

PROCEEDINGS  
OF  
THE ROYAL SOCIETY  
OF  
EDINBURGH.

VOL. XIV.

NOVEMBER 1886 TO JULY 1887.

EDINBURGH:  
PRINTED BY NEILL AND COMPANY.

MDCCLXXXVIII.

## CONTENTS.

	PAGE
Election of Office-Bearers, . . . . .	1
Chairman's Opening Address, . . . . .	2
Astronomical Tables for facilitating the Computation of Differential Refraction, for Latitudes 56° and 57°·30. By the Hon. Lord M'Laren, . . . . .	21
On the Foundations of the Kinetic Theory of Gases. Part II. By Professor Tait, . . . . .	21
Fog Bow observed on Ben Nevis, 22nd October 1886. By R. T. Omond, Esq., Supt. B.N.O., . . . . .	24
Temperatures at Different Heights above Ground at Ben Nevis Observatory. By R. T. Omond, Esq., Supt. B.N.O., . . . . .	24
Motion of Compound Bodies through Liquid. By the Rev. H. J. Sharpe, M.A. Communicated by the President, . . . . .	29
Note on Knots on Endless Cords. By A. B. Kempe, Esq. Com- municated by Professor Tait. (Plate I.), . . . . .	36
On the Ring-Waves produced by throwing a Stone into Water. By Sir W. Thomson, . . . . .	37
On the Waves produced by a Ship advancing uniformly into Smooth Water. By Sir W. Thomson, . . . . .	37
Expansion of Functions in terms of Linear, Cylindric, Spherical, &c., Functions. By P. Alexander, Esq., M.A. Communicated by Dr T. Muir, . . . . .	37
On Even Distribution of Points in Space. By Professor Tait, . . . . .	37
Address on Processes of Refrigeration. By J. J. Coleman, Esq., . . . . .	38
On the Front and Rear of a Free Procession of Waves in Deep Water. By Sir W. Thomson, . . . . .	38
Numerical and other Additions to his Paper, read on 6th December 1886, on the Foundations of the Kinetic Theory of Gases. By Professor Tait, . . . . .	46
Intimation of an Improvement in Rankine's Formula for Retaining Walls. Given by Professor Armstrong on behalf of A. C. Elliott, Esq., . . . . .	48
The Total Rainfall on the Land of the Globe, and its Relation to the Discharge of Rivers. By J. Murray, Esq., Ph.D., V.P., . . . . .	48

	PAGE
Chemical Affinity and Solution. By W. Durham, Esq., . . . . .	48
Thermometer Screens. Part IV. By John Aitken, Esq. (Plates II., III., IV.), . . . . .	53
On the General Effects of Molecular Attraction of Small Range on the Behaviour of a Group of Smooth Impinging Spheres. By Professor Tait, . . . . .	85
On a New Formula for the Pressure of Earth against a Retaining Wall. By A. C. Elliott, Esq., B.Sc., C.E. Communicated by Professor Armstrong, . . . . .	85
The Conducting Paths between the Cortex of the Cerebrum and the Lower Centres, in relation to their Function. By Professor D. J. Hamilton, . . . . .	97
Researches on Micro-Organisms, including ideas of a New Method for their Destruction in Certain Cases of Contagious Disease. By Dr A. B. Griffiths, F.R.S. (Edin.), . . . . .	97
On Cases of Instability in Open Structures. By E. Sang, Esq., LL.D., . . . . .	106
On the Increase of Electrolytic Polarization with Time. By W. Peddie, Esq. Communicated by Professor Tait, . . . . .	107
Astronomical Notes. By Ralph Copeland, Esq., Ph.D. Communicated by Lord M'Laren, . . . . .	110
Further Determinations of the Effect of Pressure on the Maximum Density Point of Water. By Professor Tait, . . . . .	110
On the Height of the Land of the Globe above Sea-Level. By Dr J. Murray, . . . . .	110
Note on the Effects of Explosives. By Professor Tait, . . . . .	110
Report on Fossil Fishes collected in Eskdale and Liddesdale. Part I. Ganoidei—Supplement. By Dr Traquair, . . . . .	111
On the Equilibrium of a Gas under its own Gravitation only. By Sir W. Thomson, . . . . .	111
On the Equilibrium of a Gas under its own Gravitation only. Part II. By Sir W. Thomson, . . . . .	118
History of the Theory of Determinants. Part I. Determinants in General: Hindenburg (1784) to Reiss (1829). By Dr Muir, . . . . .	118
Note on Solar Radiation. By John Aitken, Esq., . . . . .	118
On Laplace's Nebular Theory, considered in relation to Thermodynamics. By Sir W. Thomson, . . . . .	121
On a Class of Alternating Functions. By Dr Muir, . . . . .	121
Note on Hoar-Frost. By John Aitken, Esq., . . . . .	121
On the Quotient of a Simple Alternant by the Difference-Product of the Variables. By Dr Muir, . . . . .	125
Investigations on the Influence of certain Rays of the Solar Spectrum on Root-Absorption and on the Growth of Plants. By Dr A. B. Griffiths, F.R.S.E., F.C.S. (Lond. & Paris), and Mrs A. B. Griffiths, . . . . .	125

	PAGE
Variations in the Value of the Monetary Standard. By Professor Nicholson, . . . . .	129
On Ice and Brines. By J. Y. Buchanan, Esq., . . . . .	129
On the Distribution of Temperature in the Antarctic Ocean. By J. Y. Buchanan, Esq., . . . . .	147
Note on a Formula for $\Delta^{n0^i/n^i}$ when $n, i$ are very large Numbers. By Professor Cayley, . . . . .	149
On the Fossil Flora of the Radstock Series of the Somerset and Bristol Coal Fields. (Upper Coal Measures.) Part I. By R. Kidston, Esq., F.G.S., . . . . .	153
On the Achromatism of the Four-Lens Eye-Piece: New Arrangement of the Lenses. By Edward Sang, Esq., LL.D., . . . . .	153
An Effective Arrangement for Observing the Passage of the Sun's Image across the Wires of a Telescope. By Edward Sang, Esq., LL.D., . . . . .	155
Observations on the Structural Characters of certain new or little-known Earthworms. By Frank E. Beddard, Esq., M.A., Prosector to the Zoological Society of London, and Lecturer on Biology at Guy's Hospital. (Plate V.), . . . . .	156
On the Geology and Petrology of St Abb's Head. By Professor Geikie. (Plate VI.), . . . . .	177
Professor Rowland's Photographs of the Solar Spectrum. Exhibited by the Astronomer-Royal for Scotland, . . . . .	194
On Ship-Waves. By Sir W. Thomson, . . . . .	194
On the Instability in Fluid Motion. By Sir W. Thomson, . . . . .	194
Experimental Research in Magnetism. By D. S. Sinclair, Esq. Communicated by Principal Jamieson, . . . . .	194
On the Summation of certain Series of Alternants. By A. H. Anglin, Esq., M.A., LL.B., &c., . . . . .	194
Note on Cobaltic Alums. By Hugh Marshall, B.Sc., . . . . .	203
On the Effect produced on the Polarisation of Nerve by Stimulation. By G. N. Stewart, Esq., . . . . .	205
The Objective Cause of Sensation. Part III.—The Sense of Smell. By Professor John Berry Haycraft, . . . . .	207
On the Physics of Noise. By Professor Crum Brown, . . . . .	219
On the Physical Properties of Methyl-Alcohol. By Professor Dittmar and C. A. Fawsitt, Esq., . . . . .	219
On the Instability of the Double Sulphates $M'SO_4.R'SO_4 + 6H_2O$ of the Magnesium Series. By W. Dittmar, Esq., . . . . .	219
A Diatomaceous Deposit from North Tolsta, Lewis. By John Rattray, Esq., . . . . .	220
On the Increase of Electrolytic Polarization with Time. By W. Peddie, Esq., B.Sc., . . . . .	221

	PAGE
On the Blood of <i>Myxine</i> . By Professor D'Arey W. Thompson,	221
On the Larynx and Stomach in Cetacea. By Professor D'Arey W. Thompson,	221
On Transition Resistance at the Surface of Platinum Electrodes, and the Action of Condensed Gaseous Films. By W. Peddie, Esq., B.Sc. (Plate VII.),	221
Researches on the Problematical Organs of the Invertebrata—especially those of the Cephalopoda, Gasteropoda, Lamelli-branchiata, Crustacea, Insecta, and Oligochæta. By Dr A. B. Griffiths, F.R.S. (Edin.), F.C.S. (Lond. & Paris), Principal, and Lecturer on Chemistry and Biology, School of Science, Lincoln; late Lecturer on Chemistry, Technical School, Manchester, &c.,	230
The Nephridia of <i>Lanice conchilega</i> , Malmgren. By J. T. Cunningham, Esq.,	238
On a Furnace capable of melting Nickel and Cobalt. By J. B. Readman, Esq.,	240
On the Fossil Flora of the Radstock Series of the Somerset and Bristol Coal Fields. Concluding Part. By R. Kidston, Esq.,	240
On the Discharge of Albumen from the Kidneys of Healthy People. By Professor Grainger Stewart, M.D.,	240
The Salinity and Temperature of the Moray Firth, and the Firths of Inverness, Cromarty, and Dornoch. By Hugh Robert Mill, D.Sc., Scottish Marine Station. (Plate VIII.),	250
On the Presence of Bacteria in the Lymph, &c., of Living Fish and other Vertebrates. By J. C. Ewart, M.D., Regius Professor of Natural History, University of Edinburgh,	262
On the Origin of the Great Alpine Lakes. By Professor Sacco, University of Turin,	271
On the Minute Oscillations of a Uniform Flexible Chain hung by one End; and on the Functions arising in the course of the Inquiry. By E. Sang, Esq., LL.D. (Plate IX.),	283
Note on the Biological Tests employed in determining the Purity of Water. By A. W. Hare, Esq., M.B. Edin. (Plates X., XI.),	306
Alternants which are Constant Multiples of the Difference-Product of the Variables. By A. H. Anglin, Esq., M.A.,	313
Glories, Halos, and Coronæ seen from Ben Nevis Observatory. Extracts from Log Book. By R. T. Omond, Esq. Communicated by Professor Tait. (Plate XII.),	314
Thermal Conductivity of Iron, Copper, and German Silver. By A. C. Mitchell, Esq. Communicated by Professor Tait,	327
On the Probability that a Marriage entered into by a Man of any Age, will be Fruitful. By T. B. Sprague, Esq., M.A.,	327
On the Nephridia of <i>Hirudo medicinalis</i> . By Dr A. B. Griffiths, F.R.S.E., F.C.S. (London & Paris), Principal, and Lecturer on Chemistry and Biology, School of Science, Lincoln,	346

	PAGE
On Degenerated Specimens of <i>Tulipa sylvestris</i> . By Mrs A. B. Griffiths. Communicated by Dr A. B. Griffiths, F.R.S.E., &c.,	349
The Luminous Organs of <i>Nyctiphanes norvegica</i> , Sars. By J. T. Cunningham, B.A., and Rupert Vallentin, Esq.,	351
On a Constant Daniell Cell, for use as a Standard of Electromotive Force. By Cosmo I. Burton, B.Sc., F.C.S.,	356
On Glories. By Professor Tait,	358
Report on the Pennatulida dredged by H.M.S. "Porcupine." By A. Milnes Marshall, M.D., D.Sc., M.A., F.R.S., Beyer Professor of Zoology in the Owens College, and by G. H. Fowler, B.A., Ph.D., Berkeley Fellow of the Owens College, Manchester. Communicated by John Murray, Esq., Ph.D.,	359
Stability of Fluid Motion.—Rectilinear Motion of Viscous Fluid between two Parallel Planes. By Sir W. Thomson, LL.D., F.R.S.,	359
Note on the Epiblastic Origin of the Segmental Duct in Teleostean Fishes and in Birds. By George Brook, Esq., F.L.S., Lecturer on Comparative Embryology in the University of Edinburgh. Communicated by Professor Sir Wm. Turner, F.R.S.,	368
Preliminary Note on the Chemistry of Strophanthin. By Thomas R. Fraser, M.D., F.R.S., Professor of Materia Medica in the University of Edinburgh,	370
On a New Diffusimeter and other Apparatus for Liquid Diffusion. By J. J. Coleman, Esq., F.I.C., F.C.S.,	374
On the Minute Structure of the Eye in certain Cymothoidæ. By Frank E. Beddard, Esq., M.A., F.Z.S.,	381
On the Mean Height of the Land of the Globe. By John Murray, Esq., Ph.D.,	381
The <i>Chatopoda Sedentaria</i> of the Firth of Forth. By J. T. Cunningham, Esq., B.A.,	381
Laws of Solution. Part II. By W. Durham, Esq.,	381
On the Partition of Energy between the Translatory and Rotational Motions of a set of non-homogeneous Elastic Spheres. By Professor W. Burnside. Communicated by Professor Tait,	387
On the Salinity, Temperature, &c., of the Firth of Forth. By H. R. Mill, Esq., D.Sc.,	387
The Direct Measurement of the Peltier Effect. By Albert Campbell, Esq. Communicated by Professor Tait. (Plate XIII.),	387
On some Vapour Densities at High Temperatures. By Alexander Scott, Esq., M.A., D.Sc.,	410
On the Determination of the Plane Curve which forms the Outer Limit of the Positions of a certain Point. By Dr G. Plarr. Communicated by Professor Tait,	415
The Thermal Windrose at the Ben Nevis Observatory. By A. Rankine, Esq.,	416

	PAGE
On Ferric Ferricyanide as a Reagent for Detecting Traces of Reducing Gases. By Professor Crum Brown, . . . . .	419
On the Compressibility of Water, of Mercury, and of Glass. By Professor Tait, . . . . .	419
An Account of some Experiments which show that Fibrin-Ferment is absent from circulating Blood-Plasma, and which support the view, first advanced by Sir Joseph Lister, that the Blood has no spontaneous tendency to Coagulate. By Professor John Berry Haycraft, . . . . .	419
On the Chemical Composition of the Water composing the Clyde Sea Area. By Adam Dickie, Esq., . . . . .	422
An Experimental Critique of the Chloroplatinate Methods for the Determination of Potassium, including a redetermination of the Constant Pt. By Professor Dittmar and Mr John M'Arthur, . . . . .	428
Addition to Thermometer Screens. Part IV. By John Aitken, Esq., . . . . .	428
On the Quotient of a Simple Alternant by the Difference-Product of the Variables. By Dr T. Muir, . . . . .	433
Chairman's Closing Address, . . . . .	446
Minute of Meeting of Special Committee on the Victoria Jubilee Prize, 27th June 1887, . . . . .	449
The Theory of Determinants in the Historical Order of its Development. By Dr T. Muir, M.A., . . . . .	452
On the Conducting Paths between the Cortex of the Brain and the Lower Centres in relation to Physiology and Pathology. By D. J. Hamilton, M.B., F.R.C.S. Edin., F.R.S.E., Professor of Pathology, University of Aberdeen. (Plates XIV., XV.), . . . . .	519
Donations to the Library, . . . . .	535
Index, . . . . .	555
Obituary Notices (see separate Index), . . . . .	561