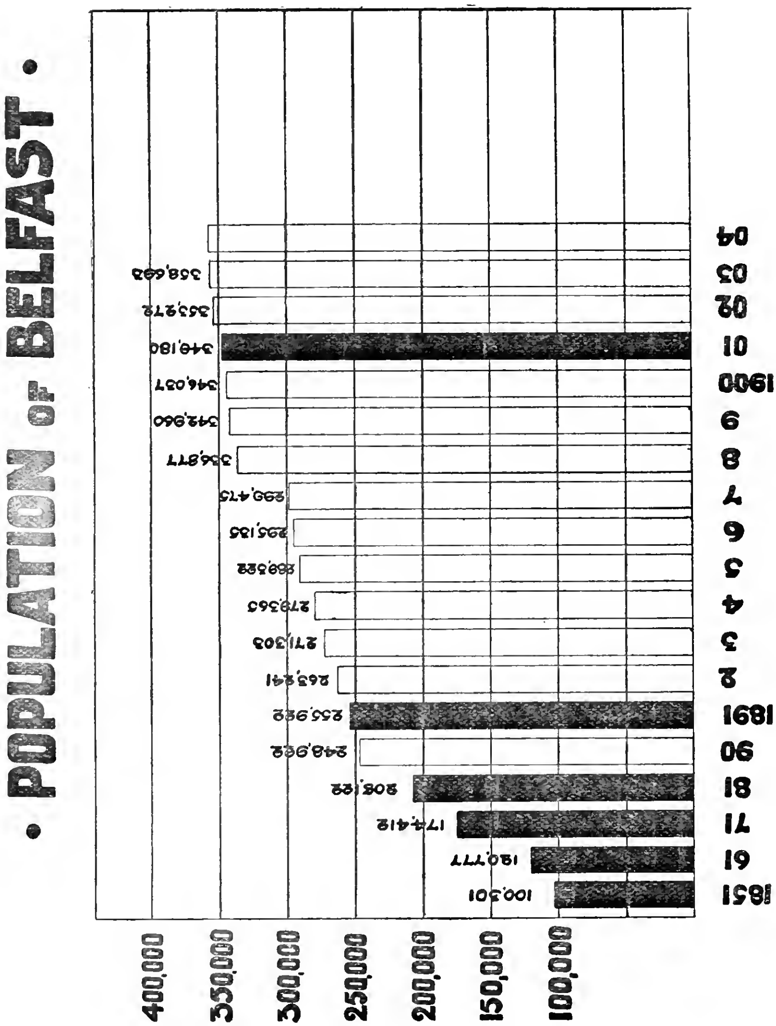
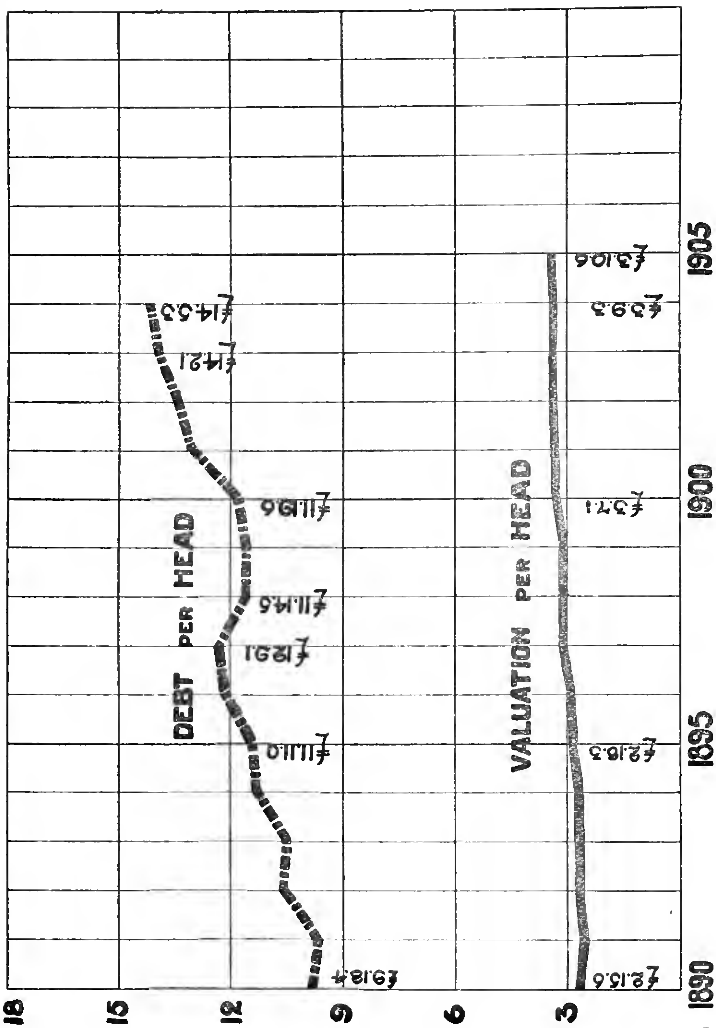

• POPULATION OF BELFAST •
100,000
150,000
200,000
250,000
300,000
350,000
400,000
1851
100,301
61
120,777
71
174,412
81
208,122
90
248,922
1891
255,922
2
263,241
3
271,303
4
279,365
5
289,522
6
295,135
7
299,475
8
336,877
9
342,960
1900
346,037
01
349,180
02
353,272
03
358,693
04

Diagram No. 4.

Debt & Valuation of Belfast per head of population.



by dividing the population in each year into the total debt as given on second diagram. The drop in 1898 is caused by the debt having been divided by the population for that year, which was increased by the inhabitants of the added area.

Diagram No. 5 gives a view of the progress of taxation during the past 15 years.

In any rapidly growing city the number of immigrants coming to take advantage of the positions offered must fill the municipality with many who take little or no interest in its public affairs. They are *in* it but not *of* it, and are content to leave all such matters in other hands. Now the tendency of such apathy is to permit public bodies to be run by interested cliques for purposes other than the good of the community. If, under such conditions, the personnel of the governing bodies depreciates, and administration is not so efficient as it should be, the citizens of course have themselves to blame.

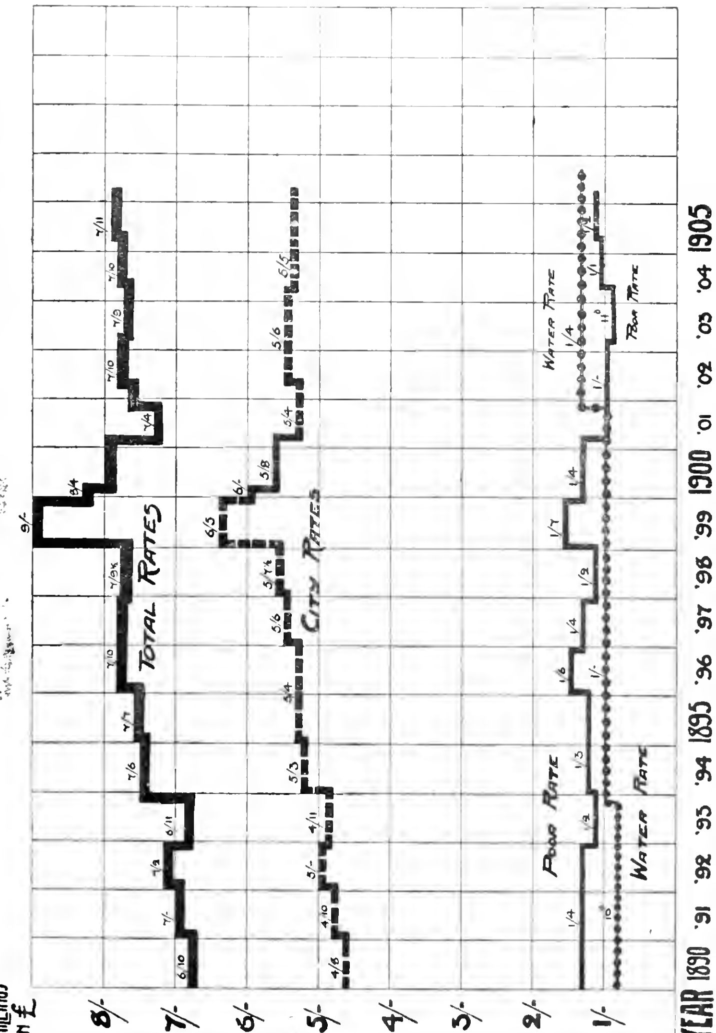
A difficulty is always present which helps to make many voters apathetic as regards civic affairs, namely :—that they pay no direct taxes. It is true of course that in the long run, and on the average, the taxes levied on the properties in which they live come out of their pockets, but this is not apparent to many of them. The result is that frequently they demand expenditure on projects in the hope of an immediate benefit for which, however, they themselves have ultimately to pay in increased taxation.

Another instance of this tendency is the cry that because one Ward has something another Ward must get it also : because one Ward has Public Baths another Ward must have it ; because one Ward has a Branch Library another must be provided in another Ward. Such a policy would build up a most serious burden on the ratepayers.

To load up our local authorities with a multiplicity of duties further increases the time which is required of the city's representatives. It makes it more and more of a tax upon those men who undertake those duties, and it tends to prevent the men who are most competent for the position from accepting office. The tendency is towards a decreasing efficiency in the representatives.

DIAGRAM NO. 5.

Rates of Belfast (Municipal, Poor & Water) on Houses over £20 Valuation



The development of municipal trading also brings into existence a number of employees paid directly by the municipalities, with the temptation to use their vote on personal rather than on public grounds.

For many years the Belfast Conservative Association has been the most potent factor in our Municipal affairs, and the citizens are deeply indebted to this organisation for its efforts in putting forward good men, and returning so many in the face of the apathy of the great bulk of the citizens. It suffers, however, from the drawback common to all associations representing party politics, namely, that it cannot secure public confidence outside its own party, and this would be equally true if it were a Liberal Association.

But after all, political or religious opinions are largely irrelevant to efficiency in civic matters, and the danger of making party politics a motive for municipal elections is that every now and again men are bound to be put forward for the mere purpose of opposing the opposite party, without reference to their fitness for civic administration.

It should be the aim of the ratepayers to return the best men, be they Conservative, Liberal Unionist, or Radical, Protestant or Catholic.

The rise in the population of Belfast is not now as rapid as it was, and we have a more settled community. Such a condition is more conducive to the development of a high ideal of citizenship. We require to rouse the body of the people from their apathy regarding the duties and responsibilities of citizenship. An interest in civic affairs must be aroused, and a spirit of civic patriotism created. Our men of means and leisure must recognise that there is a duty which they owe to the community, and that they are called upon to lay their powers on the altar of the common good. It is no use criticising the City Council and howling anathemas at the members of our public Boards. It is ourselves as citizens who are at fault if anything is really wrong. All is in our own hands. These beneficent agencies and public services are ours to make or to mar.

The object which must be set before us is a great one, and requires the assistance of every citizen. It is to make Belfast an ideal city. Knowledge of its activities must be disseminated. Love for its prosperity must be created. A sense of civic patriotism must be brought into being. Our aim should be to raise the tone of our local bodies to such a level that they shall be models to the other cities of the Kingdom. Then every citizen will be able, thinking of his part in the life spreading around the magnificent pile of his City Hall, to say with pride, and *justifiable* pride, "I am a citizen of no mean city."

Alderman King Kerr, in moving a vote of thanks to the Lecturer, said all present would go away with more information than they possessed before they entered the room, and also with a deeper sense of pride in their city. He thought the public, so far from criticising the corporators and other municipal governors, ought to criticise themselves. If they were not satisfied with the government of the city the fault was their own, for the people had the remedy in their own hands.

Mr. John Finnegan seconded the vote of thanks, which was passed by acclamation.

The Chairman, in conveying it to Mr. Muir, said Mr. Muir had treated his subject with great tact, and the Society would like to have some more papers on the same lines as those taken by the lecturer.

Mr. Muir suitably replied, and paid a tribute of praise to Mr. Hogg, who had taken the views which had added so much to the success of the lecture.

5th December 1905.

Professor Johnson Symington, M.D., F.R.S. F.R.S.E., President, in the Chair.

ON PREHISTORIC MAN IN SOUTHERN FRANCE

By W. P. De Vismes Kane, M.A., D.L., M.R.I.A

(Abstract.)

The lecturer first described the great limestone plateaux of Aquitaine, which are broken up by great cañons into separate units called Les Causses. He then showed a series of lantern slides representing the wonderful cliff scenery of the cañon of the river Tarn, down which he voyaged for 30 miles. The Causse of Gramat was then referred to, which is very similar in its appearance to the limestone plains of Galway or Clare, and likewise full of subterranean rivers and streams, but running at vast depths below the surface, and excavating caverns of enormous size and extent, the roofs of which in many cases have fallen in, and so have opened great chasms and gulfs in the flat levels, many of which have been explored by Monsr. Martel. Views of several of these abysses were given, some of them photographed by magnesium light. The barrenness of the plateaux of the higher levels abutting on the Cevennes was traced largely to the destitute condition of the peasantry, in consequence of the equal division among the children of the property of the father at his death, and the cutting of all timber to pay the debts, so that the whole country now lies bare to the sun in summer, and to the rain in winter, which washes away gradually the fertile soil into the fissures. The chalk plateaux were then described, which are the lowest in elevation, and most westerly, and the lecturer proceeded to describe the caverns and rock shelters of the Department of Dordogne, chiefly dealing with those about the village of Les Eyzies. Here he described the rock shelters of Cro-Magnon, in which three human skeletons were exhumed from among the debris of a "kitchen midden," composed of the relics of reindeer, bison, and mammoth, which had formed the food of the men who lived at that period. Another human skeleton was also referred to, which lay in a similar heap of debris, in the position in which he was killed by the falling down of the cornice of rock overhead. Flint weapons and flakes found by the lecturer in the refuse heap in which his remains were discovered were exhibited, and were referred to the close of the mid quaternary, or more properly the beginning of the upper quaternary period. Other skeletons such as that found in similar conditions at Raymondeu were mentioned belonging to the same age, namely, the late quaternary. All these were shown to have in common a very high type of dolicocephalic cranium, and the method of interment and the personal ornaments to be similar. The eleven human skeletons found in the Mentone caves in the extreme south-east France were then alluded to, where also a red ochreous earth was used to cover the bodies, while the flint weapons found in their hands and the corresponding style of ornaments proved the age to be late quaternary. The skulls corresponded in shape with those of Cro-Magnon, and showed a high index, and the stature of the men of that period proved to be on an average above 6 feet. This race of men, the lecturer said, were the earliest racial type which could be certainly ascertained to belong to any particular prehistoric period; for the Engis skull, though found in a layer of debris in which mammoth remains existed, was also accompanied by a fragment of pottery, which left the question of age open. Similarly he was unable to accept the evidence as to age of the Neanderthal skull, which is usually referred to the mid quaternary epoch. Illustrations of the chief types of weapons and implements of flint and bone were then shown, and various fragments of deer's antlers, with carvings of extinct animals, were thrown on the screen, among which cleverly executed outlines of elephants, mammoth, rein- and other deer, saïga antelope, bison and horses were shown. And lastly a description was given of cleverly executed outlines incised on the rough interior walls of caves at Les Eyzies, far away from the entrance, many of which were crusted over with a film of stalagmite, proving that they were not executed in modern times. This race of men contemporary with the age of the reindeer and mammoth in southern France were shown to be of a high type, both as regards the capacity and contour of their skulls, intelligence in ornament, and manufacture of implements from flint and ivory, so that one must look to the Tertiary period, long before the epochs of Southern European glaciation, for relics of any ancestors of the human race that approached the Simian type; though single specimens of debased shape were found both anciently as at Neanderthal, and in historical times as in the Peruvian tombs, and even in quite modern races.

On the motion of Mr. Garrett Nagle, seconded by Mr. Knabenshue, Mr. Kane was heartly thanked for his interesting and valuable paper.

4th January, 1906.

SIR JAMES HENDERSON, A.M., D.L., VICE-PRESIDENT, in the chair

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ULSTER SAYINGS AND FOLK-LORE.

By PROFESSOR BYERS, M.A., M.D.

(*Abstract*).

In this lecture, which was a continuation of a contribution brought before the Society—"Sayings, Proverbs, and Humour of Ulster"—on December 1st, 1903, and since published, Professor Byers discussed first various sayings and folk-lore used in reference to the weather and the seasons. That the Ulsterman can, when provoked, be severe, ironical, and sarcastic, was fully established by a variety of expressions; various phrases employed by him in bargaining were given; and, finally, examples were brought forward to show that even in Ulster, where the native Celtic element has been much displaced by the English and Scotch settlements, that topsy-turvy method of expression known as a "bull" is just as prevalent as in any other part of Ireland, and that, curiously, it is sometimes met with among those, otherwise learned and cultivated, as well as amongst the uneducated. The Lecture appeared in a series of articles in the *Northern Whig*, and will, with additions, be published.

Mr. WILLIAM CRAWFORD, in moving a vote of thanks to Professor Byers, said his lecture was as interesting and full of amusement and charm as the lecture he gave on the same subject on a previous occasion, and he hoped he would find time to give them a third edition.

Mr. ADAM SPEERS, in seconding the motion, said the lecture was by far the best he had ever listened to on that subject —a subject to which he had himself been giving a good deal of attention for the past thirty or forty years. The lecture Professor Byers had given that night, added to what he had said before on that subject, would make a very interesting treatise, and he hoped such a book would be produced by the lecturer soon. Perhaps the best work done in the way of collecting a vocabulary of Ulster words and phrases had been done by a gentleman whom he saw present that night—he referred to Mr. W. H. Patterson—in the treatise he had produced for the English Dialect Society.

The resolution was passed by acclamation, and was appropriately conveyed by the Chairman.

PROFESSOR BYERS, in responding, said he might perhaps on some future occasion take up the subject of "The Ulster Child: His Games and Amusements," which, he thought, would be an interesting topic to the members of the Society.

9th February, 1906.

Professor Symington, M.D., F.R.S., F.R.S.E., President, in the chair.

WITH THE BRITISH ASSOCIATION IN AFRICA,

By John Brown, F.R.S.

(Abstract).

To attempt to give in one evening anything more than a few salient impressions of a trip of 20,000 miles over land and sea would be impracticable. Quite the strongest impression remaining is that of the extraordinary cordiality and hospitality of our colonial cousins. Too much cannot be said for the careful forethought and organising power shown by the local stewards in their arrangements for entertaining a party of 376.

The members went out chiefly in two ships of the Union-Castle line, the Saxon and the Durham Castle. After the delightful voyage with its tropical seas, fishes, and birds, we had to awaken from the pleasant dreamy days on the ocean to land at Capetown. The members of the official party were hospitably entertained by the chief residents; the Hon. C. Dempers, a member of the Upper House of the Cape Parliament being "mine host."

Capetown is of course a quite old, settled, and flourishing city, set in most picturesque surroundings, within easy reach by driving, walking, or electric trams. The views from the summit of Table Mountain are very fine. A reception at the Royal Observatory was also interesting. The place was established by Royal charter in 1820. The site is not ideal, but it was the only available English possession at that time in the Southern Hemisphere. The gardens and botanical museums are most interesting, and the new City Hall a very fine building; in fact, all over South Africa one is struck by the size and excellence of the public halls available.

The opening half of the President's address was delivered here and sections met for three days.

On Saturday, 19th August, we sailed for Durban, a bright and busy, well-kept town, with a fine harbour, well filled with shipping. The streets are good, and there are electric trams, fare 3d. There are also rickshaws, drawn by natives; very fine men in fantastic dresses, very active, graceful, and full of antics. We were told they did not last long at this arduous work, partly on account of the damper climate near the sea. There is a sugar industry also a good locomotive works. Much of the retail trading appeared to be done by Hindus.

There is a beautiful suburb (the Berea). The vegetation in Natal is luxuriant, and the soil appears fertile. Tea, tobacco, sugar and maize are cultivated. Most delicious pine apples are sold at 2d. and 3d. each; they grow in drills like turnips.

Our next stay was Pietermaritzburg, another bright and pleasant town, near which, among the hills at Henly, a Kaffir dance was held in our honour by command of the Governor of the Colony, Sir H. M'Callum. The natives assembled to the number of 1,000 or more in war dresses of skins and beads, and with shields and poles, representing assegais. They saluted the Governor and suite, the salute being first a general hiss and then a crouching or "hunkering" down, and then rising to full height with a terrifying yell or howl. The dance was most strange. It was accompanied by a weird and monotonous chant, and the prevailing step was a stamping in unison with earth shaking power. The historians of the tribe marched back and forth, across the front, reciting the victories over their enemies. Occasionally a bevy of women would move across in crouching or fantastic attitudes. Some of them waving rolls of paper, which we imagined might be important documents, but which turned out to be bright coloured advertisements of somebody's patent pills.

After the dance came the marriage of a chief of the Inadi tribe to a lady who was to be his chief wife and mother of his principal heir. The ceremony began by dances of the bride's father, the bridesmaids, and marriageable girls. The amount of obole or consideration given for the bride was then arranged. The bride was asked if she were willing, presents were exchanged, and the ceremony concluded with a dance, during which the bride had to run away and be recaptured. After the dancing, etc., a number of oxen were killed, cut up, roasted, and eaten with great gusto.

At Colenso which is merely a station and a few shops, a hotel and a Hindu temple, we visited the battlefield, a plain, with low hills to westward on the banks of the Tugela, on which the Boers were entrenched or sheltered in schances. There are still shrapnel bullets and pieces of shell scattered here. The bravery of our troops and the incompetence of their leader was here fully recognised. The more we heard of the story of Colenso and Spion Kop the more miserable and foolish it appeared. There were monuments commemorating the bravery of officers and men, notably one where Lieutenant Roberts fell when trying to recover the guns.

All along the railway to Ladysmith are soldiers' graves, sometimes two or three, sometimes scores, marked with crosses, and protected with white palings. Those graves are kept in order by the Loyal Women's League of South Africa.

Ladysmith is said to be unhealthy since the war, owing to the germs of enteric fever left in the water, and is chiefly interesting on account of the mementoes of the siege. The tower of the Town Hall is preserved as it was left by a shell. The forts on the river bank still remain.

Speaking of the war leads to questions of policy, and it might be expected that one should have formed accurate impressions of the political views of the colonists. South Africa, as you probably know, has always shared with Ireland the role of scapegoat for the party Government of England. In South Africa the disastrous effects of the vacillation caused by this silliest of plans of ruling an empire became prominent. Distance is said to lend enchantment to the view—not, however, of the view by a colony of party government at headquarters. Chiefly on account of this uncertainty bred of party changes of policy the Home Government met with much condemnation, and the colonists were driven to wish for self-government, which they hoped could at least make up its mind to pursue one continuous policy. It was even said that many who were on the English side in the war would now be on the other, and it was maintained that the present Government was more extravagant, costly, and full of red tape than even that of the Boers was. The farmers and Boers seemed to think a local Government would give them protective taxes, put heavier taxes on the diamond mines, and they thought the Kaffirs should be forced to work by some means. Some said by a heavier hut tax, others by making them wear more clothes, which they would have to earn money to buy; others again by more forcible measures. I gathered from those with whom I happened to speak that Lord Milner was not approved of, was considered to have been weak, extravagant in appointments, and inclined to favouritism. By others some of these faults were attributed to the home Government. Cecil Rhodes was the one man in the colony of whom one always heard approval.

Johannesburg is a red city; the soil is red, the streets, the roofs, even the trees are red from the red sand carried by the dust-storms, to which it is subject. It has an unfinished, scattered look, very poor roads, and an air of hurry and excitement like all mining places. Ten of us were most hospitably entertained at Hohenheim, the residence of Sir Percy Fitzpatrick.

In Johannesburg the remainder of the President's address was delivered, and a very good lecture by Professor Ayrton on electric transmission of power. Speaking of Victoria Falls, he informed them that in the dry season the amount of horse power available was only one-tenth of that of Niagara, and he did not seem to think extremely favourably of the chances of utilising its power at Johannesburg, some 800 miles distant. He concluded, "Jealously guard the beauty of your Falls. Niagara was glorious nature, to day it is power; Victoria is poetry." In a paper published since the meeting, Mr. W. B. Essen disagrees with Professor

Ayrton's view and estimates the cost of transmitting the power as reasonable.

In the various sections some important papers on South African subjects were read—one by Mr. G. W. Lamplugh on the Victoria Falls and others on mining and engineering. These papers connected with South Africa were to be published in one volume by subscription in Johannesburg. I made a communication on a new form of Daniell's battery suitable for laboratory use.

The chief interest in Johannesburg is centred in the gold mines on the Rand. The gold occurs in the finely-divided metallic form in widely-extended reefs. What strikes one is the enormous outlay in plant and machinery, and the extent of the mines. The ore on being brought to the surface is machine broken, and then crushed by stamps, worked on the principle of our beetling engines, to fine powder, from which the gold is extracted first by amalgamation and then by cyanide of potassium solution, which extracts the finer particles. The drilling and work in the mines is done by Kaffirs.

The Kaffirs employed on the mines earn about 50s. per month, and are fed on mealie (maize) porridge, with occasionally meat, and they drink Kaffir beer, which is of the colour and consistency of thin gruel, tasting rather sour. They are well housed, sleeping side by side on shelves with feet towards a fire in the centre of the room. The rooms look about 20ft. high, and the boys look comfortable enough. These sleeping houses surround the yard of the compound. There is a hospital in the small compound adjoining, very clean and airy. The Kaffirs are engaged by recruiting agents sent out to their kraals, aud the chiefs appeared to have a say in the matter, as I was informed they had on some occasions objected to send boys to compounds which were not as sanitary as others.

The general opinion among employers of Kaffirs, both in the mines and farms, and in domestic service, is that it was best to engage the raw native fresh from the kraal. He is more to be trusted than the schooled and christianised native who has lost the sanctions of his old beliefs, and has probably received a surface smattering of religion and morals which he does not quite assimilate, and he has learnt other things which he would be as well without. Rev. Mr. Flint, librarian of the Cape Parliament, however, was the only person I met holding the opposite view. He contended that the gaol statistics showed this. But then we must remember that every crime or misdemeanour, especially among the servant class, is not brought to justice or to gaol.

Many of the natives, especially the young, are very graceful and easy in movement and gestures. They are said to be good orators. There was rumoured talk of a Kaffir rising, but a very intelligent and sensible owner of a fruit farm near Stellenbosch told me he thought it was merely circulated as an excuse for attacking the natives.

No Chinese are employed at the mines nearest the city, but at my suggestion an opportunity was arranged for a party of us to visit a mine employing Chinese. On the general question of Chinese labour, I gathered it was somewhat disappointing to the managers. Kaffirs, when obtainable, were preferred. I was informed the Chinese are hard to control, and very tricky. They began by carefully cutting half a foot off the end of the measuring rods for measuring the depths of the holes drilled, and fixing up the ends again with true Chinese artfulness, so that they were paid for six inches more per hole for some weeks before it was found out. They could not be induced to take care of their tools, and were otherwise disorderly at work. On the other hand, they learned quicker than Kaffirs, and earned rather more—2s. per day on a three year's contract. They appoint their own police in the compound.

Their food is a hotch-potch of meat and vegetables, very savoury, and cleanly cooked by Chinese cooks. Occasionally they had rice. The meals are served in a large, airy dining-hall. Their sleeping-rooms are even larger than the Kaffirs' and of the same style. They seem to be well cared for, if for no higher reason than that they cost so much, including their passage over, that it paid to keep them in good order. There is also a hospital.

On the whole, I gathered that the mine managers preferred Kaffirs, but the Chinese importation has brought the Kaffirs to a more reasonable frame of mind, and they are more easily dealt with, both by the mine-owners and farmers in the country. If the Chinese were sent home it is reasonable to suppose the Kaffirs would hold out again for higher pay from both managers and farmers. It has been said that if high pay were offered it would produce a larger supply of Kaffir labour. Probably it would ultimately do just the reverse. The Kaffirs are naturally easily contented and disinclined to work, so the Kaffir "boy" merely works long enough to earn sufficient to pay his hut tax and to purchase a couple of oxen, which he can exchange for a wife, who, according to the custom of his country, will do all the hard work at home. High pay would enable him to cease working sooner, a result seen after the high wages paid him during the war. Yet the native Commissioners reported that all over South Africa 270,000 more labourers were still needed.

There is absolutely no question of competition between Kaffirs or Chinese and white men. Both on account of the comparatively small wages the mining, farming, and other South African industries can afford, and the hard work in a hot climate, the white man prefers to be the overseer, the clerk, the responsible "boss." As a matter of fact, according to Sir George Farrar, the importation of Chinese gave employment to 4,000 white men.

As to the cry that the Chinese were in slavery, I must confess I do not understand it. It is scarcely polite to the Emperor of China to assume he would permit it. Mr. Douglas Blackburn, ex-assistant editor of the "Johannesburg Daily Express," writing to the "Times" recently, stated that, while at first there was injustice by incompetent compound managers, the Chamber of Mines took steps to remedy the evil, and now the treatment of Chinese was luxurious, compared with that meted out to the Kaffirs under the old regime, but Mr. Blackburn could not induce the Liberal English papers to ventilate Kaffir grievances. Why this touching sympathy for the Chinese in their comparative luxury?

Just at the time of our visit a few Chinese had got away from the compounds, and had committed crimes, even murders, but strong measures were being taken to round up these miscreants and prevent further misdeeds. I saw a gang of these being brought in, and no doubt such things would in future be prevented. A large party of us visited Pretoria and the Premier Diamond Mines, and saw Kruger's house and the Government Buildings, which were very fine.

Bloemfontein has a rural air, and seems a prosperous and growing town. There was a fair going on, and the Boers bringing in their produce struck me as rather like our own Northern Irish farmers. I was hospitably entertained here by Mr. W. S. Johnston, formerly principal of Larne Grammar School.

From Bloemfontein the line runs through miles and miles of lonely veldt with here and there a herd of cattle or flock of ostriches, apparently trying to eat stones and sunburned grass. At the end of the dry season the country gave an unfairly bad impression.

At Kimberly I was received by Mr. John Orr and his lady with true Irish hospitality. The diamond mines here again struck one as very costly undertakings. The diamonds occur in the famous "blue ground" contained in the immense "pipe" or outlet of an extinct volcano. When brought to the surface it is first spread on the ground to be "weathered," then washed from mud and waste, concentrated, and finally put through a most ingenious apparatus, where it is carried by streams of water over plates covered with grease, to which the diamonds stuck, while the waste was carried on by the water. Kaffirs were employed in these mines, strictly guarded, and thoroughly searched on leaving. We were told, however, that one ingenious person evaded the searchers by concealing diamonds behind his glass eye. Sir William Crookes gave a most interesting lecture on diamonds here. Kenilworth, a kind of garden city arranged by Rhodes for the white employes, was very interesting, with the adjoining experimental fruit gardens and zoological park.

From Kimberly the line runs north through a wilderness of sparse dried grass, with scattered small trees and occasional ant hills, some containing 40 to 50 tons of stuff. There seemed to be no humus or vegetable mould. We assumed that all vegetable remains were washed away as soon as formed in the wet season.

I venture with much diffidence to express an opinion on the question of agriculture in South Africa, which is a difficult one. Most of the country is very dry when it is dry and very wet when it is wet; also subject to disastrous hailstorms, and occasionally to continued droughts, and the locust and other insect plagues are also to be reckoned with. Animals suffer from various diseases, but it was said that in mixed farming out of all the various crops and stock a portion would survive out of which sufficient profit might be made, especially as the population increased and markets improved. The soil varies in quality a good deal, and land of course could be had at a low price, from a free grant upwards. With their large tracts of ground and native labour, the Boers made it pay. The dearth of Kaffir labour owing to the high wages of the war time made it more difficult now, and the Boers, it was said, complained that their products were cut out by imported goods and the cold storage companies. Others thought they were only making a poor mouth in view of getting compensation after the war, Fruit-farming and vine-growing appeared to succeed in parts suitable to these. I was advised that no intending settler should go out without a billet arranged for.

The climate on the high veldt is considered healthy by those who did not mind heat. All over South Africa dust is a great enemy. A doctor told me that they had to eat sand and worse than sand and the alimentary canal suffered. The great agricultural want is water, and it has been said that only by irrigation could South Africa ever hope to become a prosperous agricultural country. The difficulty is to obtain water. Attempts to obtain it by artesian boring have not been encouraging, and the rivers have a comparatively small supply in the dry season, when the water is most needed. By means of dams the flow of the wet season might be saved, but the size of such dams necessarily would limit their application when we consider that besides the water used a depth of four to seven feet is wasted by evaporation in the hot season. It is estimated that it takes a square mile of catchment area to provide water for one acre in the drier districts. A large dam in Rhodesia, begun by Mr. Rhodes, has been too recently finished to obtain results as yet. Irrigation works are also being carried out in Natal. Considering the enormous increase in the value of land produced by irrigation, it seems likely that when the country has settled down after the disturbance caused by the war more works of this kind would be undertaken in suitable districts either by private enterprise or Government funds.

Buluwayo is a place of magnificent distances—acres of streets, or where streets might be, with here and there a building, some pretentious, others mean. Among the finer are the offices of the mining companies.

I gathered that Rhodesia has not yet been at all thoroughly prospected. Except the newly-started Banket reef, of which much was expected, the gold hitherto discovered is not paying to large mines, but small reefs are found which would pay a small capital outlay. I gathered also that the former management of the Chartered Company was much open to criticism.

The Buluwayo Museum was opened by our President. It already contained many interesting geological, ethnological, and antiquarian specimens. A lecture was delivered in Buluwayo by Mr. M'Iver on Rhodesian ruins, his view being that they were of much later date than formerly supposed, a view meantime not shared by some other antiquarians.

An excursion to the Matopo Mountains, where Cecil Rhodes is buried, was very enjoyable. The rock is granite, and the formation said to be due to water denudation. I imagine ice had something to do with it, but this is a moot point. The view from Rhodes' grave is charming. I should not go so far as to call it "the world's view." North of Buluwayo the country is of the same arid type of wilderness. The line being recently made, big game are still sometimes seen in its neighbourhood. Two hunters who came after lions were attacked in their sleeping car standing on a railway siding one night, and only one hunter remained in the morning. Elephants had been seen by the train staff. A scarcity of bird life was noticed everywhere on the trip.

The Victoria Falls, on the Zambesia, which is here a mile wide, fall into the upper end of a zig-zag gorge, which, in the opinion of geologists, has been gradually formed by the action of the river. In the way of waterfalls I have not yet seen anything so grand and yet so delicately beautiful. The quantity of water at Niagara is more impressive. It is to be remembered our visit was at the end of the dry season. We arrived before daylight on September 12th, and I saw the falls at sunrise. The water falls into the gorge (380 feet deep and a mile long) in various streams and cataracts, and when the sun got a little higher a beautiful rainbow appeared below me in the spray which issued out of the gorge in flying clouds borne by the wind from the falling water.

A roar of many waters—mist, spray, foam—
A mighty gorge;
Deep in the black abyss a rainbow shone,
Bright steadfast spirit of hope in this chaotic fall.

We saw the falls by moonlight, also very beautiful with mystery. In the afternoon we were taken in boats manned by natives in their scant costumes to Livingstone's Island in the middle of the falls, where the great traveller had made a garden. A tree was pointed out on which he had carved his name.

Walking on the river bank some distance above the falls, where the river was studded with islands and shoals I heard a great splash and saw a large animal (no doubt a hippopotamus) raise its head, and then disappear. I bathed in the Zambesi twice, and it was delightful to feel and see water after the dreadfully arid country we had come through.

The Victoria Bridge, the highest in the world and carrying the railway towards distant Cairo, was opened by the President. It was here that occurred perhaps the most glaring instance of separation of the party into cliques by a most injudicious management of the Association authorities, which had been all along a great blot on the otherwise harmonious character of the trip. Only a select few were permitted to view the ceremony. The majority of the members were brought to the bridge and there held back out of sight by a military cordon. Among many other such instances might be given the high-handed attempt at Capetown to evict the less distinguished members from their berths on the Durham Castle to make room for the so-called official party ; also the attempt to evade promises of free passes to certain members of the party. Both of these latter attempts met with an undignified but well-deserved collapse. The berths were retained and the promises kept. This matter is mentioned to show that, while it is desirable to induce distinguished people to join these far-away meetings, it is the reverse to emphasise their separation into cliques. The business capacity and organising power of the B.A. officials was also sadly lacking, especially when compared with that of the local officials.

The party now returned to Buluwayo, and divided, some going home via Capetown and the rest of us via Beira and the East Coast in the Durham Castle, specially chartered for the trip, though most of us were greatly afraid of the hot Red sea or red-hot sea, as it was sometimes called. We called at Salisbury, and enjoyed a well-arranged luncheon, and we also spent a few hours at Umtali.

I endeavoured to ascertain from various people in those places what were the agricultural conditions in Rhodesia, and gathered that so far there were difficulties in transport and want of markets and in disease of stock, though one man was hopeful, and said a settler could recoup his outlay in a year or two. The unhealthiness of the country, the dust and dryness, and the tendency to a craving for drink were mentioned.

As we journeyed eastward into Portuguese territory the vegetation improved till near the coast it became green once more. At Beira the Portuguese gave us a most hospitable reception, after which we were glad to embark, and sail northwards the same afternoon, calling at Mozambique and at Mombasa, a very picturesque island and town among tropical foliage. The old fort had a varied history and is now a prison. The soil appeared more fertile on the Uganda Protectorate, at least where they were, near the coast, as it usually is near the sea.

I have almost finished but as we now leave the more southern portion of Africa, I may show just one slide illustrating very generally the physiolcgy of that portion of the Continent. We all know this familiar and frequent flat topped hill, a common object in South African landscape. The theory of the geologists is that the original surface of the Country was formed by a layer of hard dolerite or igneous rock such as seen on the top of this hill. Denudation by torrential rains gradually washed away the softer parts leaving only more resisting portions forming the table tops of these kopjes. This denudation reduced the level of the surface of the land to the present veldt, which although to appearance seems to be an irregular plain is really made up of a number of very shallow valleys, making up what the geologists call a peni-plain that is almost a plain. Each of these valleys drains into a larger valley and so ultimately into one of the permanent rivers. Down these rivers the soil or sand or stuff forming the difference in height from the original level has been swept during ages into the sea.

It will be clear that such a peni-plain must have originally terminated on or near the sea level but at present the veldt is several thousand feet above the sea and it is therefore thought that after the peni-plain was formed either the whole continent rose or the sea sank. The former seems to be more probable. Denudation is now again going on along the coast line and very beautiful examples of the formation of these branching valleys with their watercourses on the hill side may be seen from the railway line running up through Natal.

An unexpected delay gave us leisure to see Cairo and a bit of Egypt. I seemed to see in these two protectorates how well the Englishman could organise a country when he was more free from the interference at every step by the home Government and its parties and red tape.

We got cool in the Mediterranean, and saw Stromboli firing out his incandescent ashes and lava. We passed Gibraltar after nightfall, flashing its slow-sweeping searchlights like two eyes of the old lion guarding the narrow seas, and arrived at Southampton on the 24th October, much pleased with our delightful trip.

Professor Symington expressed thanks to Mr. Brown for his admirable lecture, and the lecturer appropriately replied.

6th March, 1900.

PROFESSOR JOHNSON SYMINGTON, M.D., F.R.S., F.R.S.E.
in the chair.

MAGIC IN THE GREEK AND ROMAN WORLD

BY R. M. HENRY, M.A.

(Abstract.)

THE history of primitive Magic has of late years assumed an increased importance in view of its bearing upon the question of the origin of religion, many authorities holding that all primitive religions are based in the last resort upon Magic. By Magic is understood the savage principle of thought that like produces like and the practices (such as rain making, healing diseases by homoeopathic ceremonies and the like) to which it gave rise. There are many survivals of this primitive stage of thought to be found in the practices described by such writers as Lucian and the Elder Pliny. Many of these ceremonies were accompanied by spells which at a primitive period were merely statements that the desired effect had been or would be produced. With a growth of a belief in gods spells tended to become prayers, though the old form still survived side by side with the later. In the spells of the Magical Papyri of Paris, Berlin, Leyden, and London several varieties can be discriminated. The long lines of unintelligible formulae contain many words of Egyptian, Babylonian, and Hebrew origin, pointing to borrowing with more or less intelligence from the magical practices of these nations. The rows of letters of the alphabet are the relics of a superstitious veneration for alphabetical signs, which must have arisen with the invention of writing: the employment of the alphabet as a spell to ward off evil demons is found alike in the ruins of Pompeii and in the Catacombs. A third class of spells in the Papyri are prayers to Apollo or Hekaté.

Astrological theories and the belief in malignant spirits had peopled both heaven and earth in the popular estimation with hostile powers of evil and many magical ceremonies were invented and propagated to protect mankind from their resentment and hostility. This was one of the beliefs taken over by the Church from its heathen neighbours. The possibility of demoniac possession was universally admitted and it was held to be possible for a magician to send a spirit to inhabit the body of one over whom the magician wished to gain power. The destruction of one's enemies was a common object of magical procedure. The leaden *defixiones*, found in hundreds throughout the countries comprised in the Roman Empire, which were inscribed with the name of the person to be cursed and deposited in a grave, are proof of the universality of such practices. They were used by tradesmen in the hope of injuring their rivals, by litigants against their opponents, wives against faithless husbands and *vice-versa*. A large number were drawn up by charioteers with a view to secure the victory over their opponents in the races in the great amphitheatres of Rome and Carthage. The death of an enemy was also supposed to follow the manufacture of a leaden image representing him which was, with appropiate ceremonies, hidden in a grave or flung into the sea. Some of these leaden images are still extant. Similar ceremonies with waxen images could secure the affection of a beloved person: such ceremonies are described by Theocritus, Vergil, and Lucian. To this love magic, in itself harmless, was added the belief in demons, and the horrible practice arose of attempting to secure affection by causing the object of one's desires to be possessed by a demon which brought its victim under complete control. Many curious stories of such practices are recorded and not the least curious are those in which monks and priests undertake to exorcise the demon, never questioning the reality of his presence in the victim.

Often the arts of the magician were directed towards the attainment of useful ends, such as the healing of sickness or the banishing of serpents; often they were employed for purely frivolous or spectacular purposes, such as walking on the water or flying through the air. St. Peter is credited with having on one occasion banished the demons who were supporting a follower of Simon Magus in the air, with the result that the unfortunate man was dashed to pieces. Many modern customs and ceremonies, of which more edifying explanations are current, are really survivals of the use of magic and of the belief in demons; and the study of such superstitions is not without both an historical and an ethical value.

At the conclusion of the lecture Professor Lindsay, Mr. J. Brown, and other members complimented Mr. Henry upon the excellence of his paper.

REPORT ON THE WORK OF THE MARINE LABORATORY, LARNE HARBOUR.

By. Professor Gregg Wilson, D.Sc., M.R.I.A.

(Abstract.)

Dr. Gregg Wilson's paper dealt with the work of the Marine Laboratory, Larne Harbour, and he began by referring to the equipment of the Association. He stated that the launch was in better condition for work than ever before owing to the kindness of Mr. Jack, of Larne Harbour, who had provided a number of new parts. The laboratory had been maintained in good working order, and the new naturalist (Mr. Wollaston) had carried on the routine work of the Association most efficiently. Research work had been steadily gone on with, old investigations having been continued, and new started. Work at the herring had been pursued, and now the observations were specially directed to determine the distinctions between different varieties and age distinctions. Drift work had also been continued by Mr. C. M. Cunningham, with increasingly interesting results. Apparatus for securing information as to the movements of bottom waters had been devised, and examination of all the records showed more and more clearly that there was a definite set of currents in certain directions. Systematic work at the various groups of organisms continued, and some of the results were now in print.

Mr. Pearson, the former naturalist of the Association, had had the first part of his account of the Copepoda of Ireland published, and the second part was now in the printer's hands. Mr. Adams's paper on "The Algæ of Antrim" had also been completed, and and was ready for issue to the members. Mr. G. C. Gough had finished an account of the "Foraminifera of Larne District," which was also in the printer's hands, while Mr. Joseph Wright was engaged on what might well be his *magnum opus*, an account of the Foraminifera of Ireland. Mr. Wollaston, the naturalist of the

Association, had successfully devoted himself to the Tunicata, a group greatly neglected, but of much interest. Other members of the Association had added to their lists of Crustacea, sponges, Annelida, &c. New work of various kinds was next referred to. Mussels had been dealt with by Dr. Carnwath, who studied those found in Belfast Lough, and watched the changes in their bacterial contents when removed to Larne. He found a rapid decline in bacteria that indicated sewage contamination. His results had been embodied in a paper that would soon be published. Dr. John Milroy had undertaken a laborious investigation of the glycogen present in oysters of different beds at different times of the year. The object was to help in determining the time when Irish oysters were in best condition. The Association had also decided to make experiments in oyster-fattening on the lines of work successfully carried out by the fisheries branch of the Department of Agriculture elsewhere in Ireland. It was proposed to lay down a number of small oysters in "caisses" to study their growth, and ascertain if, as is probable, successful rearing could be carried on in Larne Lough. The oysters experimented with would be examined periodically by a chemist and a bacteriologist, so that the fullest information might be available as to their condition. Mr. W. H. Gallway had undertaken another important addition to the economic work of the Association. He would label a large number of fish and return them to the sea, so that if they were recaptured something might be known of their migrations.

In Scotland and elsewhere such work had yielded valuable information as to the definite and periodic movements. Another new departure has been made by Mr. G. C. Gough, who was engaged studying the bottom deposits from various parts of the Irish coast. Samples taken by the dredge were sent by the Department of Agriculture for examination, and Mr Gough was thus enabled to engage in work that was alike of value to the biologist and of interest to the geologist. The Association's great object of ambition was a good laboratory, with an aquarium attached. The value of the aquarium for educational purposes would be very great, and it was thought that it would be taken advantage of for teachers' classes, and similar purposes, as was the case with such institutions in England and Scotland.

The lecture was illustrated by lantern illustrations, which added additional interest to it.

A vote of thanks, moved by Mr. Garrett Nagle, R.M., and seconded by Mr. John Horner, was passed to Professor Gregg Wilson.

27th April, 1905.

SIR OTTO JAFFE, J.P., in the chair.

Two Papers were read by

W. C. MARTIN, M.I.E. & S., A.M.I.E.E.

THE TELEAUTOGRAPH

For the Electrical transmission of Facsimile Writings and Drawings.

FRAHM'S INDICATOR

For indicating speed of Machinery, or the frequency of alternating Electric Currents.

ANNUAL REPORT, 1905-6.

The Annual Meeting of the Society was held on 14th September, 1906, in the Museum, College Square North. In the absence of the President (Professor Johnson Symington), the chair was occupied by the President of the Queen's College (Rev. Dr. Hamilton), and amongst those present were Rev. J. Lamont Orr, M.A.; Professor Morton, M.A.; Dr. W. Calwell; Dr. J. M. MacCormac, and Messrs. Robert Young, J.P.; R. M. Young, B.A., J.P. (Hon. Secretary); Seaton F. Milligan, J.P.; George Kidd, J.P.; John Brown, F.R.S, ; John Carson; R. A. Kyle; Joseph Wright, F.G.S.; John M. Finnegan, B.Sc., B.A.; John Smith, C.E.; Robert Patterson, M.R I.A.; Nevin H. Foster; H. C. Montgomery; W. Faren; William Gray, M.R.I.A.; Isaac W. Ward; John Horner; A. H. Muir, C.A.; and A. H. Milligan. The notice convening the meeting having been read.

The Hon. Secretary submitted the Annual Report, which was as follows:—

The Winter Session was opened in the Museum on the 7th November, 1905, when an illustrated lecture was given by Mr. Arthur H. Muir, C.A., subject "Belfast Civic Undertakings."

The Second Meeting was held on the 5th December, when an illustrated lecture was kindly delivered by Mr. W. F. de Vismes Kane, M.A., D.L., subject "Prehistoric Man in Southern France."

The Third Meeting was held on the 5th January, 1906, when Professor J. W. Byers, M.A., M.D., lectured on "Ulster Sayings and Folk-lore." Sir James Henderson, M.A., D.L (Vice-President) presided.

The Fourth Meeting was held on the 9th February, in Grosvenor Hall, when Mr. John Brown, F.R.S., delivered a popular scientific lecture, subject "With the British Association in Africa."

The Fifth Meeting was held on the 6th March, when the following papers were read :—(1) "Magic in the Greek and Roman World," by Mr. R. M. Henry, M.A. ; (2) "Report on the Work of the Marine Laboratory, Larne Harbour," with lantern illustrations by Professor Gregg Wilson, D.Sc., M.R.I.A.

The concluding meeting took place on the 27th April, when an illustrated lecture was kindly delivered by Mr. W. C. Martin, Electrical Engineer, Glasgow, subject "The Teleautograph, and Frahm's Indicator."

There was a large attendance of the members and of the general public at these meetings. The different societies holding their meetings in the Museum show no diminution. As usual, the Museum was thrown open to the public on Easter Monday and Tuesday at a nominal charge, but the attendance was not so large as usual, mainly owing to weather. No damage was done to any of the collections.

Some valuable donations have enriched the Museum during the year. Foremost amongst these is the Battersby Collection of British Insects, presented by Mrs. Battersby, Cromlyn, Rathowen, Westmeath. Some are of considerable rarity, and the collection is enhanced by the fact that many of the specimens were captured in Ireland. This series of insects is kept as a separate collection and is well displayed in five small cabinets, with thirty-five drawers, and is always available for inspection by those interested in entomology. There has also been received on loan from Mr. Osborne Grimshaw, Portrush, a most interesting collection of specimens of Zulu bead-work, consisting of headdresses, necklaces, beads, etc. It illustrates one aspect of the habits of this African race in the primitive state when unaffected by contact with European civilisation.

Since the last annual meeting the Society has to deplore the loss of two of its oldest and most respected members. Mr. John Anderson, J.P., was a member of Council and Treasurer for many years. Sir Robert Lloyd Patterson, D.L., F.L.S., had been associated closely with the Society for very many years, at first as Joint-Secretary and twice as President for terms of two years each in 1881 and 1894. He frequently contributed papers on various subjects of zoology, especially ornithology, and was always ready to aid the Society by every means in his power. Your Council have co-opted Sir Otto Jaffe to fill his place on the Council and as Vice-President. The resignation of Mr. W. H. F. Patterson from the Council was received with much regret, and Mr. Nevin H. Foster was co-opted in his stead. A large number of valuable publications issued by the various learned societies who exchange their transactions with ours, have been received and are available to every member.

In accordance with the constitution of the Society, five members of Council retire from office, all of whom are eligible for re-election—Messrs. Nevin H. Foster; Professor Johnson Symington, F.R.S.; Robert M. Young, J.P.; President Hamilton, D.D., LL.D.; and Sir Otto Jaffe, J.P.

Mr. John Horner referred to the statement of accounts, which showed that there was a balance of £26 8s. 5d. due the Treasurer. That, he said was to some extent due to the small number of admissions at Easter and to the falling off in some of their subscriptions, but he believed that before the present year's working was completed they would have the debit completely wiped out and the balance on the right side.

The Chairman, in moving the adoption of the Annual Report and Statement of Accounts, said it seemed to him of increasing importance in Belfast that they should have a Society such as that to form a meeting-place for men and women who are interested in various branches of science, and to preserve collections illustrative of those branches. He trusted that no matter what changes may come, in the direction either of consolidating the museums of Belfast, or in any other direction, the time would never arrive when that old Society, which had for so many years occupied such an honourable place in the city, and which he took leave to say had done such admirable work, would cease to exist. None of them, he was sure, would be averse from seeing the valuable collections which were housed underneath that roof made more generally available for public use under proper conditions. He was not certain if their Society had the power to dispose of those collections. That would be a matter which would have to be inquired into. The subject did not at present come before them, but he simply repeated that for his part he would deeply regret the coming of the time when the Society either ceased to exist or ceased to perform the various important functions which for so long a period it had discharged so well. The Report showed that during the past session the work of the Society was carried on with its usual vigour and he thought he might say its usual success. He had the pleasure of being present at some of the meetings at which there were discussed subjects of all kinds in connection with various branches of science so as to cater for the different aptitudes and likings of the inhabitants of the city—a very proper and important arrangement and he knew of the success which attended them. In his opinion a good deal of the success of last year's working was due to the labour of their excellent President. Professor Symington was one of the busiest men in Belfast, but in his case they had an illustration of the well known fact that if they wanted anything done they had better go to a busy man to get it accomplished. He had given himself to the work of that Society with extreme ardour and much success. An ardent votary of science himself, it was his pleasure to see not only the particular branch with which his name was associated, but all branches furthered and advanced in the city. There was only one feature in the Annual Report which caused them all the deepest regret. He referred to the announcement of the deaths of two of their oldest members—Mr. John Anderson and Sir Robert Lloyd Patterson. Both of them had been long connected with that institution, and both of them took a deep interest in its affairs. He had not the pleasure of being intimately acquainted with Mr. Anderson, though he knew well how greatly indebted various literary and scientific organizations in Belfast were to him. But it was his privilege for many years to be on intimate terms of friendship with the late Sir Robert Lloyd Patterson, and on personal grounds as well as for the sake of the

Society, he deeply regretted the fact that they would see his face no more. Everyone who knew him as a friend not only valued but loved him, and every Belfastman also knew and rejoiced that the old and honoured name of Robert Patterson gained increased honour in his person. It was not necessary for him to tell them that Sir Robert was one of their foremost ornithologists, or how well he carried on the old traditions which were associated so long with the name of William Thompson, and which had shed such lustre not merely on their Society, but on the whole North of Ireland. He trusted that the loss of such eminent members might stir up others to come forward and take their place in maintaining the interests of a body with which were so intimately bound up the interests of science in their city.

Mr. John Smith seconded the adoption of the Report, which was agreed to unanimously.

Mr. William Gray moved the re-election of the retiring members of Council—President Hamilton, Sir Otto Jaffe, Professor Symington, Mr. Nevin H. Foster, and Mr. R. M. Young. He (Mr. Gray) believed that the question of the amalgamation of the museums must come before the public in a very short time, and in his opinion the time had arrived when it would be judicious for the public to take steps in that direction with a view to the Society's collections becoming part and parcel of the municipal museum. Overtures, however, in connection with such an arrangement ought to come from the public, not from the Society.

Mr. A. H. Muir seconded the motion, which was passed.

On the motion of Dr. Calwell, seconded by Mr. H. C. Montgomery, a cordial vote of thanks was passed to President Hamilton for presiding.

Mr. George Kidd said he hoped it would not be permitted to go out from that meeting that the Shareholders would be likely to adopt a resolution transferring the Society's collection to the Corporation. He had seen in the "Northern Whig" that morning a letter from a Shareholder, who put forward as one of the chief reasons for taking such a step the great price which the Shareholders would obtain for their shares. It would be a poor testimonial to the Society as it existed at present and a poor tribute to the memories of the men who had built it up in the past to think for a moment of scattering their collection for such a reason as this. How any person could think that the collection of the Society would be better in the hands of the Corporation was more than he could understand. From a pretty long recollection of the Corporation he must say he thought the Museum would be better in its present location. The Corporation ought to establish, and doubtless would establish, a municipal museum, but he did not think it at all likely that the contents of the Society's Museum would ever be allowed by the Shareholders to be handed over to it. The Society was well able to keep its collection, and to talk of maintaining the Society and handing over its collection was a dangerous suggestion, the carrying out of which would weaken, if not extinguish altogether the Society. He took the liberty of suggesting that the Shareholders present should be allowed to give expression to their views on the subject.

The Chairman said he had not liked to interrupt Mr. Kidd in his remarks, but the business for which they had been summoned had been concluded, and it would not be in order now to launch out into a discussion such as was proposed. The Society might depend upon it that the Council would take no step in the matter without calling the members together, and giving them the most ample opportunity of considering the subject in all its bearings.

Mr. Muir said the letter referred to by Mr. Kidd suggested that the Shareholders were anxious to make a profit for themselves out of the collection. He wished to protest against this suggestion. Nothing was further from their thoughts than to seek their own personal advantage in this matter.

In reply to Mr. Kyle, Mr. Horner said there were 160 Shareholders and about 20 Subscribers in the Society.

The matter then dropped, and the Meeting terminated.

The Officers of the Society for the year were elected by the Council after the Annual Meeting:—President, Sir Otto Jaffe, J.P.;

Vice-Presidents, Sir James Henderson, D.L., Rev. President Hamilton, Robert Patterson, M.R.I.A., W. Swanston, F.G.S.; Hon. Treasurer, John Horner, J.P.; Hon. Librarian, John H. Davies; Hon. Secretary, R. M. Young, B.A., J.P.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885, 48 & 49 Vict., ch. 78.

The Account of the Council of the Belfast Natural History and Philosophical Society for the year ended 30th April, 1906.

Dr. | Cr.

CHARGE.

To Balance as per last Account		£10 2 9
,, Amount of Donations, Bequests and other Endowments ...		7 0 0
,, Subscriptions		95 9 0
,, Dividends		17 2 0
,, Rents		28 17 0
,, Fees		0 5 0
,, Sales		0 3 6
,, Miscellaneous Receipts, viz:		
Proceeds of Lecture	£6 10 6	
Admission Fees	18 14 0	
Easter Receipts	9 12 2	
		34 16 8
		£193 15 11
,, Balance due Treasurer		26 8 5
Total ...		£220 4 4

DISCHARGE.

By Amount of Payments under the following headings:—		
Maintenance of Premises, &c	£15 8 6	
Rent and Taxes, &c, ...	30 0 0	
Salaries	93 14 6	
		139 3 0
,, Other Payments viz:—		
Printing and Stationery	33 7 8	
Advertising	6 0 10	
Postage and Carriage	5 10 10	
Fuel and Gas	11 17 5	
Other Payments	21 4 7	
		81 1 4
Total Payment		220 4 4
Total		220 4 4

N.B.—Besides the above Balance there is a sum of £400 standing to the Credit of this Account in the York Street Flax Spinning Co., Ltd., 4½ per cent. Debenture Stock.

We certify that the above is a true Account.

ROBERT M. YOUNG, Governor
JOHN HORNER, Accounting Officer

Dated this 12th day of June, 1906.

I certify that the foregoing Account is correct.

J. F. MAYNE, Auditor.

Dated this 29th day of June, 1906.

DONATIONS TO THE MUSEUM, 1st MAY, 1905, TILL 1st MAY, 1906.

From MR. W. CAMPBELL.

Seven old newspapers—*The Belfast News-Letter*—dates 1812-13-14-15.

From MR. ROBERT WELCH, M.R.I.A.

Five specimens of *Trochus zizyphinus*, from Portaferry, Strangford Lough, and three specimens of *Achatina acicilloides*, from Co. Kilkenny.

From MR. JOSEPH WRIGHT, F.G.S.

Specimen of Primary Limestone, covered with cup-shaped hollows on the surface, from Sessiagh Lough, North Donegal.

From MR. GRAHAM RENSHAW, Manchester.

Seventeen photo engravings of natural history objects.

From MRS. BATTERSBY, Cromlyn, Rathowen, Westmeath.

Five cabinets of British insects.

From MR. J. P. BARRETT, Margate, Kent.

Seventy specimens of Lepidoptera.

From MR. SEATON F. MILLIGAN, M.R.I.A., J.P.

A specimen of the sea-mouse (Aphrodita aculeata), from Bangor.

ADDITIONS TO THE LIBRARY, 1st MAY, 1905, till 1st MAY, 1906.

From

Adelaide.—Memoirs of the Royal Society of South Australia. Vol. 1, part 3, and Transactions. Vol. 29, 1905. *The Society.*

Albany.—Fifty-sixth Annual Report of the New York State Museum. Vols. 2—4, 1904. *University of the State of New York.*

Ann Arbor.—Fifth Report of the Michigan Academy of Science, 1904, and Seventh Report, 1905. *The Academy.*

Basel.—Verhandlungen der Naturforschenden Gesellschaft in Basel. Vol. 18, part 1, 1905, and part 2, 1906. *The Society.*

Bergen.—Bergens Museums Aarbog, parts 1—3, 1905, and part 2, 1906. *The Director.*

Bologna.—Rendiconto della R. Accademia delle Scienze dell' Istituto di Bologna. Vols. 5—8, 1901—1904. *The Institute.*

Boston.—Memoirs of the Boston Society of Natural History. Vol. 5, No. 10, 1903, No. 11, 1904, and Vol. 6, No. 1, 1906. Proceedings. Vol. 31, Nos. 2—5, 1903, Nos. 6—10, 1904, and Vol. 32, Nos. 1 and 2, 1904; also Occasional Papers, Vol. 7, Nos. 1—3, 1904. *The Society.*

Bremen.—Abhandlungen Herausgegeben vom Naturwissenschaftlichen Verein Zu Bremen. Vol. 18, part 1, 1905. *The Society.*

BRESLAU.—Zeitschrift für Entomologie vom Verein fur Sclessiche Insektenkunde. New series, part 30, 1905.
The Society.

BRIGHTON.—Abstracts and Annual Report of Brighton and Hove Natural History and Phllosophieal Society, 1905. *The Society.*

BRISBANE.—Annals of Queensland Museum, No. 6, 1905.
The Director.

BROOKLYN.—Science Bulletin of Brooklyn Institute of Arts and Sciences. Vol. 1, Nos. 5—7, 1905, and Cold Springs Harbour Monographs, Nos. 3—5, 1905.
The Institute.

BRUSSELS.—Bulletin de la Société Royale de Botanique de Belgique. Vol. 41, part 1, 1905, and vol. 42, parts 1 and 2, 1905. *The Society.*

,, Annales de la Société Entomologique de Belgique. Vol. 49, 1905. *The Society.*

,, Annales de la Société Royal Zoologique et Malacologique de Belgique. Vol, 39, 1905,
The Society.

BUENOS AYRES.—Anales del Museo Nacional de Buenos Aires. Ser. 3, vol. 3, 1904, and vols. 4 and 5, 1904—5.
The Director

CALCUTTA.—Memoirs of the Geological Survey of India (Palæontologia Indica). New ser., vol. 2, Memoir 2, 1905, and Records, vol. 22, parts 2—4, 1905, and vol. 23, part 1, 1906. *The Director.*

CAMBRIDGE.—Proceedings of Cambridge Philosophical Society. Vol. 13, parts 2 and 3, 1905, and part 4, 1906.
The Society.

CAMBRIDGE, MASS.—Bulletin of the Museum of Comparative Zoology. Vol. 46, parts 4—10, 1905, and parts 11—13, 1906; vol. 47, 1905; vol. 48, part 1, 1905, and part 2, 1906; vol. 49, parts 1—3, 1906; also Report of Curator for 1905.
The Keeper of the Museum.

CARDIFF.—Transactions of Cardiff Naturalists' Society. Vol, 27, 1904, and vol. 28, 1905. *The Society.*

CASSEL.—Abhandlungen des Vereins für Naturkunde zu Cassel, 1905. *The Society.*

CHICAGO.—Bulletin of Chicago Academy of Sciences. Nos. 3 and 5, 1902; also Special Publications, No. 1, 1902. *The Academy.*

CHRISTIANIA.—Forhandlinger i Videnskabs-Selskabet i Christiania, for year 1904.
The Royal Norske Frederiks University.

CINCINNATI.—Bulletin of the Lloyd Library, No. 7, 1903, and 8, 1905. and Mycological Notes, 1904.

COLORADO SPRINGS.—Colorado College Studies. Six numbers, 1904—6. *Colorado College Scientific Society.*

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Hazelton, W. D., Cliftonville,	do.
Higginbotham, Granby, Wellington Park,	do.
Hutton, A. W., Chichester Street,	do.
Lynn, William H., C.E,, Crumlin Terrace,	do.
M'Laughlin, W. H., J.P., Macedon,	do.
Parr, William, St. Mark's, Ballysillan,	do.
Redfern, Prof. Peter, M.D., F.R.C.S.I., Lower Crescent,	do.
Scott, Conway, C.E. Annaville, Windsor Avenue,	do.
Swiney, J. H. H., B.A., R.E., Bella Vista, Antrim Road,	do
Thompson, John, J.P., Mount Collyer,	do.