"The Old Light and the New."

YOUR reviewer expressed an opinion, and makes two statements, and the six lines comprise his review of my book. The opinion, being on a matter of business, may be right or may be wrong. The statements are supposed to relate to fact; but they must be the outcome of hasty reading, for the "large portion of the book, dealing with theories of the natural colours of bodies," cannot surely be spoken of as "padding" in a work whose sub-title is "The Chemistry of Colour," and one of whose objects is to show that the Röntgen rays and matter yield "invisible" colour which conforms to the same laws as "visible" colour. Nor do I think it correct to call information on the X-rays "sketchy" because it happens to be concise.

WILLIAM ACKROYD.

IN my brief criticism of Mr. Ackroyd's book, I did not intend to suggest that the *whole* of the section on natural colours was "padding." My meaning would, perhaps, have been clearer had I written, "a large portion of that part of the book which deals with theories of the natural colour of bodies is nothing more than padding." The forty pages which comprise the chapter on "The Chemistry of Colour," contain the substance of a lecture delivered before the Society of Dyers and Colourists, and is so full of tabular details, while the remainder of the book is of a very elementary character, that it certainly gives the impression of having been included more to increase the bulk than on account of suitability.

YOUR REVIEWER.

"The Reminiscences of a Yorkshire Naturalist."

THE brevity of the reference, on page 205 of "The Reminiscences of a Yorkshire Naturalist," by Dr. W. C. Williamson, to the memoir in the *Annales des Sciences Naturelles*, may give rise to misconception. Prof. Hartog's share in this work was by no means that of a mere translator, although his exceptional ability as a French scholar was of essential service. His collaboration extended to the substance as well as the form of the memoir, and he was always fully recognised by Dr. Williamson as its joint author.

A. C. WILLIAMSON.

Post-Graduate Study in London.

COULD you inform a graduate in science of London University whether there is any place in London where he could attend post-graduate and research courses of study in botany? He is engaged as science master in a large public day-school, but is anxious to study botany in his spare time. Any information will greatly oblige.

"PUTHOS."

June 14.

LORD KELVIN'S JUBILEE.

OUR summary in last week's issue of the proceedings at Lord Kelvin's jubilee celebration gives only a faint idea of the completeness and success with which every part of the festival was carried out, or of the enthusiasm which characterised what was the world's tribute of admiration to the achievements and personal qualities of a truly great man. The list of delegates and visitors which we give on pp. 174-5 will convey some idea of the unanimity with which science and learning throughout the world have done honour to one who, besides advancing pure science in a remarkable degree by his own abstract researches, has not disdained to apply his great knowledge of scientific principles to the construction of apparatus and appliances which have promoted peace and good will among men and aided commerce by placing continents in telegraphic communication, by improving and facilitating navigation, and last but not least, diminished the perils to which those who sail the seas are exposed. A great physical mathematician, a physicist to whom physical principles are intuitive, an engineer whom engineers have united to honour as one of the greatest of themselves, Lord Kelvin has many scientific interests, and there is no department of science which is not the larger and richer for his work.

The opening meeting of the celebration was the *conversazione* on Monday evening at the University. The

guests were received by the *Senatus Academicus*, and the members of the Corporation of the City of Glasgow headed by Lord Provost Sir James Bell, in the Randolph Hall, which forms a "Fore Hall" or vestibule for the magnificent Bute Hall in which the high ceremonies of the University are held. In the Bute Hall, a little beyond the entrance and to the left, chairs were set for Lord and Lady Kelvin, who stood receiving the individual congratulations of the multitude of distinguished visitors. After thus paying their respects to the hero of the occasion, the guests passed on to meet one another, to renew acquaintanceships, to look at the treasures of the museum, and to inspect the splendid collection of instruments, diplomas, and medals which had been arranged to illustrate Lord Kelvin's researches and inventions, and the honours he has received. In this exhibition were many things of great interest, and we will not attempt even their enumeration. To give an adequate account of the instruments alone would require several numbers of NATURE, while the diplomas, mostly in Latin and of extraordinary distinction, represented the honour in which Lord Kelvin is held by the learned societies at home and abroad. Beginning with the certificate of the Bishop of Ely approving the appointment of William Thomson, B.A., as a Fellow of Peterhouse, they ended with the credentials of Sir William Thomson or Lord Kelvin's election as member of every one of the most distinguished scientific societies of the world, and included the letters of the Perpetual Secretary announcing, first, Lord Kelvin's election as Corresponding Member, next, as Foreign Associate of the Institute of France, and the announcement of his appointment as *Grand Officer* of the Legion of Honour.

The part played by the telegraph in the *conversazione* formed an exceedingly interesting part of the proceedings. The chief Cable Companies—the Anglo-American, the Commercial, the Eastern, and the Brazilian Submarine—sent congratulations, and instruments were arranged in the Library Hall whereby messages could be received from all parts of the world during the *soirée*. The Anglo-American Company's message may here be quoted, as it gives in a few words that credit for rendering by his instruments submarine telegraphy practically possible, which is Lord Kelvin's due, and that by a large portion of the commercial public that carries on business by means of cable communication is either unknown or apparently forgotten.

In 1858 Professor William Thomson took out his first patent for a system of working long cables, and for instruments (including the mirror-galvanometer) calculated for producing a high rate of transmission. In the Atlantic expedition of 1858 Professor William Thomson, at that time one of the directors of the Atlantic Telegraph Co., at the request of his brother directors, took upon himself the duties of electrician on board H.M.S. *Agamemnon*, which had been placed at the disposal of the company for the laying of the first Atlantic cable; and when the cable had been laid, it was Professor William Thomson's inventions and genius which caused a sufficient number of messages to be transmitted to demonstrate the practicability of Atlantic telegraphy, thus contributing most materially to the present success.

Our readers will remember that the theoretical solution of the problem of telegraph signalling by Lord Kelvin consisted in showing that the "retardation" of a signal increases in direct proportion to the square of the length of the cable supposed of a given pattern; and that therefore it was only possible by using receiving instruments for surpassing in delicacy the most sensitive of land instruments that intelligible signals could be obtained at all. There can be no manner of doubt that it was the tremendous battery power used to actuate the primitive receiving instruments that ruined the cable first laid, and brought temporary disaster to the promoters. The mirror-galvanometer with its needle and mirror of a grain or two hung by a single fibre of silk, and its long mass-

less index of a ray of light, first overcame the difficulty and reduced the battery power required to something like a fiftieth or a hundredth part of that originally employed. Then came the beautiful siphon-recorder with its pen of lightest capillary tubing, through which the ink was forced by electrical action, so that it wrote its message on a ribbon of paper without actually touching the paper-surface, thus avoiding in the most ingeniously simple manner what for long-cable signalling would have been most detrimental, the friction of the glass on the ribbon. The recorder-siphon once deflected registered successive signals in the same direction by small ripples drawn on the moving paper as from a new zero, and thus the reduction to zero between two of these signals of the current deflecting the coil, was rendered unnecessary. The shifting zero of the siphon-recorder was made still more definite in whatever position it took up by means of curb-sending, which brought out clearly the individual ripples of the last three signals of the letter *h*, the four successive signals in the same direction which form the letter *h*, and so on.

Returning, however, to the conversazione and the part played by the telegraphic instruments, we have first to mention the message of congratulation which was sent by the Jubilee Committee to Lord Kelvin, present in the same room, round a circuit as long as about three-quarters of the earth's circumference. The Anglo-American Company sent the message to Heart's Content, thence to New York, thence round by Chicago and San Francisco back to New York, thence again to Heart's Content and Glasgow. The message was as follows:—

By the Atlantic cable which represents your unrivalled combination of scientific genius and practical skill, the Glasgow Jubilee Committee send you their warmest congratulations.

The interval between sending and receiving was seven and a half minutes, and Lord Kelvin replied:—

The Cable Companies have beaten Ariel by half a minute. Warmest thanks to the Glasgow University Jubilee Committee.

The reply took only four minutes.

From Simla the Viceroy of India telegraphed:—

I offer congratulations and desire to join with the University of Glasgow in celebrating your fifty years of service. We in India, thanks to your labours, constantly feel closer to friends at home.

From the capital of the Orange Free State the following message was received:—

The President of the Orange Free State, in the name of many Free Staters who have either directly or indirectly profited by Lord Kelvin's magnificent services to science, desires to offer his hearty congratulations to Lord Kelvin on the celebration of his professorial jubilee.

Congratulatory telegrams were also received from Earl Grey (Buluwayo), Sir James Sievwright (Cape Colony), the Earl of Glasgow (Wellington, New Zealand), the Postmaster-General of New Zealand, Sir John Robinson (Prime Minister of Natal), the Governor of Hong Kong, Lord Hampden (Sydney), the Universities of Adelaide, Madras, New Zealand, Calcutta, Santiago, the Johns Hopkins University of Baltimore, and Chicago, from the Indian Telegraph Department, the College of Science, Poona, and old students and friends in Japan, and almost all parts of the world.

Lord Kelvin telegraphed his thanks to General Eckert, the President of the Western Union Telegraph Company, New York, in the following terms:—

Pray accept my sincere thanks to yourself and staff for your great kindness and assistance. The messages you have transmitted to me have given very great pleasure to the whole assembly.

The following is a list of the delegates and other distinguished visitors who, besides the Lord Provost, Magistrates, and Town Council, the members of the

Senatus Academicus, and the local guests invited, were announced as present at the reception and throughout the celebration:—

REPRESENTATIVES OF UNIVERSITIES, SOCIETIES, INSTITUTIONS, &c.

AUSTRO-HUNGARY.—Prof. Dr. Izidor Fröhlich, Academy of Sciences, Buda-Pest.

BELGIUM.—Senator Montefiore Levi, of Brussels.

DENMARK.—Prof. C. Christiansen, Royal Danish Society of Science, Copenhagen.

FRANCE.—Prof. Aug. Angellier, Academy of Lille; Prof. Pinloche, Academy of Lille; Prof. Lippmann, University of France, Paris; Prof. Henri Moissan, University of France, Paris; Prof. Picard, University of France, Paris; Prof. Bonet Maury, University of Paris; Prof. Eleuthère Mascart, Collège de France, Paris; Prof. Violle, Ecole Normale Supérieure, Paris.

GERMANY.—Prof. Heinrich du Bois, University of Berlin; Prof. Georg Quincke, University of Heidelberg; Prof. Wolde-mar Voigt, Royal Society of Science, Göttingen.

HOLLAND.—Dr. Elie van Rijckevorrel, Batavian Society of Experimental Philosophy, Rotterdam.

ITALY.—General Annibale Ferrero, Italian Ambassador, London, representing Royal Institute of Science and Letters, Milan; Royal Academy of Science, Letters, and Arts, Modena; Italian Society of Science, Rome. Prof. Peter G. Tait, M.A., D.Sc., Edinburgh, representing University of Rome. Prof. J. J. Thomson, M.A., F.R.S., Cambridge, representing Royal Academy of Turin.

MEXICO.—George J. Symons, F.R.S., representing the Antonio Alzate, Scientific Society.

RUSSIA.—Prof. Nicholas Oumov, representing University of Moscow; Imperial Society of Friends of Natural Science, Anthropology, and Ethnography, Moscow; and Imperial Society of Naturalists, Moscow.

SWEDEN.—Prof. Per Theodor Cleve, University of Upsala.

SWITZERLAND.—Mons. Lucien de Candolle, Société des Arts, Geneva.

UNITED STATES OF AMERICA.—Prof. Joseph S. Ames, Ph.D., Johns Hopkins University, Baltimore; James C. Thomas, M.D., Johns Hopkins University, Baltimore; Prof. Cushney, University of Michigan; Prof. Robert M. Wenley, M.A., D.Phil., University of Michigan; Prof. G. F. Barker, M.D., University of Pennsylvania, Philadelphia; Mr. Samuel Dickson, University of Pennsylvania, Philadelphia; Prof. Woodrow Wilson, Princeton University, New Jersey; Prof. Van Amringe, Columbia College, New York; Mr. T. C. Martin, National Electric Light Association, New York; Right Hon. Lord Rayleigh, F.R.S., representing American Academy of Arts and Sciences, Boston; General Wistar, Academy of Natural Sciences, Philadelphia; Dr. J. Cheston Morris, Philosophical Society, Philadelphia.

GREAT BRITAIN AND IRELAND, THE COLONIES, AND INDIA.

CANADA.—Sir D. A. Smith, K.C.M.G., LL.D., McGill University, Montreal; Principal Peterson, McGill University, Montreal; Mr. James Ross, Canadian Society of Civil Engineers, Montreal.

INDIA.—Mr. Justice Jardine, I.C.S., Bombay University; Ghanasham N. Nadkarin, LL.B., Bombay University; Prof. J. H. Gilliland, M.A., Calcutta University.

NEW SOUTH WALES.—Prof. Liversidge, M.A., F.R.S., University of Sydney.

UNITED KINGDOM.

I. UNIVERSITIES.

ENGLAND.

Cambridge University.—Prof. A. R. Forsyth, D.Sc., F.R.S.; Prof. Sir George G. Stokes, LL.D., F.R.S.; Prof. J. J. Thomson, M.A., F.R.S.

Durham University.—Rev. Principal Gurney, D.C.L.; Dr. Merz.

London University.—Prof. Carey Foster, F.R.S.; Sir Henry E. Roscoe, F.R.S.

Manchester—Victoria University.—Prof. Oliver J. Lodge, D.Sc., F.R.S.; Principal A. W. Ward, Litt.D., LL.D.

Oxford University.—Prof. Clifton, F.R.S.; D. B. Monro, M.A.; Provost of Oriel College; Prof. Burdon Sanderson, F.R.S.

IRELAND.

Dublin—Trinity College.—Right Hon. the Earl of Rosse, LL.D., D.C.L., F.R.S. Chancellor of the University of Dublin.
Royal University of Ireland.—Right Rev. Monsignor Molloy, D.D., D.Sc.; William A. McKeown, M.D.

SCOTLAND.

Aberdeen University.—Prof. Finlay, M.D.; Prof. Niven, F.R.S.; Prof. Pirie.

Edinburgh University.—Prof. A. Crum Brown, F.R.S.; Prof. Sir William Turner, F.R.S.; Prof. Peter G. Tait, M.A., D.Sc.

St. Andrew's University.—Prof. Scott Lang; Prof. Pettigrew, M.D., LL.D., F.R.S.

WALES.

University of Wales.—Prof. Andrew Gray, LL.D. F.R.S.; Principal J. Viriamu Jones, F.R.S., Vice-Chancellor of the University of Wales.

II.—COLLEGES.

ENGLAND.

Birmingham—Mason College.—Principal Heath, D.Sc., F.R.S.

Leeds—Yorkshire College.—Prof. Stroud, D.Sc.

Liverpool—University College.—Prof. McCunn, M.A.

London—King's College.—Prof. W. G. Adams, D.Sc., F.R.S.

London—University College.—Prof. Ramsay, F.R.S.

London—City and Guilds Central Technical College.—Prof. W. E. Ayrton, F.R.S.

London—City and Guilds Technical College, Finsbury.—Prof. S. P. Thompson, D.Sc., F.R.S.

Manchester—Owens College.—Prof. Osborne Reynolds, LL.D., F.R.S.

Newcastle-on-Tyne—Durham College of Medicine and Science.—Prof. George H. Philipson, M.D.

IRELAND.

Belfast—Queen's College.—Rev. Thomas Hamilton, D.D., LL.D.; Prof. Purser, LL.D.

Cork—Queen's College.—Prof. W. Bergin, M.A.

Galway—Queen's College.—Sir Thomas Moffett, LL.D.

SCOTLAND.

Dundee.—University College.—Prof. Steggall, M.A.

Glasgow—Faculty of Physicians and Surgeons.—Bruce Goff, M.D., F.F.P.S.

Glasgow and West of Scotland Technical College.—Henry Dyer, D.Sc.

Glasgow School Board.—Sir John N. Cuthbertson, LL.D.; Rev. William Boyd, LL.D.

WALES.

Aberystwith—University College.—R. D. Roberts, M.A., D.Sc.

Bangor—University College.—Prof. Andrew Gray, LL.D., F.R.S.

Cardiff—University College.—Prof. A. C. Elliott, D.Sc.

III.—SOCIETIES, INSTITUTIONS, &c.

ENGLAND.

Royal Society.—Prof. Sir Joseph Lister, M.B., P.R.S.; Sir John Evans, K.C.B., F.R.S.

Cambridge—Philosophical Society.—Prof. J. J. Thomson, F.R.S.

London—Society of Arts.—Sir Frederick Abel, F.R.S.

Astronomical Society.—A. A. Common, LL.D., F.R.S.

British Association for Advancement of Science.—Prof. A. W. Rücker, F.R.S.

Chemical Society.—Prof. John M. Thomson.

Institution of Civil Engineers.—Sir Benjamin Baker, F.R.S., K.C.M.G.

Society of Engineers.—Henry O'Connor.

Institution of Electrical Engineers.—John Hopkinson, F.R.S.

Royal Geographical Society.—Dr. John Murray, F.R.S.

Geological Society.—Dr. Henry Hicks, F.R.S.

Mathematical Society.—Major P. A. MacMahon, R.A., F.R.S.

Physical Society.—Captain W. de W. Abney, F.R.S.

Manchester, Literary and Philosophical Society.—Prof. Schuster, F.R.S.

IRELAND.

Royal Irish Academy.—Right Hon. the Earl of Rosse, LL.D., D.C.L., F.R.S.

SCOTLAND.

Edinburgh—Educational Institute of Scotland.—John Dunlop, Esq.

Edinburgh—Royal Society.—Hon. Lord McLaren.

Glasgow—Geological Society.—Sir Archibald Geikie, LL.D. F.R.S.; J. Barclay Murdoch, Esq.

Glasgow—Institution of Engineers and Shipbuilders.—John Inglis, Esq.

Glasgow—Philosophical Society.—Ebenezer Duncan, M.D.

Other distinguished Visitors.—Professor Cleveland Abbe, Weather Bureau, Washington; John Aitken, F.R.S., Darroch, Falkirk; Prof. Roberts-Austen, C.B., F.R.S., London; Prof. Bayley Balfour, M.D., F.R.S., Edinburgh University; Rev. A. K. H. Boyd, D.D., St. Andrews; A. Hargreaves Brown, M.P., 12 Grosvenor Gardens, London, S.W.; Alexander Buchan, LL.D., 42 Heriot Row, Edinburgh; Professor G. H. Darwin, LL.D., F.R.S., Newnham Grange, Cambridge; Prof. James Dewar, LL.D., F.R.S., Peterhouse, Cambridge; Lowes Dickinson, Esq., 1 All Souls' Place, London, W.; J. D. H. Dickson, M.A., Peterhouse, Cambridge; John M. Dodds, M.A., Peterhouse, Cambridge; Prof. J. A. Ewing, LL.D., F.R.S., Cambridge; Prof. Fitzgerald, Sc.D., Dublin; J. E. Foster, M.A., Cambridge; Prof. Michael Foster, LL.D., F.R.S., Cambridge; Prof. Frankland, F.R.S., Mason College, Birmingham; Ex-Profr. Frederick Fuller, London; David Gill, C.B., LL.D., F.R.S., Astronomer Royal, Cape Town; Dr. Gladstone, F.R.S., London; J. G. Gordon, Esq., London; Prof. Herkomer, R.A., Bushey, Herts.; Sir Joseph D. Hooker, M.D., K.C.B., F.R.S., Sunningdale, Berks; John K. Ingram, LL.D., Dublin; Prof. Alex. B. W. Kennedy, LL.D., F.R.S., London; Hon. Lord Kinnear; Hon. Lord Kyllachy; Count Lovatelli, Italian Embassy, London; Rt. Hon. Prof. Max Müller, LL.D., Oxford; Frank McClean, LL.D., F.R.S., Tunbridge Wells; John McIntyre, M.D., Odiham, Hants; Prof. Simon Newcomb, of Johns Hopkins University, Baltimore, and Nautical Almanac Office, Washington; Prof. Perry, F.R.S., London; Rev. Dr. Porter, Master of Peterhouse, Cambridge; W. H. Preece, C.B., F.R.S., General Post Office, London; Emanuel Ristori, London; Edward J. Routh, D.Sc., LL.D., F.R.S., Peterhouse, Cambridge; Sir William Russell, Adare, Ireland; Right Hon. Lord Shand, LL.D., London; Alex. Siemens, London; Major-General Sir R. M. Smith, K.C.M.G., Edinburgh; Prof. J. J. Sylvester, M.A., D.C.L., F.R.S., Oxford; James Thomson, M.A., C.E., Newcastle-on-Tyne; Prof. W. A. Tilden, Sc.D., F.R.S., London; Admiral Wharton, R.N., C.B., F.R.S., Admiralty, London.

The only noticeable want in the above list is that of any high Officer of State of our own country. The presence of some member of the Government would have added a touch of State official recognition which it would have done honour to the Government to bestow; but very possibly, like Lord Salisbury and Sir John Gorst, other ministers were unable to leave their posts.

The suite of rooms, unique in extent and convenience for such an assembly, beautiful in themselves because of their architecture and fittings, were further decorated with flowers and plants, and were illuminated by several arc-lamps which shed a bright but mellow light upon the scene. The effect was indescribably brilliant—the splendour of the ladies' dresses, the uniforms, and the municipal and academic robes of the men, mixed with the sober evening attire to which many adhered, rendered the appearance of the rooms during the evening exceedingly picturesque and bright. The east quadrangle was also lighted with the electric light, and formed a most attractive refuge from the hotter atmosphere inside. The band of the Gordon Highlanders discoursed sweet music at intervals from a band stand erected in the centre of the quadrangle, alternating with the pipers of the same regiment, who played a selection of Highland airs in excellent style.

On Tuesday a congregation of the University was held for the presentation of addresses to Lord Kelvin, and the conferring of honorary degrees on Lord Kelvin himself and the principal foreign visitors representative of science. The delegates of the various universities, colleges, societies, and institutions were accommodated

with seats in front of the principal floor-space of the hall, while the chair of the Vice-Chancellor, with chairs for officials, was placed in the centre of a semicircle of professional stalls occupied by the members of the Senatus Academicus, distinguished strangers, and representatives of the Corporation present. For the delegates who were to receive degrees, chairs were set in front of the circle occupied by the Senate. The rest of the hall and the galleries were occupied by students and spectators.

Punctually at 10 a.m. the Senatus with Lord Kelvin at its head, marched in procession up the hall, while the whole assemblage rose and cheered him to the echo. In the absence of Principal Caird, who unfortunately is not yet sufficiently recovered in health to take part in such a ceremony, the chair was taken by Prof. William Gairdner, F.R.S., who, next to Lord Kelvin, is the senior Professor now at Glasgow. After prayer, offered in Latin according to a form which has been long in use at Glasgow, Professor Stewart, Clerk of Senate, read the following letter of congratulation from H.R.H. the Prince of Wales.

Marlborough House,
Pall Mall, S.W.,
June 10, 1896.

DEAR LORD KELVIN,—The Prince of Wales desires me to offer you his warmest congratulations upon your having attained the fiftieth year of the tenure of your professorship in the University of Glasgow.

His Royal Highness is in most cordial sympathy with the eminent representatives of universities, learned societies, and other public bodies in different parts of this Empire and in foreign States who, to do you honour, have assembled in the University which has for a long series of years, eventful through the rapid advance of science and its applications, enjoyed the high prestige derived from your close association with its work, and from the invaluable and brilliant contributions to science resulting from the researches carried on by you during the last half-century within its walls.

The Prince of Wales remembers with much satisfaction that he had the gratification seventeen years ago to present you with the medal instituted by the Society of Arts as a memorial of the Prince Consort, and awarded to men who have rendered pre-eminent service in promoting arts, manufactures, and science.

The work which you had at that time accomplished was but an earnest of the important researches to which you have since then devoted yourself so indefatigably, and he cherishes the sincere hope that you may long continue to enjoy the happiness derived from the most gratifying evidence that the high value of the services rendered by you through science to mankind is universally recognised and appreciated.

I remain,

Dear Lord Kelvin,

Yours truly,

FRANCIS KNOLLYS.

P.S.—His Royal Highness desires me to repeat what he has already stated to the University authorities, how greatly he regrets that long-formed engagements in the South prevent him from having the pleasure of being present on the occasion of this interesting celebration.—F. K.

Professor Story then called forward the delegates very nearly in the order in which they are given in the foregoing list. These advanced to the dais, and presented the messages with which they were charged to Lord Kelvin; and after shaking hands with him, retired to their places. Most of the delegates presented elaborate addresses, beautifully engrossed, and signed by the authorities of the bodies represented. These were not, however, in general read, though a good many delegates made a few pointed remarks when placing the addresses before Lord Kelvin on the table. The delegates of the Institute of France were the bearers to Lord Kelvin of the Arago medal, which has only been three times before bestowed on any one. It is interesting to note in this connection that the Freedom of the City of Glasgow was in 1834 conferred on Arago himself "in testimony of admiration of his high talents and eminent

scientific attainments, and particularly of his successful exertions to extend the boundaries of astronomical science."

The medal was presented to Lord Kelvin by Professor E. Mascart, of the Collège de France.

General Ferrero, the Italian Ambassador, attended on behalf of the Royal Institute of Science and Letters of Milan, the Royal Academy of Science, Letters, and Arts of Modena, and the Italian Society of Science, Rome.

The presentation of the addresses of the Royal Society, the University of Cambridge, the students of the four Scottish Universities, the students of the University of Glasgow, and the Senatus of the University of Glasgow excited much interest.

The address of the University of Cambridge, written by the Public Orator, Dr. Sandys, on behalf of the University, was as follows :—

*Baroni Kelvin
Regiæ Societatis nuper Praesidi
Philosophiæ Naturalis inter Glasguenses
per annos quinquaginta Professori
S. P. D.
Universitas Cantabrigiæ.*

DUM tot tantæque Universitates praeceptorum tam illustri annos quinquaginta Professoris in munere feliciter exactos certatim gratulantur, Universitati nostrae imprimis consentaneum est ob rem tam laetam tamque honorificam suum gaudium confiteri, suam superbiam testificari. Etenim nostra inter nemora (iuvat recordari) quinquagesimo primo abhinc anno studiorum mathematicorum e certamine primo lauream prope primam reportasti, studiorum eorundem in certamine altero victor renuntiatus. Nostris umbraculis egressus, et alios ex aliis honores serie perpetua propter insignia merita adeptus, physicorum praesertim studiorum provinciam et inventis tuis et exemplo tuo praeclare illustrasti. Tu trans maria magna navigantibus securitatem novam dedisti, septentrionum regionem accuratius indicasti, vada periculosa etiam in ipso transcurso metiri docuisti; tu oceani denique Atlantici litus utrumque vinculo novo coniunxisti. Haec et alia inventa egregia dum contemplamur, non sine superbia recordamur plusquam quinquaginta per annos ipsum inventorem etiam nostra cum Universitate vinculo artissimo fuisse coniunctum. Alumno igitur nostro insigni, non modo annos quinquaginta Professoris in munere prospere peractos, sed etiam vitae annum septuagesimum primum feliciter expletum libenter gratulati, etiam in posterum plurimos per annos omnia fausta ex animo exoptamus. Vale.

*Datum Cantabrigiæ
mensis Iunii die xi^o
A. S. MDCCCXCVI.*

(L. S.)

The following address of the Senatus of the University of Glasgow was read by Professor Stewart, D.D. :—

MY LORD,—The rejoicings which have been arranged to celebrate the close of your fiftieth session betoken the admiration and affection with which you are regarded by your colleagues in the Senate, but it is none the less fitting that on this auspicious occasion these feelings should find articulate expression in an address of congratulation. The fifty years during which you have occupied the Chair of Natural Philosophy in this University have to an extent, unparalleled in the history of the world, been marked by brilliant discoveries in every department of physical science, and by the prompt adaptation of many of these discoveries to meet the practical needs of mankind. We recognise with admiration that in both these respects you have been a leader of the age in which we live. Your mathematical and experimental genius has unveiled the secrets of nature; your marvellous gift of utilising such discoveries has ministered in many ways to the happiness and dignity of human life. Your name and your work have been an inspiration to the physicists of the world; new departments of technical industry have sprung into existence under your hand, and even the unlettered have learned to value the gifts which science bestows. The justice of the tributes which have been paid to you by universities and scientific societies at home and abroad, and by the Governments of this and other lands, we are proud to acknowledge. But only your colleagues in university work are in a position to

appreciate the versatility of faculty, the exhaustless energy, and the tenacity of purpose which have enabled you to grapple successfully with problems the most varied, and to reveal to us on every side the reign of order and law. In the midst of all you have endeared yourself to us by the graces of your personal character, notably by that simplicity which, unmarred by honours or success, remains the permanent possession of transcendent genius, and by that humility of spirit which, the clearer the vision of truth becomes, bows with the lowlier reverence before the mystery of the universe.

My Lord, the contemplation of a past so rich in achievements and honours encourages your colleagues to look forward to the future in the hope that you may have health and strength to win new triumphs in years to come, and long to remain among us the ornament and the glory of our ancient University.

WILLIAM STEWART.
Clerk of Session.

The address from the Royal Society was presented by the President, Sir Joseph Lister, Bart., and the Treasurer, Sir John Evans, K.C.B. It ran as follows :—

The Royal Society.

DEAR LORD KELVIN,—The President, Council, and Fellows of the Royal Society desire, on the happy occasion of the jubilee of your Professoriate in the University of Glasgow, not only to be represented, as they are, by their highest officers, the President and Treasurer, but also to assure you, by some direct words, of the warm sympathy of the whole Society.

There is no need to dwell on the many ways in which you have contributed to that improvement of natural knowledge to secure which the Society was founded, or on the many valuable communications with which you have enriched the Society's records. Since you first joined the Society, and the jubilee of that event is not far off, the Society has always known how much your belonging to it has added to its strength; but it has been especially during the recent five years, which went too swiftly by, while you filled in so admirable a manner the chair of President, that the Society has felt how close are the ties which bind it to you and you to it.

We ask you to receive our heartiest congratulations on the present glad event, and our warmest wishes for your welfare in the years yet to come.

(Signed) JOSEPH LISTER, Pres. R.S.

When the presentation of addresses had been completed, Professor Moody Stuart, Dean of the Faculty of Law, amid great and prolonged applause presented Lord Kelvin for the degree of Doctor of Laws. "As a memorial," he said, "of this day, the Senate desire to confer on Lord Kelvin the highest honour they have to bestow, by placing his illustrious name on the roll of Doctors of Laws of the University."

The ceremony of capping was performed by Professor Gairdner, amid a renewed outburst of cheering.

Lord Kelvin thereafter took the chair as Senior Professor in the University, and proceeded to confer the remainder of the honorary degrees.

Prof. Moody Stuart, in presenting the recipients, said :—The Senate desire to commemorate this occasion by conferring the honorary degree of Doctor of Laws on some of the distinguished men of science from the continent of Europe, from the United States of America, and from the British Colonies, who have honoured the University by their presence to-day. In the name of the Faculty of Law, and by authority of the Senate, I have now the honour of presenting them for this degree.

Prof. Cleveland Abbe, head of the Meteorological Office, Washington, distinguished for his important contributions to astronomical and meteorological science.

Prof. Christian Christiansen, Copenhagen, author of many important papers on physical science, and of a most beautiful experimental illustration of differences of refractivity at different temperatures.

Prof. Per Theodore Cleve, of Upsala, long esteemed as one of the most notable workers in chemical and mineralogical science. His name has become known to a wider public in connection with the discovery of helium in the mineral Cleveite named after him.

His Excellency General Annibale Ferrero, Ambassador to

this country from His Majesty the King of Italy. General Ferrero is specially eminent in mathematical and geodetical science, and, notwithstanding the engrossing duties of his high office, continues to take his part in the scientific work to which his life has been devoted.

Prof. Izidor Fröhlich, of the University of Buda-Pesth and Academy of Sciences, Buda-Pesth, who has published a large number of important papers on physical optics and on electricity.

Prof. Gabriel Lippmann, of the Sorbonne, Paris, inventor of the capillary electrometer and discoverer of the principles of true colour photography.

Prof. Archibald Liversidge, of the University of Sydney, New South Wales, Dean of Faculties in that university, distinguished as a traveller, a chemist, and a geologist.

Prof. Eleuthère Mascart, official head of meteorology in France, a physicist of great reputation, and author of a very important treatise on electricity.

Prof. Henri Moissan, of the University of France, one of the most originaive and practical of modern chemists.

Prof. Simon Newcomb, of Johns Hopkins University, Baltimore, whose numerous researches have contributed largely to the progress of gravitational astronomy, the most notable being his work on the satellites of Saturn and his researches on the motion of the moon. He was awarded the Copley Medal of the Royal Society of London in 1890.

Prof. Nikolai Alekseevich Oumov, of the University of Moscow, who has gained great distinction by his researches on energy and on electro-dynamic induction.

Prof. Emile Picard, of the University of France, who holds a leading position among the great French mathematicians.

Prof. Georg Quincke, of the University of Heidelberg, one of the most famous experimental physicists in Germany, author of numerous important experimental investigations, among others on capillarity and in optics.

Prof. Woldemar Voigt, of the University of Göttingen, well known as the author of numerous papers on the mathematical theory of light and on the electricity of crystals.

Lord KELVIN then said—The University of Glasgow is honoured by the presence to-day of many distinguished visitors from foreign countries, from America, from India, from Australia, and from all parts of the United Kingdom. Names of men renowned for their scientific work in distant countries have been added to our list of honorary graduates. That I have had the honour of conferring these degrees in the name of the University is a subject of keenest regret to all here present, because it is due to the absence of Principal Caird on account of illness. We hope that the beginning of next session will see him at home in the University with thoroughly recovered health. In his absence the duty of conferring degrees has fallen, according to University law, on me as senior Professor present. I am also one of the recipients of the degree, and, in the name of all who have to-day been created Doctors of Laws of the University of Glasgow, I thank the Senate for the honour which we have thus received on the occasion of the jubilee of my professorship. For myself, I can find no words to express my feelings on this occasion. My fifty happy years of life and work as Professor of Natural Philosophy here, among my students and my colleagues of the University and my many kind friends in the great City of Glasgow, call for gratitude; I cannot think of them without heartfelt gratitude. But now you heap coals of fire on my head. You reward me for having enjoyed for fifty years the privilege of spending my time in the work most congenial to me and in the happiest of surroundings. You could not do more for me if I had spent my life in hardships and dangers, fighting for my country, or struggling to do good among the masses of our population, or working for the benefit of the people in public duty voluntarily accepted. I have had the honour to receive here to-day a gracious message from His Royal Highness the Prince of Wales, and addresses from sister-universities in all parts of the world; from learned societies, academies, associations, and institutions for the advancement of pure and applied science; from municipal corporations and other public bodies; from submarine telegraph companies, and from their officers, my old comrades in their work; from students, professors, and scientific workers of England, Scotland, and Ireland and other countries, including my revered and loved St. Peter's College, Cambridge, and my twenty Baltimore coefficients of 1884. The term coefficients is abused by mathematicians. They use it for one of the two factors of the result. To me the professor and his class of students are coefficients, fellow-workers, each con-

tributing to whatever can possibly be done by their daily meetings together. I dislike the term lecture applied here. I prefer the French expression—"conference." I feel that every meeting of a professor with his students is rather a conference than a pumping in of doctrine from the professor, perhaps ill-understood and not well received by his students. The Scottish universities have enabled us to carry out this French idea of conference. In many of our classes the professor is accustomed to converse with his students sometimes in the form of *viva voce* examination and oftener, I hope, in the manner of the interchange of thoughts, the professor discovering whether or not the student is following his lecture, and being thus really helped in his treatment of the subject. I have had addresses also from my old Japanese students of Glasgow University, now professors in the University of Tōkiō, or occupying posts in the Civil Service and Engineering Service of Japan, for which I thank them heartily. I wish particularly also to thank my Baltimore coefficients for their address. They have been useful to myself in my own keen endeavour—unsuccessful, I must say—nevertheless keen—to know something about the true dynamics of light and ether and crystals. The addresses which I have received to-day contain liberal and friendly appreciation of all my published mathematical and physical papers, beginning in 1840, and ending—not yet I hope. The small proportion of that long series of writings which has led to some definite advancement of science is amply credited for its results. The larger part, for which so much cannot be said, is treated with unflinching and sympathetic kindness as a record of persevering endeavour to see below the surface of matter. It has been carried on in the faith that the time is to come when much that is now dark in physical science shall be seen bright and clear, if not by ourselves, by our successors in the work. I am much gratified by the generous manner in which these addresses have referred to the practical applications of science in my work for submarine telegraphy; my contributions to the advancement of theoretical and practical knowledge of the tides; my improvements in the oldest and next oldest of scientific aids to navigation, the sounding plummet and the mariner's compass; and my electric measuring instruments for scientific laboratories, for the observation of atmospheric electricity, and for electrical engineering. I now ask the distinguished men who have honoured me by presenting to me these addresses to accept for themselves personally, and for the societies represented by them, my warmest thanks for the great treasure which I have thus received—good will, kindness, friendship, sympathy, encouragement for more work—a treasure of which no words can adequately describe the value. I cordially thank the French Academy of Sciences for their great kindness in sending me by the hands of my loved and highly esteemed colleague Prof. Mascart the Arago Medal of the Institute of France. I thank all present in this great assembly for their kindness, which touches me deeply; and I thank the City and University of Glasgow for the crowning honour of my life which they have conferred on me by holding a commemoration of the Jubilee of my Professorship.

A more dignified and imposing ceremony than that which was now closed with the benediction pronounced by Prof. Stewart, was never witnessed at the University of Glasgow. Anything more striking and impressive of an academic nature it is hardly possible to conceive. The demeanour of the students and general public was respectful, and at the same time displayed the most enthusiastic regard for the hero of the occasion, and all the arrangements worked without the slightest hitch or fault.

In the evening at seven o'clock a grand banquet was given in the St. Andrews Halls to about six hundred gentlemen, including all the delegates and other distinguished strangers present at the celebration. On the platform of the hall three principal tables were arranged, at which were seated the Lord Provost, with Lord Kelvin and other gentlemen, who were afterwards to speak, or who, for various reasons, it was proper should be so honoured.

The Lord Provost occupied the chair at the first table, and was supported on the right by Lord Kelvin, His Excellency General Annibale Ferrero, the Italian Ambassador, the Right Hon. Lord Rayleigh, D.C.L., LL.D.,

F.R.S., Prof. Newcomb (Washington), Lord Overtoun, the Lord Justice General of Scotland, Prof. Picard (Paris), Lord Shand, General Sir Archibald Alison, Bart.; and on the left by the Earl of Rosse, K.P. (Chancellor of the University of Dublin), Sir Joseph Lister, Bart. (President of the Royal Society), Lord Napier and Ettrick, Prof. Quincke (Heidelberg), Dr. Gill (Astronomer-Royal, Cape of Good Hope), Signor Montefiore Levi (Brussels), Prof. Abbe (Washington), James A. Campbell, LL.D., M.P.

On the main floor of the hall were arranged fourteen tables, accommodating about forty guests each. The length of each table ran at right angles to the platform, so that each person could regard the after-dinner speakers comfortably without changing his position.

After dinner the front seats of the galleries round the hall were occupied by ladies, who had previously been received on entrance by Lady Bell and Mrs. Caird.

The Lord Provost began by saying—I have been entrusted with a message from Her Majesty the Queen, and, as is customary, I would ask you to stand while Her Majesty's message is being read. It is as follows:—

The Queen commands me to beg that you will kindly express to Lord Kelvin her Majesty's sincere congratulations on the occasion of the jubilee of his professorship in the Glasgow University. Her Majesty trusts that many years of health and prosperity may be in store for him and Lady Kelvin. The Queen is particularly gratified at the presence of so many eminent representatives from all countries of the world who have come to do honour to your distinguished guest.—(Signed) Arthur Bigge, on behalf of her Majesty.

This message was received with great applause by the company, and the knowledge that Her Majesty had joined her congratulations to those of the whole scientific world gave great and evident pleasure.

After the toasts of Her Majesty the Queen, the Prince and Princess of Wales, and the other members of the Royal Family had been duly honoured, the Lord Justice General of Scotland proposed that of the Houses of Parliament, coupling it with the names of Lord Rayleigh and Dr. James A. Campbell, member of Parliament for the Glasgow and Aberdeen Universities.

In concluding his reply on behalf of the House of Lords, Lord Rayleigh said:—

I suppose there are not very many here present who have followed more closely than I have done the writings with which our guest has furthered science for many years. It would be a commonplace to say that much which now passes as current science has its origin in those writings. But what gives to me more to think about, what is to me a matter of deeply-felt gratitude, is the twenty or twenty-five years' friendship with him that it has been my own privilege to enjoy—a friendship enlivened by many discussions, some perhaps not without a spice of controversy; but it would be difficult to convey the deep debt of gratitude due for all I have learned from him, in his writings or in his stimulating conversation. I feel, however, if I were to enlarge upon this subject, I should be very soon called to order, because I should be trenching on a toast which is soon to be proposed; but I feel I cannot abstain from saying a few words as a result of the very heartfelt feelings which I have on this subject.

The Lord Provost, in a most excellent and appreciative speech, next proposed the toast of the evening. He began by reading cable messages from the University of Toronto and the students of the University of Moscow. The latter ran as follows:—

To the celebrated Lord Kelvin, famous, learned, we send our congratulations, the Moscow University Students.

Telegrams of regret for absence were read from Lord Salisbury, Sir John Gorst, and others. The Lord Provost also read the following letter from the Principal of the University, unhappily laid aside by illness:—

The University, Glasgow, June 10, 1896.

My dear Sir James,—Will you allow me to express to you and to any others who may chance to notice my absence, my great disappointment and regret that I am not permitted to be

present next week at the banquet at which you are to preside, or at any of the other functions in connection with Lord Kelvin's jubilee. It would have been a great gratification to me to take part in the universal tribute of admiration and respect that is to be paid to the great man of science, and to give public expression to the esteem and affection which for many a long year I have felt for him as my colleague and friend. Acting under medical advice, however, I am reluctantly constrained, owing to a recent illness, from which I have not yet completely recovered, to refrain from taking part in the approaching ceremonies.—
Very truly yours,
(Signed) J. CAIRD.

The Lord Provost then proceeded, and, after a very interesting, but necessarily brief, sketch of Lord Kelvin's career, he concluded with the following graceful words:—

This life of unwearied industry, of universal honour, has left Lord Kelvin with a lovable nature that charms all with whom he comes in contact. Unaffected, ever wishful to get the opinions of others, courteous and kind, well might Prof. Huxley, after a memorable controversy, introduce Lord Kelvin as his successor in the presidency of the British Association with these words:—"Gentler knight never broke lance." Lord Kelvin, indeed, inspires love and reverence in all. His home life is love and melody. His helpmate is worthy of him, and greater cannot be said. Those who have the great privilege of their friendship, will in their hearts with fervent prayer add to the toast the wish that Lord and Lady Kelvin may long be spared to one another. I give you "Lord Kelvin, and hearty congratulations on the attainment of his jubilee."

The toast was pledged with great enthusiasm, and, on the call of the Lord Provost, cheers were raised for Lady Kelvin, the entire company rising and waving handkerchiefs. The cheering was again renewed when the organist played "See the Conquering Hero," followed by "For He's a Jolly Good Fellow," in which the company joined *con amore*.

On rising to respond, Lord Kelvin was greeted with enthusiastic applause. He said—

My Lord Provost, your Excellency, my Lords, and gentlemen,—First of all, I desire to express the deep and heartfelt gratitude with which I have heard the most kind and gracious message from Her Majesty the Queen, which has been read to us by the Lord Provost. But I cannot find words for thanks. I can only, on the part of Lady Kelvin and myself, tender an expression of our loving loyalty to the Queen. My Lord Provost, my Lords, and gentlemen, I thank you with my whole heart for your kindness to me this evening. You have come here to commemorate the jubilee of my University professorship, and I am deeply sensible of the warm sympathy with which you have received the kind expressions of the Lord Provost regarding myself in his review of my fifty years' service, and his most friendly appreciation of practical results which have come from my scientific work. I might perhaps rightly feel pride in knowing that the University and City of Glasgow have joined in conferring on me the great honour of holding this jubilee, and that so many friends and so many distinguished men, friends and comrades—day-labourers in science, have come from near and far to assist in its celebration, and that congratulations and good wishes have poured in on me by letter and telegram from all parts of the world. I do feel profoundly grateful. But when I think how infinitely little is all that I have done, I cannot feel pride; I only see the great kindness of my scientific comrades, and of all my friends, in crediting me for so much. One word characterises the most strenuous of the efforts for the advancement of science that I have made perseveringly during fifty-five years; that word is failure. I know no more of electric and magnetic force or of the relation between ether, electricity, and ponderable matter, or of chemical affinity, than I knew and tried to teach to my students of natural philosophy fifty years ago in my first session as Professor. Something of sadness must come of failure; but in the pursuit of science, inborn necessity to make the effort brings with it much of the *certaminis gaudia*—and saves the naturalist from being wholly miserable, perhaps even allows him to be fairly happy, in his daily work. And what splendid compensations for philosophical failures we have had in the admirable discoveries by observation and experiment on the properties of matter, and in the exquisitely beneficent applications of science to the use of mankind with which these

fifty years have so abounded! You, my Lord Provost, have remarked that I have had the good fortune to remain for fifty years in one post. I cordially reply that for me they have been happy years. I cannot forget that the happiness of Glasgow University both for students and professors is largely due to the friendly and genial City of Glasgow in the midst of which it lives. To live among friends is the primary essential of happiness; and that, my memory tells me, we inhabitants of the University have enjoyed since I first came to live in it in 1832, sixty-four years ago! And when friendly neighbours confer material benefits, such as the citizens of Glasgow have conferred on their University in so largely helping to give it its present beautiful site and buildings, the debt of happiness due to them is notably increased. I do not forget the charms of the old college in the High Street and Vennel, not very far from the comforts of the Saltmarket, which was my home from 1832 till 1870. Indeed, I remember well when, in 1839, the old Natural Philosophy class-room and apparatus-room (no physical laboratory then) was almost an earthly paradise to my youthful mind. And the old College Green, with the ideal memories of Osbaldistone and Rashleigh and their duel, and Rob Roy intervening to prevent bloodshed, created for it by Sir Walter Scott, was attractive and refreshing to the end. But density of smoke and of crowded population in the adjoining lanes increased, and pleasantness, healthiness, and convenience of the old College both for students and professors diminished year by year. If, my Lord Provost, your predecessors of the Town Council, and the citizens of Glasgow, and wellwishers to the city and its university all over the world, and the Government, and the great railway company that has taken the old college for a passenger and goods station, had left us undisturbed on our ancient site, and had not given us our new college, I do not believe that attractions elsewhere would have taken me away from the old college—but I do say that the fifty years of professorship which I have enjoyed would have been less bright and happy, and I believe also less effective in respect to scientific work, than they have been with the great advantages with which the University of Glasgow has been endowed since its migration from the High Street. My Lord Provost, I ask you to communicate to your colleagues of the Town Council my warmest thanks for their great kindness to me in joining with the University to celebrate this jubilee. Your Excellency, my Lords, and gentlemen, I thank you all for the kind manner in which you have received the toast of my health proposed by the Lord Provost, and for your presence this evening to express your good wishes for myself.

Prof. W. T. Gairdner, F.R.S., in an interesting speech, proposed the representatives present from other Universities and learned bodies, coupling it with the names of His Excellency General Annibale Ferrero, Ambassador for Italy, Sir Joseph Lister, President of the Royal Society, and Prof. Simon Newcomb, Washington. These gentlemen replied as follows.

His Excellency General Annibale Ferrero, Ambassador for Italy, who, in acknowledging the compliment, spoke in French, said—My Lords, Ladies, and Gentlemen, when the honour was done me of asking me to speak in the name of so many illustrious men, I thought that it would be great hardihood on my part to accept a duty which would have better suited men whose name had already a place in the history of science. However, I thought that I had the honour of representing a country from which there have come great predecessors of Lord Kelvin, such as Galileo, Volta, and Galvani. In coming here to represent the scientific bodies of our respective countries we have merely the desire to render homage to the man of genius whose jubilee is being celebrated by the University of Glasgow, which has the honour of possessing him. But our presence is also intended to show that the whole scientific world desires to take part in recognising the services which Lord Kelvin has rendered to the human race. The light which shines to-day upon the University of Glasgow is like that of the sun. It does not belong to one country but extends to all nations. We owe special thanks to Prof. Gairdner for the way in which he has proposed the toast of the representatives of other institutions and learned bodies. We also owe a tribute of gratitude to the Corporation of Glasgow for the cordial and dignified welcome which has been accorded us. We have taken part in this jubilee celebration with the most lively feeling of admiration for the great man who is its object. The noble ceremony which we witnessed to-day in the University raised our spirits and touched our hearts. I cannot

better express our common thought than by saying that we have taken part in the apotheosis of science. I conclude by expressing the kindest wishes to the University of Glasgow, and our gratitude to Providence for having confided to us an incalculable treasure in the person of Lord Kelvin. May he be long spared to humanity.

Sir Joseph Lister said—My Lord Provost, my Lords and gentlemen, I have to thank Prof. Gairdner, my old friend, for the kind words in which he has referred to myself in the close of his speech, and this most distinguished company for the manner in which they have been received. It has been to myself a matter of unalloyed satisfaction to attend this grand celebration. A jubilee is sometimes attended with melancholy when it is felt that the man in whose honour it is held is failing in body and in mind, and that his life's work is over. No such cloud hangs over us to-day. It is true, as you are all aware, that some months ago Lord Kelvin experienced some indisposition. There was felt anxiety in some quarters, whether it might be prudent for him to undergo the fatigue and excitement necessarily attendant upon an occasion like this. Lord Kelvin came

me a matter of very great pleasure to witness the splendid vitality and vigour of the school in which I had once the honour of being a teacher, in palatial buildings, which may well excite the envy of us Londoners—a true teaching university in the full tide of prosperity and usefulness. I have also been exceedingly pleased to observe the friendly co-operation between the university and the municipality, of which this magnificent banquet is of itself sufficient evidence. The electrical illumination of the college buildings, which so largely promoted the success of last night's entertainment, was due to the liberality of the municipality, guided by the wise and bold policy of the Lord Provost. I visited to-day the Botanic Garden—that indispensable adjunct of an efficient university. In former days these gardens produced a painful impression upon those who visited them. They gave too clear an evidence that science was confined and cribbed for want of pecuniary means. Now all this is altered. The beautiful site has been extended and embellished, magnificent new houses have been erected, and everything bears the stamp on the one hand of scientific wisdom in their management, and on the other hand of ample resources. Now, all this is due to the beneficent

Exhibition of diplomas and instruments, showing telegraph receiving and sending instruments, used for receiving and replying to congratulatory messages.

to London some weeks since, and he did me, as an old colleague, the honour of asking my advice. I looked into his case as carefully as I could, and it seemed to me that his ailment had been in its origin purely local, implying nothing of constitutional defect, and giving no reason to apprehend any ultimate impairment of bodily or mental vigour. A certain amount of care had been required at the outset, and this had been taken under the direction of the eminent men whose advice he had had in Glasgow; and I agreed with them in the opinion that the care might be gradually relaxed; and finally I took upon myself the somewhat serious responsibility of giving to Lord Kelvin *carte blanche* to behave as any ordinary mortal might do. Now, gentlemen, I venture to think that what we have seen and heard of Lord Kelvin in the course of the last two days justifies my boldness, and that we may confidently look forward to the fulfilment of the hope which he expressed this morning, that he may yet for many years to come pursue with unabated energy those magnificent researches which have already done so much to benefit humanity. There is another aspect of this occasion with regard to which I should like to say a word. It has been to

rule of the municipality of Glasgow. I feel, therefore, that whether I look at this great celebration with regard to its essential object—the homage of the scientific world to our illustrious friend—or to the evidence which it has afforded of the prosperity of the University and the wise liberality of this great city, it has given me unmixed pleasure; and it has been a high privilege to have been permitted to take part in it.

Prof. Simon Newcomb, Washington, U.S., replied for the Americans. He remarked—I feel that an apology is due to you in accepting the invitation to speak this evening, and thereby imperilling a certain reputation which I believe my country has for grace in after-dinner speeches. The fact is, that until it was too late I was really not aware America would have so many representatives here better able than I am to do justice to the occasion. But there is yet another reason why I was extremely unwilling to voice the sentiments which I know are entertained by all Americans on the present occasion. If among the friends of Lord Kelvin, who for twenty-five years have been in more or less intimate association with him, that one was to be selected of whom during that period he had most kindly spoken, and

awarded a praise that was perhaps the least deserved, I think it would have been the humble individual who now has the honour of addressing you. As Americans, you are aware how very close is our association with the great man of science whose jubilee we now celebrate. He first became known to us through his work in connection with the Atlantic cable of 1858, a cable which, those of you who now can remember it, ceased after a week or two of rather intermittent activity. It is quite true that on that occasion his fame was temporarily eclipsed by that of the operator who sent the messages from the end in Newfoundland. The name of this operator ran from city to city throughout the country. It had never been heard of before; it filled the land for those few brief days, and when the cable ceased to send the current, it disappeared almost for ever. For an explanation we had to refer to one of our most eminent men of science, who has lived, I think, wherever the English language is spoken—the author of the “Autocrat of the Breakfast Table”—and who published a theory or explanation of the whole phenomenon. This man was a living product of the galvanic action of the cable, and when the current ceased to pass, there was nothing left in the room he occupied but a cloud of organic elements such as man is made of. On the subsequent occasion of laying the cable in 1866, our guest again became well known to us for his work in promoting that object. Also, in our naval service, to which I have the honour to belong, we are in many ways most indebted to him. I do not think the name of any man is more familiar to the officers of our navy anywhere than that of Lord Kelvin, first, by his work on magnetism, and for the navigation of ships, and by his deep-sea sounding apparatus, as well as by many others of his inventions which relate to navigation. There are certain features of his work which, as one so long intimately associated with him, it may not be amiss that I recall. The first, and perhaps most unique, feature is the combination of abstract results with practical application. It has been the general—I do not know but that it has been the almost universal—rule that the men who have by their studies and thought promoted our knowledge of nature have not been those who have applied that knowledge to the direct benefit of mankind by inventing means for its application. I am not sure but that Lord Kelvin is the single, solitary exception to this rule. The ground covered by his work is certainly remarkable in its extent. The first knowledge I had of him—probably the first that those who cultivate mathematics know of him—is in connection with a journal published back in the forties, and known under different names at different times as the *Cambridge, London, and Dublin Mathematical Journal*. For a period, I believe, he was associated in the editorship of that journal. Now, it is worthy of remark in this connection, that at the present time sets of this journal can command a price that is almost fabulous in the public market from the mathematicians of the day. Then at this point he diverged from the doctrine which was said to have been laid down by one of the most eminent workers in the words, “I thank Heaven that I cultivate a science which cannot be prostituted to any useful purpose.” In passing from the field of mathematics we come next to pure philosophy by saying that the theory of energy in its present form is, I think, very largely due to his work. This is, perhaps, the most far-reaching generalisation as to the laws of action that the world has seen; it enables us to see the beginning of the universe and to look forward towards its end. We all read discussions as to the age of the earth and the question whether the geologist has an indefinite bank of time on which he can draw cheques without limit. Yet another question of geology was that of the rigidity of the earth, in which I think his view is almost universally accepted. In this wide range of activity I think we may say that he has made few mistakes—perhaps we may say that he is almost unique in not having made any. I beg leave, on behalf of the foreign representatives, to thank you, my Lord Provost and the citizens of Glasgow for the very cordial reception we have met in coming here to present our congratulations to Lord Kelvin on this memorable occasion. We shall ever remember that reception, and I beg leave on behalf of all to again express the hope that our honoured guest of this evening may live for many years.

Prof. Story, at the suggestion of the Lord Provost, very gracefully proposed the health of Lady Kelvin, which was received with great applause. Lady Kelvin, who occupied a seat in the balcony, bowed her acknowledgments, and Lord Kelvin, replying for her, said—

Prof. Story has said well that I owe a great deal to Lady Kelvin, but he does not know how much I owe. No person in the world except myself knows how much of any results for science that it has been possible for me to arrive at are due to her co-operation. I thank you warmly for the very kind manner in which you, Prof. Story, have proposed this toast, and with which the company have received it.

After the toasts of the University and City of Glasgow, proposed by the Earl of Rosse, D.C.L., F.R.S., and the Lord Provost, proposed by Sir Henry Roscoe, F.R.S., had been duly honoured and replied to, the company joined in singing “God Save the Queen,” and afterwards, on the request of Lord Kelvin, in singing “Auld Lang Syne.”

Thus closed the celebration proper, a celebration almost unique in the experience of every one present for its grand simplicity, splendid enthusiasm, and entire success in every detail of arrangement. For the latter characteristic the Jubilee Committee deserve the highest credit, and its Secretaries, and others, among whom are the Rev. Professor Stewart, D.D., Clerk of Senate, Mr. Allen Baird, and members of the Senatus, who had charge of the University arrangements, may well be proud of the result of their labours.

Nothing in Lord Kelvin's reply to the toast of his health at the banquet was more characteristic of the man than his humble confession of failure to penetrate the mystery of the constitution of matter and of ether. It is no doubt true, as Lord Kelvin remarked, that the nature of electric and magnetic force, and the relation between ether, electricity, and ponderable matter, are still unknown to us; but Lord Kelvin's researches have been the means of enabling himself and others to unravel many of their phenomena, to connect these phenomena by general laws, and to marshal the forces of science for still further assaults on the unknown. The *certaminis gaudia* is not after all in this case mere joy of conflict, but the pleasure of obtaining by strenuous endeavour some view first of the very innermost secrets of nature, and what is of very great consequence and may in time include everything, an accurate conception of her method of working, and of the dynamical laws which govern her operations.

A number of delegates and others left Glasgow on Wednesday morning, but many remained and accepted the invitation of the Senatus to a special excursion on the Firth of Clyde. A special train was run from St. Enoch's station to Greenock, where the steamer *Glen Sannox* awaited the party. The morning was wet, but the ample saloon accommodation of the splendid steamer, with an awning erected on deck, provided sufficient shelter. The steamer headed down the Clyde instead of proceeding up Loch Long, where it was likely to be raining still more heavily, and proceeded past Largs, saluting Nether Hall, Lord Kelvin's country house at Largs, in passing, thence between the Cumbræes to the mouth of Loch Fyne, then round the Kyles of Bute, and back to Greenock in time to allow Glasgow to be reached before the departure of the limited mail train in the evening. Luncheon and tea were served on board. The weather cleared about midday, and the excursion proved most enjoyable to all, and there were many who ventured to go. Lord and Lady Kelvin with their party were present, and, it was gratifying to observe, seemed to be in excellent health and spirits in spite of the excitement and fatigues of the previous days.

A. GRAY.

INTERNATIONAL CATALOGUE OF SCIENCE.

THE approaching International Conference arranged by the Royal Society to consider proposals for an International Catalogue of Scientific Literature will be formally opened at the apartments of the Society in Burlington House on the morning of Tuesday, July 14. A reception of the delegates will be held by the