

Biblioteka Główna i OINT
Politechniki Wrocławskiej



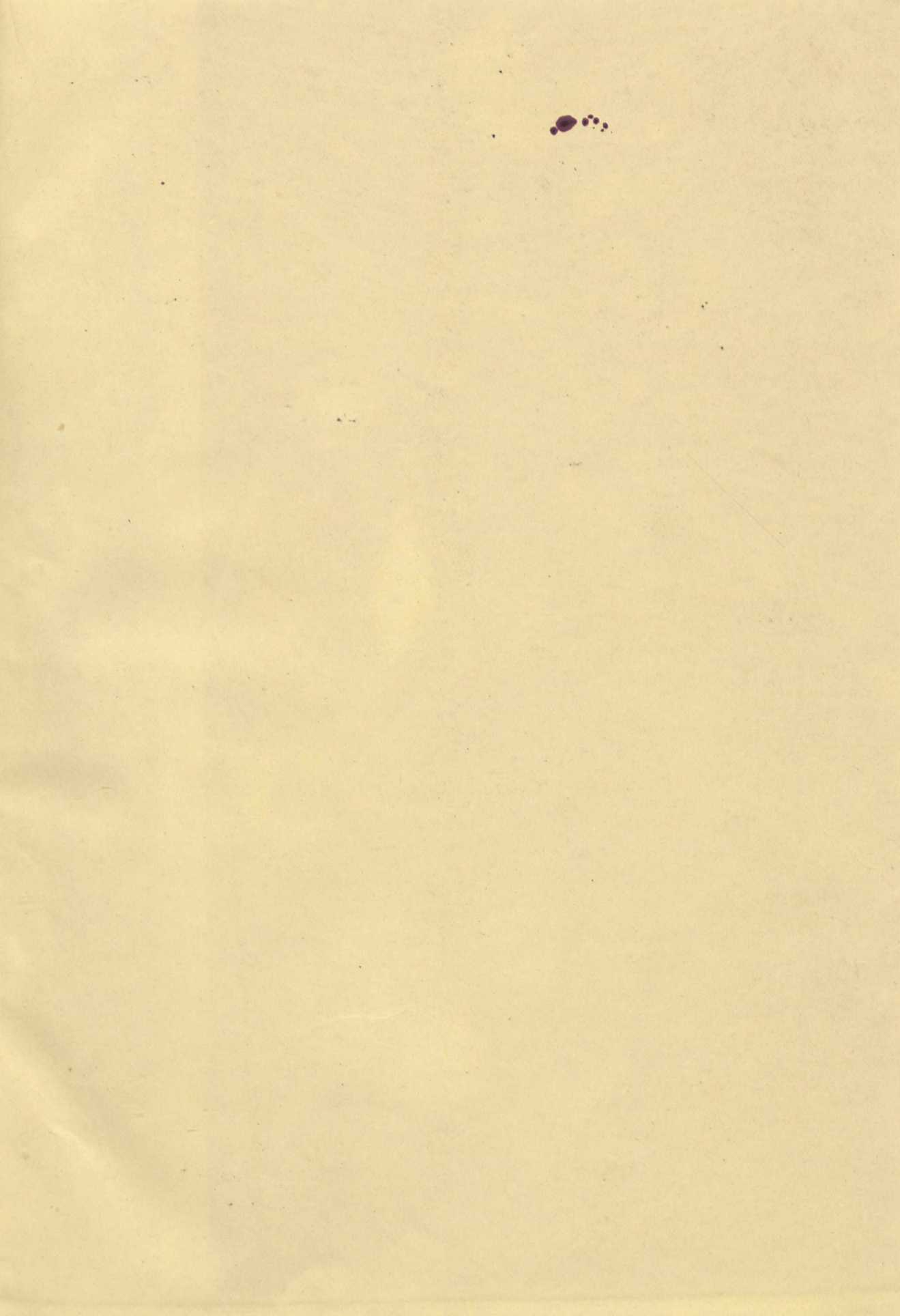
100100234282

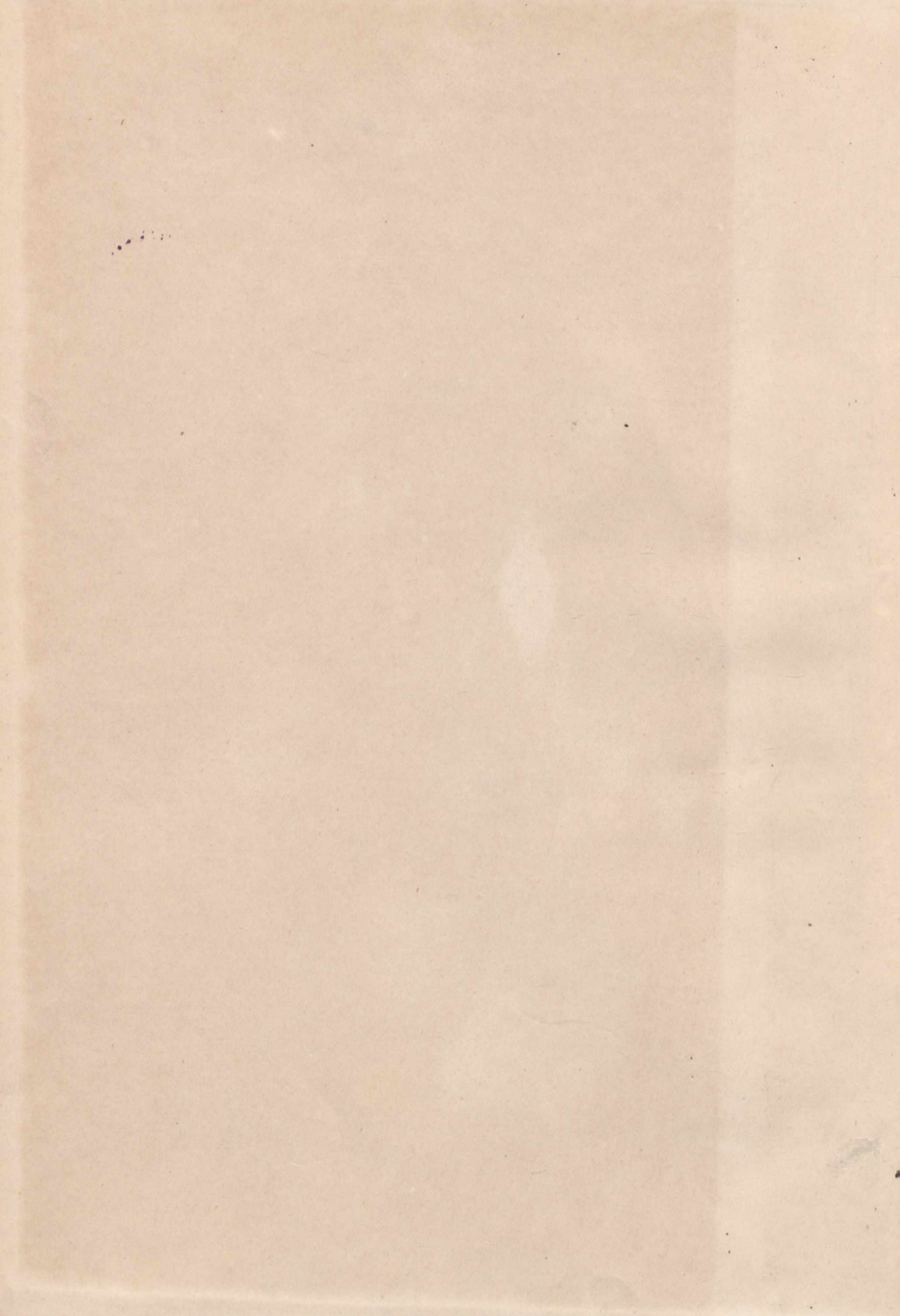
A 610 u

42



Colt. Magda
18. II. 13





Supplement to Nature,
June 2, 1892

Nature



A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

VOLUME XLV

NOVEMBER 1891 to APRIL 1892



*"To the solid ground
Of Nature trusts the mind which builds for aye."*—WORDSWORTH

1912. 1942.

London and New York

MACMILLAN AND CO.

1892

Nature



ILLUSTRATED JOURNAL OF SCIENCE

RICHARD CLAY AND SONS, LIMITED
LONDON AND BUNGAY



INDEX

- AALIA PAAKAI, the Salt Lake of, A. B. Lyons, 29
Abbe (Prof. C.), Cloud-Observations at Sea, 70
Aberrant Fossil Ungulates of South America, 608
Aberration, Lord Rayleigh, Sec. R.S., 499
Aberration Problems, Prof. O. Lodge, F.R.S., 549
Aberration, Theory of Astronomical, M. Mascart, 68
Abney (Capt.), Colour Photometry, 213
Aborigines of the Dominion of Canada, Hon. E. Dewdney, 587
Abraham (R.), a Standard Condenser, 528
Accidents in Germany, Workmen Killed and Wounded in, Vacher, 350
Acloque (A.), Les Champignons, 222
Acoustics: Refraction and Velocity of Sound in Porous Bodies, 156
Acquired Characters, Inheritance of, Alfred W. Bennett, 53
Acromegaly: the Skeleton of the Irish Giant Cornelius Magrath, Dr. D. J. Cunningham, F.R.S., 147
Across Thibet, Gabriel Bonvalot, 269
Adami (J. G.), Contributions to the Physiology and Pathology of the Mammalian Heart, 451
Adams (Prof. John Couch): Obituary Notice of, 301; the Cambridge Philosophical Society and, 322; Proposed National Monument to, 401
Addenbrooke (G. L.), Aluminium and its Application to Photography, 134
Adelsberg Cave, the, 207
Adhesion, the Limpet's Power of, Percy A. Aubin, 464
Æolosoma, Formation of a Temporary Cyst in the Fresh-water Annelid, Frank E. Beddard, 28
Aerial Locomotive Machines, Use of Chronophotography for Study of, Marey, 71
Aërodynamics, Experiments in, Lord Rayleigh, F.R.S., 108
Africa: Projected Expedition by Dr. Oscar Baumann in East, 65; Equatorial, My Personal Experiences in, as Medical Officer of the Emin Pasha Relief Expedition, Thos. Heazle Parke, 265; Travels in Africa during the years 1879-83, Dr. Wilhelm Junker, 507; My Second Journey through Equatorial Africa, Hermann von Wissmann, 507; Two African Explorers, 376; 'Captain Dundas's Expedition in East, Mount Kenia, Ernest Gedge, 566; African Diamond Industry, the South, at the Chicago Exhibition, 567
Agassiz (Prof. Alex.), Dredging Operations in the Eastern Pacific, 281
Agriculture: Results of Experiments in, at Rothamsted, on the Question of the Fixation of Free Nitrogen, Dr. J. H. Gilbert, F.R.S., 32; Agricultural Department, Victoria, Results of the Travelling Dairy, A. Crawford, 39; the Weather Bureau of the United States, 86; the Reclaiming and Cultivation of Land in the Camargue, M. Chambréant, 143; Principles of Agriculture, 173; the Value of Maize as Food, 234; Elements of Agriculture, Dr. W. Fream, 388; the Average Yield of Wheat in Ohio, 420; Proposed Establishment of an Agricultural College in British Guiana, 520; Agricultural Needs of India, 588; Journal of the Royal Agricultural Society, 568
Air Temperature, Sun-spots and, 271
Air and Water, Vivian B. Lewes, 531
Airy (Sir George Biddell), Obituary Notice of, 232
Aitken (John, F.R.S.), on the Number of Dust Particles in the Atmosphere of Various Places in Great Britain and on the Continent, with Remarks on the Relation between the Amount of Dust and Meteorological Phenomena, 299
Alaska, the Boundaries of, the Geographical Position of Mount St. Elias, I. C. Russell, 472
Alder (H. St. A.), Scientific Nomenclature, 104
Algol, Dr. S. C. Chandler, 446
Alkali-maker's Hand-book, by George Lunge, Ph.D., and F. Hurter, Ph.D., Prof. T. E. Thorpe, F.R.S., 121
Allbutt (Dr. T. C., F.R.S.), Appointment of, to be Regius Professor of Physic in room of late Sir Geo. Paget, 402
Allison (Mrs.), the Similkameen Indians of British Columbia, 164
Alloys, Prof. W. C. Roberts-Austen, F.R.S., Report to the Alloys Research Committee of the Institution of Mechanical Engineers, 22
Aloi (Prof.), Influence of Electricity on Growth of Plants, 520
Alpine Rubi, T. D. A. Cockerell, 320
Alternate Currents of High Potential and Frequency, Lectures on, Nikola Tesla, 345
Altitudes, Astronomical Possibilities at Considerable, Prof. Pickering, 498
Alum Solution, T. C. Porter, 29
Aluminium: and its Application to Photography, G. L. Addenbrooke, 134; the Manufacture and Use of, from an Engineering Point of View, A. E. Hunt, 568
Amazons, Obituary Notice of Henry Walter Bates, F.R.S., the Naturalist of the, 398
America: American Journal of Mathematics, 45; Spanish Arrangements for the Celebration of the Quatercentenary of the Discovery of America, 64, 567; American Meteorological Journal, 70, 189, 357, 597; American Journal of Science, 118, 310, 445, 622; American Superiority in Mechanics, Coleman Sellers, 157; the Utilization of the By-products of the Coke Industry, Dr. B. Terne, 157; McKinley Tariff and Scientific Instruments, 208; Fisheries of the Great American Lakes, 259; Fishing through the Ice in the Great American Lakes, 280; Remarkable Display of Aurora Borealis in, 378; Kalm's Account of his Visit to England, on his way to, in 1748, 412; American Society for Prevention of Cruelty to Animals, Report of, 496; Influenza in, Prof. Edward S. Holden, 582; American Town Trees, J. Robinson, 603; Forestry in, Prof. W. R. Fisher, 611; Ancient Civilization of Central, Alfred P. Maudslay, 617
Amorphous Boron, the Properties of, A. E. Tutton, 522
Amsterdam Royal Academy of Sciences, 48, 72, 240, 408, 576, 600
Anatomy, Comparative: the Cranial Nerves of Man and Seliachians, Prof. Cossar Ewart, 527
Anatomy of the Dog, 16
Ancient Civilization of Central America, Alfred P. Maudslay, 617
Ancient Monuments, Orientation of, Rev. Fred. F. Grensted, 464
Ancient Tombs and Burial Mounds of Japan, Prof. Hitchcock, 381
Andalusite at Ariège, on the Relations existing between the Form and Nature of the Beds of, M. A. Lacroix, 624
Andaman Islands, Disappearance of the Aborigines of the, 587
Anderson (Thos. D.), the New Star in Auriga, 365
Andes of the Equator, Travels among the Great, Edward Whympier, Prof. T. G. Bonney, F.R.S., 561
Andoyer (M.), Orthochromatic Plates for Astronomical Photography, 280
André (M.), the Spontaneous Oxidation of Humic Acid and Vegetable Soil, 288; the Manifestation of Negative Electricity during Fine Weather, 528
Anemometer Comparisons, W. H. Dines, 623
Anemometers, Two New Forms, in use at Kew Observatory, 587
Aneroid Barometer, How to Use the, Edward Whympier, 339

- Aneroid in Hypsometry, the, Herbert Tomlinson, F.R.S., 440
- Aneurism, a Treatise on the Ligation of the Great Arteries in continuity, with Observations on the Nature, Progress, and Treatment of, Chas. A. Ballance and Walter Edmunds, Dr. M. Armand Ruffer, 530
- Angot (A.), Instructions Météorologiques, 196
- Angot (M.), Temperature Observations in 1890 on Eiffel Tower, 234
- Ångström, the Chromosphere Line 6676.9, Rev. A. L. Cortie, 103; Heat-Radiation of Gases under the Electric Discharge, 306
- Animal Sketches, C. Lloyd Morgan, 291
- Animals, a Remarkable Book on the Habits of, W. H. Hudson, Dr. Alfred R. Wallace, 553
- Annales of the University Observatory in Vienna, 138
- Annelid *Eolosoma*, Formation of a Temporary Cyst in the Fresh-water, Frank E. Beddard, 28
- Annelids: Preliminary Notice of a New Branchiate Oligochaete, Frank E. Beddard, 109
- Anthrax, Animals rendered immune to, Dr. Th. Weyl, 312
- Anthropogéographie, Friedrich Ratzel, 557
- Anthropology: Anthropological Society, 71, 164, 431, 503, 551; the Mexican Atlas, or Spear Thrower, 66, 103; the Limits of Savage Religion, Dr. Tylor, 71; Strange Symbolical Marriage Custom in India, Dr. Post, 135; the Similkameen Indians of British Columbia, Mrs. Allison, 164; Nature and Man in North America, Prof. N. S. Shaler, 220; Prof. Putnam's Exhibit at Chicago Exhibition, 259; the Transformation of the Animal Skull into a Human Skull, P. Topinard, 260; Discovery of Aboriginal Skulls in the Argentine, Señor Moreno, 278; Rev. Lorimer Fison on Anthropological Study, 426; Anthropogenie, oder Entwicklungsgeschichte des Menschen, Prof. Ernst Haeckel, 482; L'Anthropologie, 521; the Manchu Race, 523; the Ceremonial Circuit of the Cardinal Points among the Tusayan Indians, J. W. Fewkes, 546; Finds at the Great Zimbabwe Ruins, Theodore Bent, 551; Population of the Five Continents, Emile Levasseur, 552; Mission Scientifique de Cap Horn, J. Deniker and P. Hyades, 577; the Botocudos of Brazil, 615
- Anti-Taurus, the Eastern Taurus and the, D. G. Hogarth, 138
- Antipodes, Oysters at the, 43
- Antoine (Ch.), the Characteristic Equation of Water-vapour, 336
- Antwerp, proposed International Economic Congress at, 586
- Apertures, the Law of Limiting, Dr. E. J. Spitta, 186
- Aphanapteryx in the New Zealand Region, Prof. Henry O. Forbes, 580
- Apteryx, Additional Observations on Development of, T. J. Parker, F.R.S., 311
- Arabian Sea: Cyclones in the, 276; Cyclone Memoirs of the, W. L. Dallas, 135
- Archæology: Excavation of the Prehistoric Mounds in Ohio, 20; the Chronology of the Neolithic Age in Scandinavia, and the Bronze Age in the East and Southern Europe, Prof. Montelius, 39; Dr. Ermling on the Nurhagi of Sardinia, 114; the late Dr. Reinholm on Finnish Archæology, 496
- Architects, Institution of Naval, 570
- Architecture, Naval: the Steadying of Vessels at Sea, J. I. Thornycroft, 570; the Influence of Shallow Water upon the Trial Trip Speeds of Modern Vessels, W. H. White, F.R.S., 571; on Balancing Marine Engines and the Vibration of Vessels, A. F. Yarrow, 571
- Arctic Plants, Fresh Evidence concerning the Distribution of, during the Glacial Epoch, Dr. A. G. Nathorst, 273
- Arendt (Dr.), Relationship of Atmospheric Electrical Phenomena to Terrestrial Magnetism, 432
- Argentine, Discovery of Aboriginal Skulls in the, Señor Moreno, 278
- Arithmetic, Chemical, Problems in, E. J. Cox, 293
- Arithmetic, Mental, Clive Cuthbertson, 78; Dr. K. Haas, 198
- Arithmetic for Schools, Chas. Smith, 247
- Arithmetical Exercises in Chemistry, Leonard Dobbin, 76
- Arizona, the Prehistoric Irrigation Canals of, 185; the Native Iron of Cañon Diablo, M. Mallard, 575
- Armstrong (H. E., F.R.S.): Sulphochloride of Isomeric Dibromonaphthalenes, 263; Action of Alcohol on Sulphonic Chloride, a Means of producing Ethereal Salts of Sulphonic Acid, 263; Action of Bromine on Mixture of Ortho- and Paranitro-*a*-Acenaphthalides, 263; Camphrone, 263; the Interactions occurring in Flames, 430; Relative Orienting Effect of Chlorine and Bromine, the Constitution of Parabrom- and Parachloraniline Sulphonic Acids, 525; Anhydrides of Sulphonic Acids, 525; Production of Ketone 1: 2: 4-Acetorthoxylyene from Camphor by Action of Sulphuric Acid and Zinc Chloride, 551
- Arons (Dr.), Experiments on the Electrical Polarization at the Two Sides of a Metallic Plate Immersed in an Electrolyte at Right Angles to the Current, 576
- Arrow Poison, A. Coppen Jones, 343
- Art, on the Relation of Natural Science to, Prof. E. du Bois Reymond, F.R.S., 200, 224; W. Ainslie Hollis, 319
- Arteries, a Treatise on the Ligation of the Great, in Continuity, with Observations on the Nature, Progress and Treatment of Aneurism, Chas. A. Ballance and Walter Edmunds, Dr. M. Armand Ruffer, 530
- Artillery of the Future and the New Powders, James Atkinson Longridge, 146
- Asia, Central, M. Grum-Grzimailo's Journey to, 40
- Askenasy (Herr), Silent Combination of Hydrogen and Oxygen, 616
- Ass, the Cat and the Sheep in China, the Origin of the, Dr Macgowan, 285
- Assheton (R.), the Formation and Fate of the Primitive Streak in the Frog, 140
- Assimilation of Diet investigated in a Dog working in a Tread mill, Dr. Rosenberg, 599
- Assmann (Dr.), Meteorological Observations during Balloon Voyages, 168
- Assmann (Dr.), Observations made in a Captive Balloon, 432
- Aston (Emily), some Compounds of Oxides of Silver and Lead, 93
- Astronomy: T. W. Backhouse on the Apparent Size of Objects near the Horizon, 7; Proper Motions of the Stars, W. H. S. Monck, 8; Dr. Müller on the Telluric Spectrum, 21; Tempel-Swift's Periodic Comet, 21; Catalogue of Rutherford's Photographs, 21; Our Astronomical Column, 21, 41, 68, 89, 117, 137, 159, 186, 210, 237, 261, 280, 307, 325, 352, 380, 404, 422, 446, 473, 497, 521, 547, 569, 589, 616; Outburst of Dark Spots on Jupiter, 42; Wolf's Periodic Comet, 42; the Total Lunar Eclipse of November 15, 42; the Elements of the Minor Planets, 42; Star Groups, J. Ellard Gore, 52; Theory of Astronomical Aberration, M. Mascart, 68; Two New Laws of Celestial Mechanics, H. Struve, 70; the Rotation of Jupiter, A. Belopolsky, 70; Determination of the Solar Parallax, A. Auwers, 89; Photometric Observations, Dr. Müller, 90; Tables of Vesta, G. Leveau, 95; Method of observing the Motion of Stars in the Line of Sight, Prof. J. Norman Lockyer, F.R.S., 117; the Variation of Latitude, 117; Photography of the Eclipsed Moon, 117; the Recent (December 1, 1891) Eclipse of the Moon, Mrs. R. M. Crawshaw, 134; Proposals for a Co-operative Observation of the so-called Luminous Clouds, 117; Prof. J. S. Slater's Improved Armillary Sphere, 134; the Secular Acceleration of the Moon, and the Length of the Sidereal Day, 137; State of Solar Activity, Prof. Tacchini, 137; Observations of μ Cephei, J. E. Gore, 137; Influence of Ring and Disk Blinds in Micrometric Measurements, Dr. Walter Wislicenus, 137; Annales of the University Observatory in Vienna, 138; Astronomische Nachrichten 3068, 3069, 159; Jupiter and his First Satellite, E. E. Barnard, 159; Spectra of the Sun and Metals, F. McClean, 159; Tempel-Swift Comet, 159; Distribution of Energy in Stellar Spectra, Prof. Pickering, 159; on the Observation of North Polar Stars in the Vertical of Polaris, 159; Measurement of Jupiter's Satellites by Interference, A. A. Michelson, 160; Capture of Comets by Planets, Prof. H. A. Newton, 186; Law of Limiting Apertures, Dr. E. J. Spitta, 186; Connaissance des Temps, 186; Secular Variation of Latitudes, 210; Rotation of Venus, Herr Loschardt, 210; Stars having Peculiar Spectra, Prof. Pickering, 210; a Double Moon, Rose Mary Crawshaw, 224; Wolf's Periodic Comet, Dr. Berberich, 237; the Diffraction Effects produced by placing Screens in Front of Object Glasses, Prof. Pritchard, 237; Refractive Power of Cometary Matter, E. E. Barnard, 237; Himmel und Erde, 237; Washington Observations, 1886, 237; Stonyhurst Drawings of Sun-spots and Faculae, Rev. Walter Sidgreaves, 261; some apparently Variable Nebulae, Lewis Swift, 261; the Red Spots on Jupiter, W. F. Denning, 272; Motion of Stars in the Line of Sight, Prof. H. C. Vogel, 280; Orthochromatic Plates for Astronomical Photography, M.M. Fabre and Andoyer, 281;

- the Astronomical Theory of the Glacial Period, Sir Robert Ball, Prof. G. H. Darwin, F.R.S., 289; on some Points in Ancient Egyptian Astronomy, J. Norman Lockyer, F.R.S., 296, 373; Obituary Notice of Prof. John Couch Adams, 301; Proposed National Monument to late Prof. J. C. Adams, 401; Election of Sir R. S. Ball to Lowndes Professorship in room of late Prof. Adams, 402; Wolf's Numbers for 1891, 307; Solar Activity in 1891, Rudolf Wolf, 307; a New Journal, 307; Large Meteor of January 24, 1892, W. F. Denning, 317; New Star in the Milky Way, Ralph Copeland, 325; Observations of Mars, Dr. Lohse, 326; Solar Prominence Photography, Prof. G. E. Hale, 326; Re-discovery of Brooks's Comet (1890 II.), 326; the Vacant Chair of Astronomy at Cambridge, 337; on the New Star in Auriga, 344, 366; Thos. D. Anderson, 365; G. Rayet, 408; J. Norman Lockyer, F.R.S., 429; the Astronomer-Royal for Scotland, 454, 527; H. C. Vogel, 498; Report of U.S. Naval Observatory, 352; Observations of Nebulæ and Star Clusters, M. Bigourdan, 352; Solar Observations, Prof. Tacchini, M. Marchand, 352; Measures of the Nebula near Merope, 352; Photographic Magnitudes of Stars, 380; Zodiacal Light, O. T. Sherman, 381; a Preliminary Statement of an Investigation of the Dates of some of the Greek Temples as derived from their Orientation, F. C. Penrose, 395; Solar Disturbances of 1891, June 17, H. H. Turner, 404; Photography of Solar Prominences, M. Deslandres, 404; on the Variation of Latitude, Dr. S. C. Chandler, 404; the Warner Observatory, 422; Measurement of Solar Prominences, M. Fizeau, 422; the Draper Catalogue of Stellar Spectra, A. Fowler, 426; Cordova Observatory, 446; Algol, Dr. S. C. Chandler, 446; Sun-spots of February, 446; a New Comet, Prof. Lewis Swift, 446; Prof. Krueger on Motions of Periodic Comets, 446; Orientation of Ancient Monuments, Rev. Fred. F. Grensted, 464; Solar Investigations, Prof. Hale, 473; New Double Star, 26 Aurigæ, S. W. Burnham, 473; Rotation of Jupiter, W. F. Denning, 473; New Star in Auriga, Herrn Eugen and Gothard, J. Norman Lockyer, F.R.S., 473; the Lick Spectroscope, 473; a Bright Comet, 473; Sun Pillar, Annie Ley, 484; New Comet, W. F. Denning, 484; Fuzziness of some Variable Stars, Cuthbert G. Peek, 497; Astronomical Possibilities at Considerable Altitude, Prof. Pickering, 498; Increase of the Earth's Shadow during Lunar Eclipses, Dr. Hartmann, 498; Aberration, Lord Rayleigh, Sec.R.S., 499; a New Comet, W. F. Denning, 513; the Planet Jupiter, 521; the Objective Prism, Prof. Pickering, 521; Variation of Latitude, Dr. B. A. Gould, 521; the Discovery of Neptune, Prof. Holden, 522; Astronomy at the Paris Academy, March 21, 522; Variability of Nebulæ, Dr. Lewis Swift, 522; Solar Prominence Photography, M. Deslandres, 522; Aurora Spectrum, Prof. Hale, 522; the Capture of Lexell's Comet by Jupiter, Prof. G. H. Darwin, 526; the Relative Motion of 61 Cygni, Prof. A. Hall, 547; the Temperature of the Sun, M. H. Le Chatelier, 547; Comet Swift, March 6, 548; Wolf's Comet, 1891 II., Herr Dr. Thraen, 548; Periodic Perturbations of the Four Inner Planets, Prof. Newcomb, 548; N.P.D.'s observed with Greenwich and Washington Transit Circles, Prof. Newcomb, 548; Washington Observations, 1887, 548; Observations of the Spectrum of Nova Aurigæ, Dr. Henry Crew, 569; E. W. Maunder, 616; Denning's Comet (*b* 1892); Dr. R. Schorr, 569; Comet Swift, 1892, 569; Displacement of Radiant Points, Dr. J. Kleiber, 570; Two New Variables in Cepheus, Paul S. Vendell, 570; on the Variation in Latitude, M. Faye, 570; Elementary Mathematical Astronomy, C. W. C. Barlow and G. H. Bryan, 579; Astronomy at the Paris Academy, April 11, MM. Périgaud and Boquet, 589; Solar Heat, Dr. Joseph Morrison, 589; Periodic Variations in Latitude, — Chandler, 589; Perseids observed in Russia in 1890, Th. Bredichin, 597; Photography at the Cape Observatory, D. Gill, 600; Photographs of the Region of Nova Cygni, 617; Winnecke's Comet, Dr. G. F. Haerdtl, 617; Personal Equations in Transit Observations, 617; the Sirius System, Dr. A. Auwers, 617; Photographs of a part of Cygnus, M. Faye, 624
- Atlantic, North, Severe Weather in the, October 1891, 38
 Atlantic, North, Pilot Chart of, December 1891, 258
 Atlas, the Dwarfs of Mount, R. G. Haliburton, 66
 Atlas, Handy, of Modern Geography, 605
 Atlas, the Universal, 52
 Atlal, the Mexican, 66, 102
- Atmosphere, the Mass of the, M. Mascart, 311
 Atmosphere, Polarization of, by Light of Moon, N. Piltchikoff, 456
 Atmosphere, the General Circulation of the, Dr. J. M. Pernter, 593
 Atmospheric Pressure, Physiological Action of Diminished, F. R. Mallet, 606
 Atmospheric Rings, Dr. Sprung, 599
 Attitudes of the Zebra during Sleep, and their Influence on the Protective Value of its Stripes, on the, 248
 Aubin (Percy A.), the Limpet's Power of Adhesion, 464
 Auriga, on the New Star in, 344, 366; Thos. D. Anderson, 365; G. Rayet, 408; J. Norman Lockyer, F.R.S., 429; Astronomer-Royal for Scotland, 454, 527; S. W. Burnham, 473; H. C. Vogel, 498
 Auroras : a Rare Phenomenon seen at Lyons, N.Y., Dr. M. A. Veeder, 7; at Halifax, Prof. J. G. MacGregor, 7; at Toronto, R. N. Hudspeth, 7; Plan for Observations to determine Local Distribution and Altitude of, M. A. Veeder, 234; Aurora, Geo. M. Seabroke, 605; Arthur Marshall, 605; Arthur E. Brown, 605; Aurora visible from Westgate-on-Sea, 613; Aurora Borealis, J. Lovel, 223; Aurora Borealis in America, Remarkable Display of, 378; the Aurora Spectrum, Prof. Hale, 522
 Australia: Hydrology of the Mitta Mitta, James Stirling, 40; Botanical Museums and Gardens of Australasia, Prof. Goodale, 65; a New Freshwater Isopod, Charles Chilton, 66; Olive-Culture in Australia, J. L. Thomson, 135; Horticulture in South Australia, 184. Australasian Association for the Advancement of Science: Section A, Mathematics, Physics, and Mechanics—Mathematical Analogies between various Branches of Physics, Prof. Bragg, 423; Seismological Phenomena in Australasia, 423; Quaternions as a Practical Instrument of Physical Research, A. McAuley, 423; the Grouping of Stars in the Southern Part of the Milky Way, H. C. Russell, F.R.S., 423. Section B, Chemistry and Mineralogy—W. M. Hamlet on the Progress of Chemistry in Australasia, 423; A. Liversidge, F.R.S., on the Rusting of Iron, 424. Section C, Geology and Palæontology—T. W. E. David on Volcanic Action in Eastern Australia and Tasmania, 424; W. J. C. Ross on the Discovery of Two Specimens of Fossil Lepidodendrons in the Neighbourhood of Bathurst, New South Wales, and the Inferences to be drawn from their Occurrence, 424. Section D, Biology—Prof. W. Baldwin Spencer on the Freshwater and Terrestrial Fauna of Tasmania, 425; Prof. Hutton on the Origin of the Struthious Birds of Australasia, 425; Prof. Spencer on the Habits of Ceratodus, the Lung Fish of Queensland, 425. Section E, Geography—Captain Pasco on Early Discoveries in Australia, 425; D. Murray on Mr. Lindsay's Expedition in Western Australia, 425; J. P. Thomson on Recent Explorations and Discoveries in British New Guinea, 425. Section F, Economics and Social Science and Statistics, 426. Section G, Anthropology—Rev. Lorimer Fison on Anthropological Study, 426. Section H, Sanitary Science and Hygiene, 426. Section I, Literature and Fine Arts—Prof. Morris on Universities in Australia, 426. Section J, Engineering and Architecture—C. Napier Bell on Sanitary Engineering, 426
 Austria, Health Springs of Germany and, Dr. F. O. Buckland, 510
 Austria-Hungary, the Increase of Population in, 158
 Austrian Economists, W. Smart, 268
 Auwers (A.), Determination of the Solar Parallax, 89; the Sirius System, 617
 Aylesbury, Proposed County Museum for Bucks, 114
 Aymonnet (M.), Periodic Heat Maxima observed in Spectra from Flint and Crown Glass, and Rock Salt, 504
 Ayrton (Prof. W. E., F.R.S.): the Thermal Emissivity of Thin Wires in Air, 162; Rotatory Currents, 191; Electrotechnics, 326; the Function of a University, 439
 Azaleas, Intermediate Forms of, Wm. Sowerby, 519
 Azoimide, N₃H, Further Researches upon, A. E. Tutton, 127
- Babel, the Tower of, and the Confusion of Tongues, Thos. G. Pinches, 210
 Bacillus in Influenza, the Alleged Discovery of a, 250
 Backhouse (T. W.): Apparent Size of Objects near the Horizon, 7; Nacreous Clouds, 365
 Bacterium *allii*, Dr. Griffiths, 624
 Bagard (H.), a Thermo-electric Standard of Electromotive Force, 192

- Bahama Islands : Sponge Trade of the, 20 ; Telegraphic Connection with, 114
- Bailey (E. H. S.), Tonganoxie Meteorite, 119
- Bailey (G. H.), Superheated Steam, 414
- Baird (Mr. Spencer F.), Death of, 278
- Bakhuis Roozeboom (Dr.), Influence of Isomorphism on Behaviour of Double Salt, during Solution, 240
- Balansa (B.), Death and Obituary Notice of, 349
- Ball (Sir Robert, F.R.S.): the Cause of an Ice Age, 365 ; Prof. G. H. Darwin, F.R.S., 289 ; Henry H. Howorth, 440 ; Election of, to succeed the late Prof. Adams in the Lowndes Professorship of Astronomy at Cambridge, 402
- Ball (Dr. Valentine, F.R.S.), the Koh-i-Nur, 126
- Ballance (Chas. A.), a Treatise on the Ligation of the Great Arteries in Continuity, with Observations on the Nature, Progress, and Treatment of Aneurism, Dr. M. Armand Ruffer, 530
- Ballistics : Calculation of Trajectories of Elongated Projectiles, Rev. F. Bashforth, 473
- Balloon Voyage for Scientific Purposes, the First, Prof. Hellmann, 471
- Balloon Voyages, Meteorological Observations during, Dr. Assmann, 168
- Barclay (Dr. A.), Rain and Mildews in India, 477
- Barlow (C. W. C.), Elementary Mathematical Astronomy, 579
- Barnard (E. E.): Jupiter and his First Satellite, 159 ; Refractive Power of Cometary Matter, 237
- Barometer, How to use the Aneroid, Edward Whymper, 339
- Barometrical Depression (Nov. 11, 1892), Phenomenal, G. J. Symons, 65
- Barrett-Hamilton (G. E. H.), Harrow Birds, 342
- Barus (Carl): the Solution of Vulcanized India-rubber, 118 ; Relation of Melting-point to Pressure in Igneous Rock Fusion, 311
- Bashforth (Rev. F.), Calculation of Trajectories of Elongated Projectiles, 473
- Basses Pyrénées, Extermination of the Wild Daffodil in the, 545
- Basset (A. B., F.R.S.): on Selective and Metallic Reflection, 119 ; on the Theory of Elastic Wires, 215 ; Phronomy, 486
- Batavian Society of Arts and Sciences, 88
- Bates (H. W., F.R.S.): Death of, 377 ; Obituary Notice of, 398
- Bateson (W.), Variations in the Colour of Cocoons, 143
- Bats flying in the Daytime, R. Haig Thomas, 8
- Batten (E. H. M.), the Opium Question, 545
- Batters (E. A. L.), a New Marine Alga, *Gonimophyllum Buffhami*, 596
- Baumann (Prof. Oscar), Projected East African Expedition, 65
- Bausch (Edward), Manipulation of the Microscope, 342
- Beaches, Formation of, Signor P. Cornaglia, 362
- Beaches, the Formation and Erosion of, 415
- Beast and Man in India, John Lockwood Kipling, 131
- Beddard (Frank E.): Formation of a Temporary Cyst in the Fresh-water Annelid *Eolossoma*, 28 ; Warning Colours, 78 ; Preliminary Notice of a New Branchiate Oligochaete, 109
- Bedford College and the Gresham University, Dr. W. J. Russell, F.R.S., Lucy J. Russell, 391
- Beeby (W. H.), Grafted Plants, 151
- Behrens (Mr.), Microscopic Structure of Hard Steel, 48
- Belajeff (Herr W.), the Pollen-Tube of Gymnosperms, 471
- Bell (Alex. Graham), a Rare Phenomenon, 79
- Bell (C. Napier), on Sanitary Engineering, 426
- Bell (Dugald), the Alleged Submergence in Scotland during the Glacial Epoch, 527
- Bell (Prof. F. Jeffrey), on the Echinoderms collected during the Fishing Survey on the West Coast of Ireland, 598
- Belopolsky (A.), the Rotation of Jupiter, 70
- Bemmelen (Heer van), the Difference of Colloid Oxides and Crystalline Hydrates, 576
- Ben Nevis, Dust-Counting on, Angus Rankin, 582
- Benham (Dr. W. B.), the Nephridium of Lumbricus and its Blood-Supply, 140
- Bennett (Alfred W.): Inheritance of Acquired Characters, 53 ; Alleged Pseudopodes of Diatoms, 177
- Bent (Theodore): the Zimbabwe Ruins, 402 ; Finds at the Great Zimbabwe Ruins, 551
- Berberich (Dr.), Wolf's Periodic Comet, 237
- Berg (E.), Frequency and Geographical Distribution of Heavy Daily Rainfall, 258
- Berlin : Prof. Pictet's Laboratory at, Prof. R. du Bois-Reymond, 31 ; Berlin Physical Society, 48, 96, 168, 240, 312, 432, 456, 576 ; Berlin Physiological Society, 48, 95, 168, 240, 312, 432, 456, 576, 599 ; Berlin Meteorological Society, 95, 168, 312, 432, 576 ; Rainfall and Thunderstorms of, 114
- Bernard (H.), a New Form of Mechanical Stage for Microscopical Work, 239
- Bernays (Dr. A. J.), Death of, 258
- Berthelot (D.): Existence of Acid or Basic Salts of Monobasic Acids in very Dilute Solutions, 72 ; Heat of Formation of Hydrazine and Hydrazoic Acid, 95 ; the Three Basicities of Phosphoric Acid, 192 ; the Spontaneous Oxidation of Humic Acid and Vegetable Soil, 288 ; a Method of Organic Analysis, 408
- Besant (Dr. W. H., F.R.S.), Phronomy, 462
- Besson (M.): Phosphides of Boron, 136 ; the Bromine Derivation of Methyl Chloride, 143 ; Two New Compounds of Carbon, Chlorine, and Bromine, 351 ; a Silicon Chloro-sulphide, 240
- Bienfait (Dr. Alfred) and the Physiology of Respiratory Centres, 624
- Biese (Dr. E.), Meteorology of Finland, 87
- Bigourdan (M.), Observations of Nebulae and Star Clusters, 352
- Binnie (W. J. E.), Electric Self-recording Rain-Gauge, 95
- Biology : of Seaside Plants, W. Botting Hemsley, F.R.S., 3 ; Suggestions for Securing Greater Uniformity of Nomenclature in Biology, Prof. T. Jeffery Parker, F.R.S., 68 ; Preliminary Notice of a New Branchiate Oligochaete, Frank E. Beddard, 109 ; the Marine Biological Association, 116 ; Discoloration of Water by Minute Marine Organisms in Port Jackson, Sydney, 184 ; Proposed Columbus Station at Jamaica, 401 ; Prof. Ray Lankester, 420 ; Wandering Cells in Echinoderms, &c., H. E. Durham, 450 ; the Excretory Processes in Marine Polyzoa, S. F. Harmer, 450 ; on *Onchnesoma steenstrupii*, A. E. Shipley, 450 ; Note on a Sieve-like Membrane across Oscula of a Species of Leucosolenia, E. A. Minchin, 450 ; the Nauplius Eye persisting in some Decapods, Margaret Robinson, 450 ; a New Genus of Synascidians from Japan, Oka and Willey, 450 ; Anatomy and Habits of Alcyonium, S. J. Hickson, 455 ; Appointment of Mr. George Brebner as first Marshall Scholar, 183 ; Evolution of Life, or Cause of Change in Animal Forms, Hubbard Winslow Mitchell, 364 ; the Limpet's Power of Adhesion, Percy A. Aubin, 464 ; the Limpet's Strength, J. Lawrence Hamilton, 487 ; Biology of the Sunflower, A. Gordyaghin, 597 ; Prof. A. Chauveau elected President of the Société de Biologie, 612
- Bird Gallery in the British Museum, 154
- Birds, Extinct, on a Recent Discovery of the Remains of, in New Zealand, Prof. Henry O. Forbes, 416
- Birds, Fossil, Catalogue of, in the British Museum, Richard Lydekker, 33
- Birds, Harrow, G. E. H. Barrett-Hamilton, 342
- Birds, Intelligence in, A. Wilkins, 151, 177
- Birds, Migratory, passing over Dublin, 20
- Birds, Struthious, of Australasia, on the Origin of the, Prof. Hutton, 425
- Birds in Victoria, the Protection of, Baron von Mueller, 280
- Birkinbine (John), Production of Pig Iron in United States, 208
- Bishop (Mrs.), Journeys in Persia and Kurdistan, 248
- Blackie (Prof.), on the Most Recent Phases of Greek Literary Style, 624
- Blake (J. F.), Annals of British Geology, 1890, 77
- Blakesley (Thos. H.), a Possible Misunderstanding, 441
- Bianford (Henry F., F.R.S.), Winter Storms of Northern India, 490
- Bleicher (M.), Microscopic Structure of Oolitic Iron from Lorraine, 504
- Blindness, Colour, and Colour Perception, F. W. Edrige Green, 195
- Blondlot (R.) Experimental Determination of Velocity of Propagation of Electro-magnetic Waves, 72 ; Influence on Electro-magnetic Resonance of Unsymmetrical Arrangement of Propagation Circuit, 408
- Blood, Influence of Leucocytes on the Clotting of, Dr. Lillienfeld, 599
- Blowpipe Analysis, J. Landauer, 580
- Blue Hill Meteorological Observatory, 418
- Boerlage (Dr. J. G.), Handleiding tot de Kennis der Flora van Nederlandsch Indie, 28
- Boernstein (Prof.), Extraordinarily Rapid Evaporation on Glacier, 312
- Boilers, Modern Lancashire, Samuel Boswell, 22

- Bois-Reymond (Prof. R. du), Prof. Pictet's Laboratory at Berlin, 31
- Boisbaudran (Lecoq de): Researches on Samarium, 504; the Spark Spectra of Gallium, 575
- Bollettino della Società Botanica Italiano, 478
- Boltzmann-Maxwell Law of Partition of Kinetic Energy, on the, Rev. H. W. Watson, F.R.S., 512
- Bombay Natural History Society, Account of the Taming of a Heron, 588
- Bonaparte's (Prince Louis Lucien), Collection of Metals, 348
- Bonaparte (Prince Roland), Measures of Variations in Lengths of Dauphny Glaciers, 576
- Bonavia (E.), Philosophical Notes on Botanical Subjects, 483
- Bonney (Prof. T. G., F.R.S.): With Axe and Rope in the New Zealand Alps, George Edward Mannering, 147; Note on Specimens of Rock Exposed to High Temperature, 357; the Hornblende Schists, Gneisses, and other Crystalline Rocks of Sark, 359; Cirques, 391; Travels among the Great Andes of the Equator, Edward Whymper, 561; the Year-book of Science, 1891, 604
- Bonnier (Dr. G.), the Relation of the Mistletoe to its Parent Tree, 421
- Bonvalot (Gabriel), Across Thibet, 269
- Books, Forthcoming Scientific, 476
- Boquet (M.), Astronomy at the Paris Academy, April 11, 589
- Borkovsky (M.), the Grain Production of Russia, 67
- Boston, Fossils Recently Discovered near, Warren Upham, 622
- Boswell (Samuel), Modern Lancashire Boilers, 22
- Botany: Biology of Seaside Plants, W. Botting Hemsley, F.R.S., 3; Botany of the Emin Relief Expedition, W. T. Thiselton Dyer, F.R.S., 8; Major J. A. M. Jephson, 9; Handleiding tot de Kennis der Flora van Nederlandsch Indie, Dr. J. G. Boerlage, 28; B. Daydon Jackson's Index of Genera and Species of Flowering Plants, 39; Wild Maize found in Mexico, 39; Government Mission to Investigate the Botany of Sierra Leone, 64; Botanical Museums and Gardens of Southern Hemisphere, Prof. Goodale, 65; the Acclimatization of the Avocado Pear in New South Wales, F. Turner, 66; Botanical Gazette, 70, 287, 478, 596; Third Series of Hooker's Icones Plantarum, 86; Pupils at the Missouri Botanical Gardens, 88; Disease among the Cocoa-nuts of Jamaica, 88; Zoology and Botany of the West Indian Islands, 139; Grafted Plants, W. K. Beeby, 151; Current Botanical Expeditions, 155; Insectivorous Plants, R. Lindsay, 157; the Prolongation of the Gooseberry Season, D. Thomson, 157; Revisio Genera Plantarum Vascularium Omnium, atque Cellularium Multarum, secundum Leges Nomenclaturæ Internationales, cum enumeratione Plantarum in Itinere Mundi Collectarum, Dr. Otto Kuntze, W. Botting Hemsley, F.R.S., 169; Some Peculiar Changes in Colour of Flower of *Swainsonia procumbens*, J. P. Eckert, 185; the Ginger-beer Plant, Prof. H. M. Ward, F.R.S., 190; Parasitic Fungi in Fodder, F. Turner, 236; Chinese Fibres, 278; the Flora of the River Gambia, Dr. Brown Lester's Collection, 278; List of Staff of Kew and Corresponding Colonial Establishments, 278; Obituary Notice of Walter Hood Fitch, 302; Chloride of Sodium in Plants, P. Lesage, 312; the Kew Bulletin, 323, 402, 586; Proposed Discontinuance of the Kew Bulletin, 494; Jubilee of Kew Gardens, 378; Herr J. Bornmüller's Botanical Expedition, 378; Caoutchouc-containing Cells of *Eucommia ulmoides*, F. E. Weiss, 335; the Genus *Dianthus*, F. N. Williams, 383; Grasses of the South-West, Dr. George Vasey, 390; Sisal Hemp, 402; Ripe Seeds of the Monkey-Puzzle Tree (*Araucaria imbricata*) of Chili, grown in England, Dr. R. C. A. Prior, 421; the Relation of the Mistletoe to its Parent Tree, Dr. G. Bonnier, 421; a New West Indian Form of *Agave rigida*, J. H. Hart, 445; Method of Fertilization in *Ixora*, J. C. Willis, 455; the Pollen-tube of Gymnosperms, Herr W. Belajeff, 471; Rain and Mildews in India, Dr. A. Barclay, 477; a New Capillary Theory, F. Pasquale, 478; Earthquakes and Vegetation, A. Goiran, 478; the Relationship of Autumn- to Spring-Blossoming Plants, A. F. Foerste, 478; the Effect of Mechanical Movement on the Growth of Certain Plants, H. L. Russell, 478; Movements of the Flower and Fruit of *Erodium gruinum*, Dr. R. Cobelli, 478; Philosophical Notes on Botanical Subjects, E. Bonavia, 483; Award by Royal Society of New South Wales of Clarke Memorial Medal to Mr. W. T. Thiselton Dyer, 495; the Spanish Broom as a Fibre Plant, 495; Uganda Bark Cloth, 495; New Papuan Plants, Diagnoses of, Baron v. Mueller, 496; the Oak, a Popular Introduction to Forest Botany, H. Marshall Ward, F.R.S., 509; Intermediate Forms of Azaleas, Mr. William Sowerby, 519; Effects of Earthquakes on Vegetation, Signor Goiran, 520; Influence of Electricity on Growth of Plants, Prof. Aloï, 520; a New Seaweed from Cape Colony (*Phacelocarpus disciger*), 526; Extermination of the Wild Daffodil in the Basses Pyrénées, 595; Botanical International Congress to be held at Genoa in connection with Celebration of Quatercentenary of Discovery of America by Columbus, 545; Remarkable Development of Botanical Establishment of Harvard University by Munificence of Prof. G. L. Goodale, 545; the Ants attracted by *Cynips calycis* Galls, a Protection to *Quercus pedunculata*, Dr. Ráthay, 546; a New Theory of the Morphology of the Carpel in Flowering Plants, F. Pasquale, 546; Dr. J. T. Rothrock on the Flora, &c., of the Bahamas and Jamaica, the Mangrove as a Source of Tannin, 546; Fertilization of the Casuarinaceæ, 548; Sets of Exsiccate Coccidæ to be issued by the Institute of Jamaica, 567; Panax Gum, J. H. Maiden, 567; Sunflower Cultivation in Southern Russia, 568; Biology of the Sunflower, A. Gordyaghin, 597; J. Carruthers appointed Lecturer in Botany at the College of Agriculture, Downton, 586; Lectures on Systematic Botany at St. Thomas's Hospital, 586; Evolution in Methods of Pollination, Miss Alice Carter, 596; on the Phenomena concerned in the Production of Forked and Branched Palms, D. Morris, 598; Our Trees, John Robinson, 603
- Bothamley (C. H.): the Ilford Manual of Photography, 460; the Optical Lantern as an Aid in Teaching, 437
- Botocudos of Brazil, the, 615
- Boulenger (G. A.), Zoological Regions, 104
- Bourne (Dr. A. G.), *Pelomyxa viridis*, 140
- Bow as Origin of Stringed Instruments, the, Dr. E. B. Tylor, F.R.S., 184
- Bowman (Sir William, F.R.S.): Death of, 517; Obituary Notice of, Prof. J. Burdon Sanderson, F.R.S., 564
- Bower (Capt.), Journey from China to Simla, 615
- Bragg (Prof.), Mathematical Analogies between various Branches of Physics, 423
- Brain, the Intracranial Circulation and its Relation to the Physiology of the, James Cappie, M.D., 26
- Branchiate Oligochæte, Preliminary Notice of a New, Frank E. Beddard, 109
- Brazil: Dismissal of Dr. Fritz Müller, 156; the Mineral Wealth of, 235; the Botocudos of, 615
- Brebner (Mr. George), Appointment as first Marshall Scholar in Biology of, 183
- Brewing, the Science of, E. R. Moritz and G. H. Morris, 100
- Briggs (J. F.), Relative Orienting Effect of Chlorine and Bromine, 525
- Briggs (W.), Synopsis of Non-Metallic Chemistry, 604
- British Art, Science Museum and Gallery of, at South Kensington, 348
- British Association, Arrangements for Edinburgh Meeting, 401
- British Columbia, the Salmon Industry in, 279
- British Earthworm, a Rare, Rev. Hilderic Friend, 365
- British Edible Fungi, how to Distinguish and how to Cook the m, M. C. Cooke, 75
- British Flies (Diptera), an Account of, Hon. M. Cordelia E. Leigh and F. V. Theobald, 173
- British Fungi, Phycomyces and Ustilaginæ, G. Masee, 411
- British Geology, 1890, Annals of, J. F. Blake, 77
- British Guiana, Proposed Establishment of an Agricultural College in, 520
- British Isles, Volcanic Action in the, Sir Archibald Geikie, F.R.S., 398
- British Museum: Catalogue of Fossil Birds in, Richard Lydekker, 33; Bird Gallery in the, 154; Mr. A. S. Woodward appointed Assistant-Keeper of the Department of Geology, 566
- Broads, how to Organize a Cruise on the, E. R. Suffling, 52
- Brochet (A.), Pyrogenous Hydrocarbons formed in Gas Industry, 504
- Brodie (F. J.), the Prevalence of Fog in London, 1871-90, 215
- Bronze Age in the East and Southern Europe, the, Prof. Montelius, 39
- Bronze in the London Atmosphere, Prof. Roberts-Austen, 443
- Brooks's Comet (1890 II.), Rediscovery of, 326
- Brown (Prof. A. Crum, F.R.S.), Rule for Determining whether a given Benzene Mono-derivative shall give a Meta-di-derivative or a Mixture of Ortho- and Para-di-derivatives, 525

- Brown (Arthur E.), Aurora, 605
 Brown (A. J.), the Influence of Oxygen and Concentration on Fermentation, 453
 Brown (H. T.), Search for a Cellulose-dissolving Enzyme in Digestive Tract of certain Grain-feeding Animals, 452
 Brown (J. A.), the Continuity of the Palæolithic and Neolithic Periods, 503
 Browne (R. G. Mackley), the Precipitation and Deposition of Sea-borne Sediment, 598
 Bruce (E. S.), an Aerial Graphoscope for Showing Effects of Persistence of Vision, 574
 Brücke (Dr. Ernst von), Death of, 303
 Brugsch-Bey (H.), Egypt under the Pharaohs, 363
 Brun (E.), Combinations of Cuprous Iodide with Ammonium Thiosulphate, 528
 Brussels Academy of Sciences, 216, 624
 Bruyn (Dr. de), a New Hydroxylamine, 48
 Bryan (G. H.), Elementary Mathematical Astronomy, 579
 Buchanan (Dr. George), Knighted, 544
 Buckinghamshire, Proposed County Museum for, 114
 Buckland (Dr. F. O.), Health Springs of Germany and Austria, 510
 Buda Pesth, Natural History Society of, 471
 Budde (Dr.), Experiments on the Inert Layer in Emulsions of Chloroform and Soda, 599
 Building and Decoration, Stones for, Geo. P. Merrill, 222
 Bulletin de l'Académie des Sciences de St. Pétersbourg, 70, 597
 Bulletin de la Société des Naturalistes de Moscou, 141
 Bulletin of the New York Mathematical Society, 597
 Bunsen (Prof.) and the Chemical Society, 469
 Burbury (S. H., F.R.S.), Prof. Burnside's Paper on the Partition of Energy, 533
 Burial Mound in Florida, Opening of a, C. B. Moore, 567
 Burnham (S. W.), New Double Star, 26 Aurigæ, 473
 Burnside's (Prof.) Paper on the Partition of Energy, R.S.E., July 1887, Prof. W. Burnside, S. H. Burbury, F.R.S., 533
 Burton (Dr. C. V.), a New Theory concerning the Constitution of Matter, 142
 Butler (G. W.): the October Eruption North-West of Pantelleria, 154; on the Matter thrown up during the Submarine Eruption North-West of Pantelleria, October 1891, 251; Abstract of Mr. A. Ricco's Account of the Submarine Eruption North-West of Pantelleria, October 1891, 584
 Butterflies, Pigment in Yellow, F. Gowland Hopkins, 197
 Buvé (Abbé), the Quantity of Sugar produced in Various Plants as a Means of determining the Meteorological Elements concerned, 279
 C.G.S. System of Units, O. H. Tittmann, 581; Prof. J. D. Everett, F.R.S., 581
 Cabinet-Making, the Art and Craft of, D. Denning, 459
 Caddis-fly, Abbreviated Wings of the Male, R. McLachlan, F.R.S., 623
 Calculations, Chemical, R. Lloyd Whiteley, 604
 Calculus, an Introduction to the Differential and Integral, T. Hugh Miller, 52
 Calcutta, Catalogue of Mammalia in the Indian Museum, W. L. Slater, 50
 California, Earthquake in, 471
 California Foxes, Prof. Edward S. Holden, 8
 California, Severe Earthquake in, 614
 Call (R. Ellsworth), the Tertiary Silicified Woods of Eastern Arkansas, 119
 Callendar (H. L.), a Compensating Air-Thermometer, 212
 Calvert (Albert F.), Ornithology of the Sandwich Islands, 485, 558
 Camargue, Reclaiming and Cultivation of Land in the, M. Chambréant, 143
 Cambridge: Cambridge Philosophical Society, 47, 143, 166, 455, 526; Cambridge Philosophical Society and the late Prof. Adams, the, 322; Election of the Duke of Devonshire to Chancellorship, 233; Preliminary Installation of the Duke of Devonshire as Chancellor of Cambridge University, 257; the Vacant Chair of Astronomy at, 337; Election of Sir R. S. Ball to succeed late Prof. Adams in Lowndes Professorship, 402
 Camel, Herr Lehmann on the, 87
 Camera Lucida Measurements, Apparatus for making Accurate, Sir W. J. Sendall, 46
 Campbell (A. J.), Nest and Egg of Bird of Paradise, 379
 Campbell (Charles W.), Korea, 307
 Canada, Aborigines of the Dominion, Hon. E. Dewdney, 587
 Canal between New York and Philadelphia, Proposed Ship, Prof. L. M. Haupt, 497
 Canals of Arizona, the Prehistoric Irrigation, 186
 Cannizzaro (Prof. Stanislao): Royal Society Medallist, 111; Banquet to, 183
 Cap Horn, Mission Scientifique de, J. Deniker and P. Hyades, 577
 Cape Colony, Dr. Thomas Muir appointed Superintendent-General of Education for, 443
 Cape Observatory, Photography at the, D. Gill, 600
 Cape of Good Hope, *Vedalia cardinalis* successfully Colonized at the, 615
 Cappie (James, M.D.), the Intracranial Circulation and its Relation to the Physiology of the Brain, 26
 Capture of Comets by Planets, Prof. H. A. Newton, 186
 Carbonyl, Iron, from Water Gas, A. E. Tutton, 36; Mond and Langer on, 89; Berthelot on Nickel Carbonyl, 89
 Carllil (S. B.), Notes on Zebras, 526
 Carpenter (Dr. Alfred), Death of, 323
 Carpenter (W. B., F.R.S.): the Microscope and its Revelations, 313; on Eozoon, Sir J. William Dawson, F.R.S., 461
 Carr (George S.), on the Terms Centrifugal Force and Force of Inertia, 463
 Carruthers (J.), Appointed Lecturer in Botany at the College of Agriculture, Downton, 586
 Carter (Miss Alice), Evolution in Methods of Pollination, 596
 Carus-Wilson (C.), Warning against the Use of Rotten Flints for Macadamizing Roads, 379
 Carvalho (E.), Crystalline Absorption and the Choice between the Different Theories of Light, 528
 Castello (F. de), Viticulture for Victoria, 324
 Casuarinaceæ, Fertilization of the, 548
 Cat, Origin of, in China, Dr. Macgowan, 285
 Cave, the Adelsberg, 207
 Celestial Mechanics, Two New Laws of, H. Struve, 70
 Centenarian, Prof. Ignace Vonberg, 518
 Centrifugal Force and Force of Inertia, on the Terms, George S. Carr, 463
 Century Dictionary, the, W. Dwight Whitney, 316
 μ Cephei, Observations of, J. E. Gore, 137
 Cepheus, Two New Variables in, Paul S. Yendall, 570
 Ceratodus, the Lung Fish of Queensland, on the Habits of, Prof. Spencer, 425
 Ceylon and Borneo, About, Walter J. Clutterbuck, 149
 Chadwick (W. I.), the Leach Lantern Microscope, 47
 Chaix (M.), Temperature Observations at Geneva, 304
 Challenger, Report on the Scientific Results of the Voyage of H.M.S., during the years 1873-76, Prof. John Judd, F.R.S., 409
 Chambers's Encyclopædia, 196
 Chambréant (M.), Reclaiming and Cultivation of Land in the Camargue, 143
 Champignons, Les, A. Acloque, 222
 Chandler (Dr. S. C.): on the Variation of Latitude, 117, 404, 589; Algol, 446
 Changefulness of Temperature as an Element of Climate, 610
 Chappuis (James), Refraction of Liquefied Gases, 384
 Charpy (Georges): the Direct Combination of Metals with Chlorine and Bromine, 47; Vapour Tensions of Cobalt Chloride Solutions, 167; the Density of Aqueous Solutions, 480
 Chassevant (A.), a Double Chloride of Copper and Lithium, 72
 Chauveau (Prof.): his Laboratory at the Paris Museum of Natural History, 86; elected President of the Société de Biologie, 612
 Cheal (J.), Practical Fruit Culture, 579
 Cheddar Cheese-making, Experiments in, 614
 Chemistry: Isolation of Free Hydroxylamine, 20; Alum Solution, T. C. Porter, 29; Prof. Pictet's Laboratory at Berlin, Prof. R. du Bois-Reymond, 31; Results of Experiments at Rothamsted on the Question of the Fixation of Free Nitrogen, Dr. J. H. Gilbert, F.R.S., 32; Fixation of Nitrogen of Arable Soils, Gautier and Drouin, 192; the Fixation of Free Nitrogen of Plants, Schloësing, Jun., and Laurent, 143; Prizes offered by the Royal Danish Academy of Sciences, 134; the Spontaneous Oxidation of Humic Acid and Vegetable Soil, Berthelot and André, 288; Iron Carbonyl from Water Gas, A. E. Tutton, 36; Experiments on the Production of Ozone by Electric Silent Discharge, Siemens and Halske, 39; Sulphides and Selenides of Boron and Silicon Selenide, Paul

Sabatier, 41; Butylene Monobromides, E. Reboul, 47; the Direct Combination of Metals with Chlorine and Bromine, Gautier and Charpy, 47; a New Hydroxylamine, Dr. de Bruyn, 48; a Text-book of Chemical Physiology and Pathology, W. D. Halliburton, Dr. E. H. Starling, 51; Two New Phospho-iodides of Boron, H. Moissan, 67; Action of Aqueous Solution of Ammonia on Phthalic Chloride, Hoogewerff and van Dorp, 72; a Double Chloride of Copper and Lithium, A. Chassevant, 72; Existence of Acid or Basic Salts of Monobasic Acids in very Dilute Solutions, D. Berthelot, 72; Arithmetical Exercises in Chemistry, Leonard Dobbin, 76; Mond and Langer on Iron Carbonyl, 89; Berthelot on the Oxidation of Nickel Carbonyl, 89; Chemical Society, 92, 213, 262, 382, 429, 452, 525, 550, 623; Prof. Bunsen and the Chemical Society, 469; Magnetic Rotatory Power of Solutions of Ammonia and Sodium Salts of Fatty Acids, Dr. W. H. Perkin, F.R.S., 92; Action of Water Gas on Iron, Roscoe and Scudder, 92; Dissociation of Liquid Nitrogen Peroxide, J. T. Cundale, 92; Ortho- and Para-nitro-ortho-toluidine, Green and Lawson, 92; Gedda Gums, the Dextro-rotatory Varieties, C. O'Sullivan, 93; Some Compounds of Oxides of Silver and Lead, Emily Aston, 93; Electrolysis of Potassium Acetate Solutions, Dr. T. S. Murray, 93; New Method of Preparing β -dinaphthylene Oxide, Hodgkinson and Limpach, 93; Van der Waals's Generalizations regarding Corresponding Temperatures, Pressures, and Volumes, Prof. Sydney Young, 93; Heat of Formation of Hydrazine and Hydrozoic Acid, Berthelot and Matignon, 95; the Dielectric Power, Julien Lefebvre, 95; Treatise on the Manufacture of Sulphuric Acid, George Lunge, Ph.D., Prof. T. E. Thorpe, F.R.S., 121; a Hand-book of Industrial Organic Chemistry, Samuel P. Sadtler, 125; Further Researches upon Azoimide, N_3H , A. E. Tutton, 127; Phosphides of Boron, Moissan and Besson, 136; the Bromine Derivatives of Methyl Chloride, A. Besson, 143; the Ammonia in the Air and Rain of a Tropical Region, Marciano and Muntz, 143; Attraction of Liquid Oxygen by Faraday Magnet, Prof. Dewar, 154; Curious Compound of Lead Sodium and Ammonia, Joannis, 158; Vapour Tensions of Cobalt Chloride Solutions, Georges Charpy, 167; Thermal Data concerning Active Malic Acid and Potassium and Sodium Malates, G. Massol, 167; Ammonia in Atmospheric Waters, Albert Lévy, 168; Chemical Constitution of Adenin and Hypoxanthin, Dr. Krüger, 168; two New Methods of preparing Free Solid Hydroxylamine, M. Crismer, 185; the Three Basicities of Phosphoric Acid, D. Berthelot, 192; a Green Solid Chromic Sulphate, A. Recoura, 192; Crystallization of Tetra-iodide of Carbon, M. Moissan, 209; Phosphorous Oxide, ii., Thorpe and Tutton, 213; Frangulin, ii., Thorpe and Miller, 214; Structure and Chemistry of Flames, Smithells and Ingle, 214; the Structure of Luminous Flames, A. Smithells, 214; Mydatic Alkaloid Hyoscyamine in Lettuce, T. S. Dymond, 214; Cryptopine, Brown and Perkin, 214; Action of Sodium on Etheral Salts, iii., Benzylic Orthotoluolate, R. W. Hodgkinson, 214; New Compounds of Carbonyl Platinum Chloride and Bromide with Ammonia Derivatives, Dr. Foerster, 236; Molecular Weight of Gadolinia, 237; Metallic Borates, H. Le Chatelier, 240; a Silicon Chlorosulphide, A. Besson, 240; Influence of Isomorphism on Behaviour of Double Salts during Solution, Dr. Bakhais Roozeboom, 240; the Chemistry of Paints and Paintings, A. H. Church, F.R.S., Dr. Hugo Müller, F.R.S., 241; Colour and Spectrum of Free Gaseous Fluorine, Moissan, 260; Metallic Hydro-sulphides, Linder and Picton, 262; Physical Composition of some Sulphide Solutions, H. Picton, 263; Solution and Pseudo-Solution, ii., Picton and Linder, 263; Change in Acidified Solution of Sodium Thiosulphate, when Products retained within System, A. Colefax, 263; Action of Sulphurous Acid on Flowers of Sulphur, A. Colefax, 263; α and β Modifications of Chloro-benzene Hexachloride, F. E. Matthews, 263; Sulphochlorides of Isomeric Dibromonaphthalenes, Armstrong and Rossiter, 263; Action of Alcohols on Sulphonic Chlorides as means of producing Etheral Salts of Sulphonic Acids, Armstrong and Rossiter, 263; Action of Bromine on Mixture of Ortho- and Paranitro- α -acenaphthalide, Armstrong and Rossiter, 263; Camphrene, Armstrong and Kipping, 263; Metaxylenesulphonic Acids, ii., G. T. Moody, 263; Direct Combination of Nitrogen with the Alkaline Earthy Metals, Maquenne, 264; Nitration of Hydrocarbons of the Methane Series, Konvaloff, 264; Magnesium Nitride, Dr. Merz, 280; Manganates of Potash, G. Rousseau, 288; Outlines of Practical Physiological

Chemistry, F. Charles Larkin and Randle Leigh, 292; Problems in Chemical Arithmetic, E. J. Cox, 293; New Liquid Compound of Carbon, Oxygen, and Chlorine, M. Fauconnier, 306; Lithium Nitride, Dr. Merz, 307; Origin of Flame Coloration, Prof. Smithells, 306; Composition of Iolite, O. C. Farrington, 310; a Series of Cæsium Trihalides, H. L. Wells, 310; Action of Carbon Monoxide on Iron and Manganese, M. Guntz, 311; Chloride of Sodium in Plants, P. Lesage, 312; the Indexing of Chemical Literature, 324; Remarkable Series of Compounds of Halogen Salts of Cæsium, with two more Atoms of Chlorine, Bromine, or Iodine, Wells and Penfield, 325; the Characteristic Equation of Water Vapour, Ch. Antoine, 336; the Estimation of Molybdenum, E. Péchard, 336; Guide to the Examinations in Chemistry, W. Jerome Harrison, 342; Two New Compounds of Carbon, Chlorine, and Bromine, M. Besson, 351; Barium and Strontium Nitrates, M. Maquenne, 360; Action of Metals on Salts dissolved in Organic Liquids, Raoul Varet, 360; Experiment illustrating the Power of Palladium of occluding Hydrogen, Prof. Wilson, 380; Certain Ternary Alloys, v., C. R. A. Wright, F.R.S., 381; the Luminosity of Coal Gas Flames, V. B. Lewes, 382; the Action of Dilute Nitric Acid on Coal, R. J. Friswile, 383; a Pure Fermentation of Mannitol and Dulcitol, Frankland and Frew, 383; Synthesis of Hexahydro-terephthalic Acid, Mackenzie and Perkin, 383; Magnetic Rotation of Dissolved Salts, W. Ostwald, 383; the Dissociation of Nitrogen Peroxide, W. Ostwald, 383; Corydaline, Dobbie and Lauder, 383; Silver Compounds of Thiourea, J. E. Reynolds, 383; Determination of Freezing Point of very Dilute Solutions, as applied to Cane-sugar, M. Raoult, 384; Refraction of Liquefied Gases, James Chappuis, 384; Decomposition of Sulphurous Acid by Water at very High Temperatures, M. Scheurer-Kestner, 384; Chlorosulphide and Bromosulphide of Lead, F. Parmentier, 384; Manual of Chemical Technology, Rudolf von Wagner, 386; Interesting Compound of Carbon and Barium, M. Maquenne, 403; a New Method of Organic Analysis, M. Berthelot, 408; Action of Alkaline Metals on Boric Acid, H. Moissan, 408; Variation with Temperature of Dielectric Constant of Liquids, D. Negreano, 408; Zeitschrift für Anorganische Chemie, 421; the Preparation of Amorphous Boron, M. Moissan, 421; on the Progress of Chemistry in Australasia, W. M. Hamlet, 423; A. Liversidge, F.R.S., on the Rusting of Iron, 424; Pedetic Motion in relation to Colloidal Solution, W. Ramsay, 429; the Acid Action of Drawing-papers, W. N. Hartley, 430; the Interactions occurring in Flames, Sir G. G. Stokes and Dr. Armstrong, 430; Properties of Alcoholic and other Solutions of Mercuric and other Chlorides, S. Skinner, 430; the Isothermals of Mixtures of Gases, Prof. Tait, 431; Researches on Ethyl Monochlor-, Monobrom-, and Monocyanacetate, Haller and Held, 432; Tartronic Acid and Tartronates of Sodium and Potassium, G. Massol, 432; Prize offered by Schnyder von Wartensee's (Zurich) Foundation, 443; Chromosulphuric Acid, M. Recoura, 445; Phosphorous Oxide, A. E. Tutton, 446; Search for a Cellulose-dissolving Enzyme in Digestive Tract of certain Grain-feeding Animals, H. T. Brown, 452; on the Influence of Oxygen and Concentration on Fermentation, A. J. Brown, 453; Limettin, W. A. Tilden, 453; the Acid Action of Drawing-papers, Prof. Hartley, 453; the Heats of Formation of Potassium Carballylates, G. Massol, 456; the Composition of Hæmocyanin, M. Zune, 456; Milk Ferment Identical with "Kefyr" in use in Canada and United States, C. L. Mix, 471; New Mode of Synthesizing Tartaric Acid, M. Genvesse, 472; the Density of Aqueous Solutions, Georges Charpy, 480; a Study of the Velocity of Decomposition of Diazo-compounds of Water, P. T. Muller and J. Hausser, 480; the late Prof. Stas's "Silver" (the results of further Stöchiometrical Investigations), Prof. Spring, 497; the Action of Dry Hydrochloric Acid Gas on Dry Carbonates, Wilson and Hughes, 503; Researches on Samarium, Lecoq de Boisbaudran, 504; Periodic Heat Maxima observed in Spectra furnished by Flint and Crown Glass and Rock Salt, M. Aymonnet, 504; some Well-defined Alloys of Sodium, M. Joannis, 504; Citric Acid, G. Massol, 504; Pyrogenous Hydrocarbons formed in the Compressed Gas Industry, A. Brochet, 504; a Treatise on Chemistry, Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S., 509; Prof. Ignace Vonberg, 518; the Properties of Amorphous Boron, A. E. Tutton, 522; Rule for determining whether a

- given Benzene Mono-derivative shall give a Meta-di-derivative or a Mixture of Ortho- and Para-di-derivatives, Brown and Gibson, 525; Relative Orienting Effect of Chlorine, (1) the Constitution of Parabrom- and Parachloranilinesulphonic Acids, Armstrong and Briggs, 525; Anhydrides of Sulphonic Acids, H. E. Armstrong, 525; the Aconite Alkaloids, ii., Dunstan and Umney, 525; Do., iii., Dunstan and Passmore, 525; the Carbon deposited by Coal Gas Flames, W. Foster, 525; Chromic Acid, Eleanor Field, 525; Origin of Acetylene in Flames, V. B. Lewes, 525; the Properties of Amorphous Boron, H. Moissan, 527; Combinations of Cuprous Iodide with Ammonium Thiosulphate, E. Brun, 528; the Principles of Chemistry, D. Mendeléeff, 529; Synthesis of Two New Liquids containing Fluorine, M. Meslans, 547; Conditions of Combination between Cyanides of Zinc and Mercury, W. R. Dunstan, 550; Lecture Experiment to Illustrate Phenomena of Coal Dust Explosions, T. E. Thorpe, 551; Production of Ketone 1:2:4; Acet-orthoxylenes from Camphor by Action of Sulphuric Acid and Zinc Chloride, Armstrong and Kipping, 551; Platinum Tetrachloride, W. Pullinger, 551; a New Acid from Camphoric Acid, W. H. Perkin, Jun., 551; Specific Rotatory and Cupric Reducing Power of Invert Sugar, and of Dextrose obtained from Cane Sugar by Means of Invertase, J. O'Sullivan, 551; Ethyldimethylamidobenzene, Hodgkinson and Limpach, 551; Action of Nitric Acid on Oxanilide and its Analogues, A. G. Perkin, 551; Action of Potassium Fluoride on Anhydrous Chlorides, C. Poulenc, 552; Anhydrous Sulphates of Zinc, Nickel, Copper, and Cobalt obtained in Crystals, M. Klobb, 569; the Difference of Colloid Oxides and Crystalline Hydrates, Van Bemmelen, 576; Ethylaldehyde, Franchimont, 576; Quantitative Chemical Analysis, Frank Clowes and J. Bernard Coleman, 578; Titanium Phenylate and other Compounds in which Hydroxylic Hydrogen of Phenols is replaced by Titanium, M. Levy, 589; Recent Advances in Physical Chemistry, Prof. W. Ostwald, 590; Experiments on the Inert Layer in Emulsions of Chloroform and Soda, Dr. Budde, 599; Outlines of Theoretical Chemistry, Lothar Meyer, Prof. M. M. Pattison Muir, 601; Synopsis of Non-Metallic Chemistry, William Briggs, 604; Chemical Calculations, R. Lloyd Whiteley, 604; Silent Combination of Hydrogen and Oxygen, Prof. Victor Meyer and Herr Askenasy, 616
- Cheshire (F.), Wave Motion Model, 347
- Chicago, the Congress of Electricians at, 19
- Chicago Exhibition: Australia and the, 113; Economic British Minerals at the, 155; Proposed Indian Bureau Exhibit, 184; Proposed U.S. Patent Office Exhibit in Illustration of Progress of Mechanical Civilization, 207; Messrs. Siemens and Halske's Exhibit (Electrical Engineering), 207; Prof. Putnam's Anthropological Exhibit at, 259; the English Electrical Exhibit, 377; Cabot Relics to be sent to, 443; Electricity Building at, 443; Monster Steam Hammer, 497; the South African Diamond Industry at, 567; Leather Industry at the, 587; Use of Mica at the, 615
- Chilton (Charles), a New Isopod, 66
- China, the Origin of the Ass, the Cat, and the Sheep in, Dr. Macgowan, 285
- China, the Manchu Race, 523
- China to Simla, Capt. Bower's Journey from, 615
- Chinese Fibres, 278
- Chloroform and Soda, Experiments on the Inert Layer in Emulsions of, Dr. Budde, 599
- Chree (C.): Long Rotating Circular Cylinders, 455; Change in Dimensions of Electric Solids due to given System of Forces, 527
- Chromosphere Spectrum, Note on the, Prof. C. A. Young, 28
- Chromosphere Line Ångström 6676.9, Rev. A. L. Cortie, 103; Prof. C. A. Young, 198
- Chronophotography: Use of, for Study of Aërial Locomotive Machines, Marey, 71; Chronophotography or Photography as Applied to Moving Objects, 228
- Church (A. H., F.R.S.), the Chemistry of Paints and Paintings, Dr. Hugo Müller, F.R.S., 241
- Circulation of the Atmosphere, the General, Dr. J. M. Pernter, 593
- Cirques, Prof. T. G. Bonney, F.R.S., 391; Prof. G. Frederick Wright, 317; Prof. Israel C. Russell, 317
- City and Guilds of London Institute, Report on 1891 Technological Examinations, 38
- Civilization, Ancient, of Central America, Alfred P. Maudslay, 617
- Clarke (Sir Andrew, F.R.S.), Elected (fifth time) President of Royal College of Physicians, 566
- Clarke (W. E.), the Great Skua in Scotland, 545
- Clerke (A. M.), *Œuvres Complètes de Christiaan Huygens*, 434
- Climate of British Empire during 1891, 38
- Climate, Changefulness of Temperature as an Element of, 610
- Climatology: the Weather Bureau of the United States, 86; Projected Exhibition of Instruments, &c., relating to, 258
- Cloud Observations at Sea, Prof. C. Abbe, 70
- Clouds, Luminous, Proposals for a Co-operative Observation of the So-called, 117
- Clouds, Nacreous, T. W. Backhouse, 365
- Clowes (Frank and J. Bernard Coleman), Quantitative Chemical Analysis, 578
- Clutterbuck (Walter J.), About Ceylon and Borneo, 149
- Coagulation of the Blood, Pekelharig, 600
- Coal on Tenasserim River, Discovery of, 496
- Coal-Dust Explosion, Lecture Experiment to illustrate Phenomena of, T. E. Thorpe, 551
- Cobelli (Dr. R.), Movements of the Flower and Fruit of *Erodium gruinum*, 478
- Cocoid, the *Iceya purchasi* at St. Helens, 115
- Cockerell (T. D. A.), Alpine Rubi, 320
- Cocoa-nut Palms of Jamaica, Disease among the, 88
- Cocoons, Variations in the Colour of, W. Bateson, 143
- Cohen (E.), Meteoric Iron, 69
- Coke Industry, the Utilization of the By-products of the, Dr. B. Terne, 157
- Colchester, Capture of a Spotted Eagle near, 158
- Cole (F. N.), Klein's Modular Functions, 597
- Cole (Prof. G. A. J.), the Variolite of Annalong, Co. Down, 455
- Colefax (A.): Change in Acidified Solution of Sodium Thiosulphate when Products retained within System, 263; Action of Sulphurous Acid on Flowers of Sulphur, 263
- Coleman (J. Bernard) and Frank Clowes, Quantitative Chemical Analysis, 578
- Colleges, University, in Great Britain, Report of Committee on Grants to, 544
- Colliding Bodies, the Virial of a System of Hard, Lord Rayleigh, F.R.S., 80
- Colliery Manager's Hand-book, Caleb Pamely, 77
- Collins (F. Howard), Migration of the Lemming, 149
- Colloid Solutions, on the Nature of, C. E. Linebarger, 622
- Colot (Edmond), on the Tensions of Saturated Vapours of Different Liquids at the same Pressure, 528
- Colour, First Visible, of Incandescent Iron, Capt. A. Noble, F.R.S., 484
- Colour Blindness, Hering on a Rare Case of, 115; and Colour Perception, F. W. Edridge Green, 195
- Colour Photography by Lippmann's Process, 119
- Colour Photometry, Captain Abney, 213; First Visible Colour of Incandescent Iron, Capt. A. Noble, F.R.S., 484
- Colours of Fish and other Animals, a Medium for Preserving the, 212
- Colours, Warning, Frank E. Beddard, 78; Edward B. Poulton, F.R.S., 174; W. L. Distant, 174
- Colours, Supplementary, Prof. S. P. Thompson, F.R.S., 452
- Colours, on Insect, F. H. Perry Coste, 513, 541
- Colson (Albert), on the Flow of Liquids in Capillary Tubes, 120
- Columbia, British, the Similkameen Indians of, Mrs. Allison, 164
- Columbia College, New York, Electrical Engineering at School of Mines, 207
- Columbus Marine Biological Station at Jamaica, Proposed, 401; Prof. Ray Lankester, 420
- Columbus, Quatercentenary of Discovery of America by, Botanical International Congress to be held at Genoa in connection with Celebration, 545
- Comenius (Johann Amos), Tercentenary of Birth of, 495
- Cometary Matter, Refractive Power of, E. E. Barnard, 237
- Comets: Tempel-Swift's Periodic Comet, 21; Tempel-Swift Comet, 159; Comet Swift, March 6, 548; Wolf's Periodic Comet, 42; Dr. Berberich, 237; Wolf's Comet, 1891 II., Herr Dr. Thraen, 548; Capture of Comets by Planets, Prof. H. A. Newton, 186; Re-discovery of Brooks's Comet (1890 II.), 326; a New Comet discovered by Prof. Lewis Swift, 446; Prof. Krueger on Motions of Periodic Comets, 446; a Bright Comet, 473; New Comet, W. F. Denning, 484, 513;

- Denning's Comet (*b* 1892), Dr. R. Schorr, 569; Comet Swift 1892, 569; Winnecke's Comet, Dr. G. F. Haerdtl, 617
- Commerce, Evolution of, Gardiner G. Hubbard, 588
- Conchology of the West Coast of South America, Robert E. C. Stearns, 89
- Congo, French, Copper Mines of, 135
- Congress, Botanical International, to be held at Genoa in connection with Celebration of Quatercentenary of Discovery of America by Columbus, 545
- Congress at Chicago, Proposed International Electrical, 64, 278
- Connaissance des Temps, 186
- Conn (Prof. H. W.), the Living World, Whence it Came and Whither it is Drifting, 317
- Cons (Miss E.), Polytechnics and Recreation, 28
- Coode (Sir John), Death of, 443
- Cooke (M. C.), British Edible Fungi, 75
- Cope (Prof. E. D.), Discovery of New Species of Frog in New Jersey, 208
- Copeland (Ralph): New Star in the Milky Way, 325; New Star in Auriga, 454, 527
- Copernic et la Découverte du Système du Monde, Camille Flammarion, 77
- Copper Mines of French Congo, 135
- Copper-mining on Lake Superior, Prehistoric Mines in Neighbourhood, E. B. Hinsdale, 39
- Cordova Observatory, 446
- Corleone, Earthquake at, 184
- Cornaglia (Signor), Sul Regime delle Spiagge e sulla Regolazione dei Porti, 362
- Cortie (Rev. A. L.), the Chromosphere Line Ångström 6676.9, 103
- Coste (F. H. Perry): Salts in Natural Waters, 176; on Insect Colours, 513, 541; Pigments of Lepidoptera, 605
- Cotes (E. C.), the Wild Silk Insects of India, 520
- Cotterill (Prof. James A., F.R.S.), Superheated Steam, 414
- Courty (M.), Photography of the Eclipsed Moon, 117
- Cox (E. J.), Problems in Chemical Arithmetic, 293
- Cranbrook (Lord), and the University Extension Movement, 155
- Crane (Agnes), the Mexican Atlatl or Spear-Thrower, 102
- Crawford (A.), Results of the Government Travelling Dairy in Victoria, 39
- Crawshay (Mrs. R. M.): the Recent Eclipse of the Moon, 134; a Double Moon, 224
- Cremation, Progress of, 379
- Crew (Dr. Henry), Observations of the Spectrum of Nova Aurigæ, 569
- Crichton-Browne (Harold), Dwarfs and Dwarf Worship, 269
- Crime, Photography applied to the Detection of, Dr. Paul Jeserich, 568
- Crismer (M.), Two New Methods of preparing Free Solid Hydroxylamine, 185
- Crocuses, Sparrows and, R. McLachlan, F.R.S., 441
- Croft (W. B.): Nickel Heat Engine, 392; Sensitive Water Jets, 606
- Cromer Drift, Striated Surface under the, William Sherwood, 511
- Crookes (Prof. W., F.R.S.), Electricity in Relation to Science, 63
- Croonian Lectures, 19
- Crops, Farm, J. Wrightson, 247
- Cruise on the Broads, How to Organize a, E. R. Suffling, 52
- Crum (John), Prof. Wiborgh's Air Pyrometers, 304
- Crustacea, Freshwater: a New "Isopod," Charles Chilton, 66
- Cryptogams: British Edible Fungi, M. C. Cooke, 75
- Crystal Palace Electrical Exhibition, the Coming, 64
- Crystal Palace Electrical Exhibition, 113, 261, 356
- Crystals, Ice, Gilbert Rigg, 319; Bernard Hobson, 365
- Cuckoo, Torpid, A. Holte Macpherson, 416
- Cundale (J. T.), Dissociation of Liquid Nitrogen Peroxide, 92
- Cunningham (Dr. D. J., F.R.S.), the Skeleton of the Irish Giant Cornelius Magrath, 147
- Cunningham (Prof. J. T.), Growth of the Pilchard or Sardine, 255, 558
- Cunningham (Rev. Prof. W.), the Relativity of Economic Doctrine, 519
- Cuthbertson (Clive), Mental Arithmetic, 78
- Cyclone Memoirs of the Arabian Sea, W. L. Dallas, 135
- Cyclone, the Samoan, of March 16, 1889, 161
- Cyclone in Siam, 86
- Cyclones in the Arabian Sea, 276
- Cyclones in Europe, 114
- Cyclopædia of Nature Teachings, H. Macmillan, 248
- Cygni, the Relative Motion of 61, Prof. A. Hall, 547
- Cygnus, Photographs of a Part of, M. Faye, 624
- Cyst, Formation of a Temporary, in the Fresh-water Annelid *Eolosoma*, Frank E. Beddard, 28
- Czapski (Prof.), the Calculable Limit of Microscopic Views, 575
- Daffodil in the Basses Pyrénées, Extermination of the Wild, 545
- Dairy Farming in Victoria, Results of the Government Travelling Dairy, A. Crawford, 39
- Dakyns (J. R.), the Plutonic Rocks of Garabal Hill and Meall Breac, 360
- Dallas (W. L.), Cyclone Memoirs of the Arabian Sea, 135
- Dallinger (Rev. W. H., F.R.S.), the Microscope and its Revelations, W. B. Carpenter, F.R.S., Prof. E. Ray Lankester, F.R.S., 313
- Darwin (Charles), Boehm's Statue of, 19
- Darwin (Francis, F.R.S.), elected Member of Athenæum Club, 566
- Darwin (Prof. G. H., F.R.S.): the Capture of Lexell's Comet by Jupiter, 526; "The Cause of an Ice Age," Sir Robert Ball, F.R.S., 289
- Darwinian Society of Edinburgh, the, 19; William White, 53; John S. Flett, 104
- Dary (George), L'Electricité dans la Nature, 460
- David (T. W. E.), on Volcanic Action in Eastern Australia and Tasmania, 424
- Davis (Floyd), "An Elementary Hand-book on Potable Waters," Prof. Percy F. Frankland, F.R.S., 25
- Davison (C.), the Elements of Plane Trigonometry, 509
- Dawes (Prof. W. M.), Ferrel's View of the General Circulation of the Atmosphere, 357
- Dawson (Sir J. William, F.R.S.), Dr. Carpenter, on Eozoon, 461, 606
- Deep-Sea Deposits (*Challenger* Expedition), Murray and Renard's Report on, Prof. John Judd, F.R.S., 409
- Delagoa Bay, its Natives and Natural History, Rosa Monteiro, 124
- Deniker (J.), and P. Hyades, Mission Scientifique de Cap Horn, 577
- Denning (D.), the Art and Craft of Cabinet-Making, 459
- Denning (W. F.): the Red Spot on Jupiter, 272; Large Meteor of January 24, 1892, 317; Rotation of Jupiter, 473; New Comet, 484; a New Comet, 513
- Denning's Comet (*b* 1892), Dr. R. Schorr, 569
- Derrécaigaix (General), New Measurement of the Perpignan Base, 384
- Deslandres (M.), the Motion of Stars in the Line of Sight, 117; Photography of Solar Prominences, 404, 522
- Determinants, the Theory of, in the Historical Order of its Development, Thomas Muir, 481
- Deutsches Meteorologisches Jahrbuch, 1890, 587
- Devonian Limestone of South Devon, on the Microscopic Structure and Residues insoluble in Hydrochloric Acid in the, Edward Wethered, 597
- Devonshire, the late Duke of, and Science, 182
- Devonshire (Duke of), Election to Chancellorship of the University of Cambridge, 233; Preliminary Installation as Chancellor of University of Cambridge, 257
- Dewar (Prof.), Attractions of Liquid Oxygen by Faraday Magnet, 154
- Dewdney (Hon. E.), Aborigines of the Dominion of Canada, 587
- Diamond Industry at the Chicago Exhibition, the South African, 567
- Diamonds in the Iron, a new Locality for Meteoric Iron, with a Preliminary Notice of the Discovery of, Prof. A. E. Foote, 178
- Diatoms, Alleged Pseudopodes of, Alfred W. Bennett, 177
- Dictionary, the Century, W. Dwight Whitney, 316
- Dielectric Power, the, Julien Lefebvre, 95
- Dietrich (Dr. F. C.), Death of, 155
- Diffraction Effects produced by placing Screens in Front of Object Glasses, Prof. Pritchard, 237
- Dines (W. H.), Anemometer Comparisons, 623
- Dinornis*, Evidence of a Wing in, Henry O. Forbes, 257
- Diphtheria, its Natural History and Prevention, by R. Thorne Thorne, F.R.S., 123
- Diptera, an Account of British Flies, Hon. M. Cordelia E. Leigh and F. V. Theobald, 173
- Disease, a Zoologist (Dr. Elie Metschnikoff) on, Prof. E. Ray Lankester, F.R.S., 505

- Distant (W. L.), Warning Colours, 174
 Distribution of Energy in Stellar Spectra, Prof. Pickering, 159
 Dittmar (William), Obituary Notice of, 493
 Dixon (Edward T.), the Implications of Science, 125, 272, 391
 Dixon (J. E.), Curious Death of a Ring-tailed Opossum, 88
 Dixon (Mr.), the Logical Foundations of Applied Mathematical Sciences, 407
 Dobbie (J. J.), Corydaline, 383
 Dobbin (Leonard), Arithmetical Exercises in Chemistry, 76
 Dog, the Anatomy of the, 16
 Dog, the Tubercular Vaccination of the, Héricourt and Richet, 576
 Dog working in a Treadmill, Assimilation of Diet investigated on a, Dr. Rosenberg, 599
 Dogs, Intelligence of, 177
 Dorp (W. A. van), Action of Aqueous Solution of Ammonia on Phthalic Chloride, 72
 Double Orange, Gerald B. Francis, 607
 Downing (F. S.), Death of, 85
 Draper Catalogue of Stellar Spectra, A. Fowler, 427
 Dredging Operations in the Eastern Pacific, Prof. Alexander Agassiz, 281
 Drouin (R.), Fixation of Nitrogen by Arable Soils, 192
 Du Bois-Reymond (Prof. E., F.R.S.), on the Relation of Natural Science to Art, 200, 224
 Dublin Royal Society, 166, 287, 407, 455
 Dublin, Trinity College, Tercentenary Celebration of, 378
 Dufour (M.), Influence on Electro-Magnetic Resonance of Unsymmetrical Arrangement of Propagation Circuit, 408
 Dundas (Capt.), Expedition to Mount Kenia in East Africa, Ernest Gedge, 566
 Dunn (Matthias), Pilchards, 511
 Dunstan (W. R.), the Aconite Alkaloids, ii. and iii., 525; Conditions of Combination between Cyanides of Zinc and Mercury, 551
 Duppa-Crotch (W.), Migration of the Lemming, 199, 294
 Durham (H. E.), Wandering Cells in Echinoderms, &c., 450
 Durrant (Reginald G.), a Lecture Experiment on Sound, 415
 Dust Particles, on the Number of, in the Atmosphere of Various Places in Great Britain and on the Continent, with Remarks on the Relation between the Amount of Dust and Meteorological Phenomena, John Aitken, F.R.S., 299
 Dust Counting on Ben Nevis, Angus Rankin, 582
 Dutch Academy of Sciences, Haarlem, Prize Subjects proposed by, 37
 Dwarfs of Mount Atlas, the, R. G. Haliburton, 66
 Dwarfs and Dwarf Worship, Harold Crichton-Browne, 269
 Dyer (J. M.), Elementary Trigonometry, 174
 Dyer (W. T. Thiselton, F.R.S.), Botany of the Emin Relief Expedition, 8; Instruction in Horticulture, 402
 Dymond (T. S.), Mydatic Alkaloid Hyoscyamine in Lettuce, 214
 Dynamic Action and Ponderosity of Matter, by "Waterdale," 100
 Dynamics and Statics, Rev. J. B. Lock, 101
 Eagle, Spotted, Capture near Colchester of, 158
 Earth Vibrations, on, Dr. Emil Oddone, 510
 Earth's Shadow, Increase of the, during Lunar Eclipses, Dr. Hartmann, 498
 Earthquakes: in Japan, 286; Effects of Earthquake in Japan, 38; Seismometry and Engineering in relation to the recent Earthquake in Japan, Prof. John Milne, F.R.S., 127; the recent Earthquake in Japan, Prof. F. A. Forel, 199; Earthquake-observing Stations in Japan, 471; Earthquake at Pantelleria, 120; at Corleone, 184; in Jamaica, 207; in Italy, Greece, and New York State, 259; in Rome (Province) and France, 304; in California, 471, 614; in Nicaragua, 471; Effect of Earthquakes on Vegetation, Signor Goiran, 520; Earthquake at Portland, Oregon, 586 (see also Seismology)
 Earthworm, a Rare British, Rev. Hilderic Friend, 365
 Echinoderms collected during the Fishing Survey on the West Coast of Ireland, Prof. F. Jeffrey Bell, 598
 Eckert (J. P.), some Peculiar Changes in Colour of Flowers of *Swinsonia procumbens*, 185
 Eclipse, Total Lunar, of November 15, 42
 Eclipse of the Moon, Robert C. Leslie, 53
 Eclipses, Lunar, Increase of the Earth's Shadow during, Dr. Hartmann, 498
 Economic Congress at Antwerp, Proposed International, 586
 Economic Doctrine, the Relativity of, Rev. Prof. W. Cunningham, 519
 Economists, Austrian, William Smart, 268
 Economy, Political: the Relativity of Economic Doctrine, Rev. Prof. W. Cunningham, 519
 Edinburgh Royal Society, 239, 311, 431, 454, 527, 623
 Edinburgh University Darwinian Society, 19, 53, 104
 Edmunds (Walter), a Treatise on the Ligation of the Great Arteries in Continuity with Observations on the Nature, Progress, and Treatment of Aneurism, Dr. M. Armand Ruffer, 530
 Education: the Speaker of the House of Commons on Technical Education, 19; Report on 1891 Technological Examinations of City and Guilds of London Institute, 38; the Place due to Horticulture in Technical Education, W. Wilks, 38; True Relation of Technical Education to the Study of Pure Science, Dr. Sorby, 38; Record of Technical and Secondary Education, 65; Scientific and Technical Education in New South Wales, 88; Technical Education in Essex, 155, 234; in Scotland, 377; in London, 403; the New London County Council and Technical Education, 566; Examinations in Science, 85; Lord Cranbrook and the University Extension Movement, 155; Education in the United States, 156; the English Language in Japanese Schools, 303; the Registration of Teachers, 324; Free Education in Ireland, 403; Dr. Thomas Muir appointed Superintendent-General of Education for Cape Colony, 443; the Government and Scientific Education, 470; the Government and the proposed Teaching University for London, 470; Royal Commission to investigate the Question of a Teaching University for London, 612; Tercentenary of the Birth of J. A. Comenius, 495; Report of Committee on Grants to University Colleges in Great Britain, 544
 Edwards (Amelia B.), Death of, 586; Chair of Egyptology endowed by, 613
 Edwards (E. P.), Burning Oils for Lighthouses, 379
 Egg of the Extinct Gigantic Bird of Madagascar, *Æpyornis maximus*, 586
 Egypt under the Pharaohs, H. Brugsch-Bey, 363
 Egypt Exploration Fund, the, 470
 Egypt, Prehistory of, W. M. Flinders Petrie, 580
 Egyptian Antiquities, proposed Grant on behalf of, 113
 Egyptian Astronomy, on some Points in Ancient, J. Norman Lockyer, F.R.S., 296, 373
 Egyptology, Chair of, endowed by Amelia B. Edwards, 613
 Elder (H. M.), Thermodynamical View of Action of Light on Silver Chloride, 524
 Electricity: Electricity and Magnetism, translated from the French of Amédée Guillemin, Prof. A. Gray, 1; Proposed International Electrical Congress at Chicago, 19, 64, 85, 278; Electric Snow-sweeper, 39; Experiments on the Production of Ozone by Electric Silent Discharge, Siemens and Halske, 39; an Experiment of Sir Humphry Davy's, G. F. C. Searle, 47; some Notes on Clark's Cells, Glazebrook and Skinner, 47; some Notes on the Fraukfort International Electrical Exhibition, 54, 105; Electricity in Relation to Science, Prof. W. Crookes, F.R.S., 63; Electrical Exhibition at the Crystal Palace, 64, 113, 261, 356; Experimental Determination of Velocity of Propagation of Electro-magnetic Waves, R. B. Blondlot, 72; Electro-magnet and Electro-magnetic Mechanism, S. P. Thompson, F.R.S., Prof. A. Gray, 73; Electrolysis of Potassium Acetate Solutions, Dr. T. S. Murray, 93; the Dielectric Power, Julien Lefebvre, 95; the Specification of Insulated Conductors for Electric Lighting, W. H. Preece, F.R.S., 155; the Thermal Emissivity of Thin Wires in Air, Ayrton and Kilgour, 162; the Self-induction of two Parallel Conductors, H. M. Macdonald, 166; Electricity in relation to Mining, Ernest Scott, 184; Rotary Currents, Prof. W. E. Ayrton, F.R.S., 191; a Thermo-Electric Standard of Electromotive Force, H. Bagard, 192; Electrical Engineering at School of Mines, Columbia College, New York, 207; Repulsion and Rotation produced by alternating Electric Currents, G. T. Walker, 213; Study of Light and Heat Phenomena accompanying Electrolysis, Lagrange and Hoho, 216; Interference with Alternating Currents, M. H. Kilgour, 238; a First Book of Electricity and Magnetism, W. Perren Maycock, 248; Electricity on the Stage, 259; Influence of Electric Discharge during Thunderstorms on Apparatus registering Terrestrial Magnetism, Em. Marchand, 264; Electro-capillary Phenomena and Differences of Potential produced by Contact, Gouy, 264; Electrical Exhibition

- at St. Petersburg, 303; the Specifications for Conduit System for Electrical Conductors at Chicago Exposition, 303; Electrical Transmission of Power from Lauffen to Frankfort, the, 303; Gaseous Carbonic Acid not capable of Generating Electricity by Mechanical Friction on Metal, Prof. Wesendonck, 306; Heat-radiation of Gases under the Electric Discharge, Herr Ångström, 306; Electrotechnics, Prof. W. E. Ayrton, F.R.S., 326; on Hertz Oscillations, A. Perot, 336; Lectures on Alternate Currents of High Potential and Frequency, Nikola Tesla, 345; the Driving of Electro-magnetic Vibrations by Electro-magnetic and Electrostatic Engines, Prof. G. F. Fitzgerald, F.R.S., 358; Vacuum Tubes and Electric Oscillations, Prof. Oliver J. Lodge, F.R.S., 366; Electro-dynamic Theories and the Electro-magnetic Theory of Light, M. Poincaré, Prof. A. Gray, 367; the English Exhibit at the Chicago Exhibition, 377; Electric Fans to blow away Smoke from Guns of American Turret Ship, 403; Influence on Electro-magnetic Resonance of Unsymmetrical Arrangement of Propagation Circuit, Blondlot and Dufour, 408; Medical Utilization of Alternating Currents of High Potential, Gautier and Larat, 456; L'Electricité dans la Nature, Georges Dary, 460; Fifteenth Convention of the National Electric Light Association, 470; Modes of representing Electromotive Forces and Currents in Diagrams, Prof. S. B. Thompson, F.R.S., 478; the coexistence of Dielectric Power and Electrolytic Conductivity, E. Bouty, 480; Execution by Electricity, 519; Influence of Electricity on Growth of Plants, Prof. Aloï, 520; Choking Coils, Prof. Perry, F.R.S., 524; some Experiments on Electric Discharge, Prof. Thomson, 526; the Manifestation of Negative Electricity during fine weather, Ch. André, 528; the Pittsburgh Electric Club, 568; Electromotive Forces of Gold and Platinum Cells, Prof. Herroun, 574; some Electrical Instruments, R. W. Paul, 574; the Attraction between two Disks separated by a Dielectric, Julien Lefebvre, 575; Experiments on the Electrical Polarization at the two sides of a Metallic Plate immersed in an Electrolyte at Right Angles to the Current, Dr. Arons, 576; Working of the Search Light, W. B. Lefroy Hamilton, 587; Relation of Voltaic Electromotive Force to Molecular Velocity, Dr. G. Gore, F.R.S., 596; Decomposition of Sulphur tested Electrolytically, Dr. Gross, 599; the Behaviour of Spermatozoa towards Electric Currents, Dr. Schweizer, 599
- Elements, on the Line Spectra of the, Prof. C. Runge, 607
- Eliot (John), Report on the Meteorology of India in 1889, 217
- Elliott (E. B., F.R.S.)¹ Dualistic Differential Transformation, 503
- Ellison (Allan), Migratory Birds passing over Dublin, 20
- Emin Pasha Relief Expedition, my Personal Experiences in Equatorial Africa as Medical Officer to the, Thos. Heazle Parke, 265
- Emin Relief Expedition, Botany of the, W. T. Thiselton Dyer, F.R.S., 8; Major I. A. M. Jephson, 9
- Encyclopædia, Chambers's, 196
- Endlicher (Stephen), Proposed Monument to, 419
- Energy, Prof. Burnside's Paper on the Partition of, R.S.E., July 1887, S. H. Burbury, F.R.S., 533
- Engelburg (Mr. E.), the New Director of the Dutch Meteorological Observations on Land, 183
- Engine, a Simple Heat, Fred. J. Smith, 294, 464; Prof. Konstantin Karamate, 416
- Engineering, Sanitary, C. Napier Bell, on, 426
- Engineering, Seismometry and, in Relation to the Recent Earthquake in Japan, Prof. John Milne, F.R.S., 127
- Engineering: the Manufacture and Use of Aluminium from an Engineering Point of View, A. E. Hunt, 568
- Engineers, Annual Meeting of Institution of Mechanical, 355
- England, Kalm's Account of his Visit to, on his way to America in 1748, 412
- English Language in Japanese Schools, the, 303
- Entomology: Silk-producing Moths, Col. Swinhoe, 38; Entomological Society, 46, 71, 166, 430, 454, 526, 575, 623; Presidential Address, F. D. Godman, F.R.S., 359; Mr. Albert Koebele and the Enemies of Insect Pests, Sir James Hector, 65; the Macro-Lepidoptera of Winchester, 115; Le Pamir et sa Faune Lépidoptérologique, Grum-Grshimailo, 115; the *Icerya purchasi* at St. Helena, 115; Variations in the Colour of Cocoons, W. Bateson, 143; Association between Gamasids and Ants, A. D. Michael, 164; a New Herbarium Pest, Dr. C. V. Riley, 235; Dr. Riley's New Herbarium Pest, R. McLachlan, 259; the West Indian Ticks, 303; *Orcus chalybeus*, an important enemy of the Red Scale, M. Koebele, 323; the Insects, &c., that injure Tobacco, Prof. A. T. Tozzetti, 325; Ants' Nest Beetles, J. J. Walker, 351; a new case of Mimicry, Prof. A. Giard, 379; two Species of Indian Ants, E. A. J. Rothney, 454; the Wild Silk Insects of India, E. C. Cotes, 520; the Plague Locust of New South Wales, A. S. Olliff, 520; the Ants attracted by *Cynips calycis* a protection to *Quercus pedunculata*, Dr. Ráthay, 596; Hellebore as an Insecticide, W. W. Smith, 596; Abbreviated Wings of the Male Caddis-fly, R. McLachlan, F.R.S., 623; Dr. Sharp on the Phyllium, 623
- Eozoon, Dr. W. B. Carpenter on, Sir J. William Dawson, F.R.S., 461, 606; the Tudor Specimen of, J. W. Gregory, 486
- Epidemic, a New, in Vienna, 349
- Epidemics, Untenability of Atmospheric Hypothesis of, Hon. R. Russell, 431; the Origin of Influenza Epidemics, H. Harris, 431
- Equation, Virial, for Gases and Vapours, Prof. P. G. Tait, 199
- Equations, Personal, in Transit Observations, 617
- Equator, Travels among the Great Andes of the, Edward Whymper, Prof. T. G. Bonney, F.R.S., 561
- Equatorial Africa, my Second Journey through, Hermann von Wissmann, 507
- Equatorial Forests and Rivers of South America, Adventures amidst the, Villiers Stuart, 317
- Ermiling (Dr.), on the Nurhagi of Sardinia, 114
- Eruption North-West of Pantelleria, the October, G. W. Butler, Prof. John W. Judd, F.R.S., 154; on the Matter thrown up during the, Gerard W. Butler, Geo. H. Perry, 251; Abstract of Mr. A. Ricco's Account of the, G. W. Butler, 584
- Eskimo Throwing-Sticks, Prof. O. T. Mason, 66; Agnes Crane, 103
- Essex, Technical Education in, 155, 234, 613
- Ethnology: the Dwarfs of Mount Atlas, R. G. Haliburton, 66; Prints of Havesu-pai Indians, Dr. Shufeldt, 235; Use of the Sumpitan and Bow in Indonesia, C. M. Pleyte, 235; Purchases for the Australian Museum, Sydney, E. P. Ramsay, 324; Surface and Population of European States, E. Levasseur, 528
- Euclid's Elements of Geometry, A. E. Layng, 149
- Euclid II. 9 and 10, Simple Proof of, Miss Hilda Hudson, 189; Percival and Co., 250
- Euclid's Elements, the First Book of, Rev. J. B. Lock, 460
- Eugen (Herr), New Star in Auriga, 473
- Europe, Research on Extremes of Temperature in, Dr. Lachmann, 576
- Europe, Central, the Temperature of the Rivers of, 114
- European States, Surface and Population of, Emile Levasseur, 528
- Evans (Dr. Evan), Death of, 118
- Evaporation on Glacier, Extraordinarily Rapid, Prof. Boernstein, 312
- Everett (Prof. J. D., F.R.S.): Wet and Dry Bulb Formulæ, 95; C.G.S. System of Units, 581
- Evolution of Life, or Causes of Change in Animal Forms, Hubbard Winslow Mitchell, 364
- Evolution of Man, Prof. Ernst Haeckel, 482
- Evolution in Methods of Pollination, Miss Alice Carter, 596
- Ewart (Prof. Cossar) on Scottish Zoology, 87; the Lateral Sense-Organs of Elasmobranchs, 239; the Cranial Nerves of Man and Selachians, 527
- Ewart (Prof. J. G.), the Electric Organ of the Skate, 451
- Examinations in Science, 85
- Execution by Electricity, 519
- Exhibition in Celebration of Quatercentenary of Discovery of America, Projected Spanish, 64
- Exhibition, the Chicago, Economic British Minerals at, 155; Proposed Indian Bureau Exhibit, 184; Proposed U.S. Patent Office Exhibit in Illustration of Progress of Mechanical Illustration, 207; Messrs. Siemens and Halske's Exhibit, Electrical Engineering, 207; Prof. Putnam's Anthropological Exhibit at, 259
- Exhibition, the Coming Crystal Palace Electrical, 64
- Exhibition, Electrical, at St. Petersburg, 303
- Exhibition of Instruments Relating to Climatology, Projected, 258
- Explorers, Two African, 376
- "Extension" Psychology, 76
- Eyes, Peculiar, Jas. Shaw, 104; G. K. Gude, 151; E. B. Titchener, 177

- Fabre (M.), Orthochromatic Plates for Astronomical Photography, 280
 Falconry, a Bibliography of, J. E. Harting, 67
 Famine in Russia, Causes of the, Dr. A. Woeikof, 378
 Farm Crops, J. Wrightson, 247
 Farrington (O. C.), Composition of Iolite, 510
 Fauconnier (M.), New Liquid Compounds of Carbon, Oxygen, and Chlorine, 306
 Fauna, Freshwater, of Sumatra, Java, &c., Prof. Max Weber, 408
 Faye (M.), on the Variation in Latitude, 570; Photographs of a part of Cygnus, 624
 Fayrer (Sir Joseph, F.R.S.), elected Corresponding Member of the Royal Academy of Sciences of Lisbon, 585
 Featherwork, Surviving Specimens of Ancient Mexican, 66
 Fens, the Gradual Extinction of many Species of Lepidoptera in the, Dr. Wheeler, 567
 Ferrel's View of the General Circulation of the Atmosphere, Prof. W. M. Davis, 357
 Ferric Oxychloride, a New Crystalline, 24
 Fertilization of the Casuarinaceæ, 548
 Féry (C.), a new Spectrometer, 239
 Fewkes (J. W.), the Ceremonial Circuit of the Cardinal Points among the Tusayan Indians, 546
 Fibres, Chinese, 278
 Field Geology, Outlines of, Sir Archibald Geikie, F.R.S., Prof. A. H. Green, F.R.S., 97
 Field (Eleanor), Chromic Acid, 525
 Finland, Meteorology of, 87
 Finlay (George), the Working and Management of an English Railway, 116
 Finnish Archæology, the late Dr. Reinholm, 496
 Finn (Frank), a Tortoise inclosed in Ice, 320
 Fish and other Animals, a Medium for Preserving the Colours of, 212
 Fish: Destruction of Immature Sea-Fish, Alfred O. Walker, 176; Ernest W. L. Holt, 249; on the Habits of Ceratodus, the Lung Fish of Queensland, Prof. Spencer, 425; Pilchards, Matthias Dunn, 511
 Fisher (Prof. W. R.), Forestry in America, 611
 Fisheries of the Great American Lakes, 259; Fishing through the Ice, 280
 Fisheries, Scotch, 49
 Fison (Rev. Lorimer), on Anthropological Study, 426
 Fitch (Walter Hood), Obituary Notice of, 302
 Fitzgerald (C.), Squirrels in Winter, 136
 Fitzgerald (Prof. G. F., F.R.S.), the Driving of Electro-magnetic Vibrations by Electro-magnetic and Electrostatic Engines, 358; Value of Useless Studies, 392; the Functions of Universities, 513; M. Poincaré and Maxwell, 532
 Fitzgerald (Prof. M.), the Flexure of Long Pillars under their own Weight, 479
 Fixation of Free Nitrogen, Results of Experiments at Rothamsted on the Question of the, Dr. J. H. Gilbert, F.R.S., 32
 Fizeau (M.), Measurement of Solar Prominences, 422
 Flame Coloration, Origin of Prof. Smithell's, 306
 Flames, on an Optical Proof of the Existence of Suspended Matter in, Sir G. Stokes, F.R.S., 133
 Flammarion (Camille), Copernic et la Découverte du Système du Monde, 77
 Flett (John S.), the Darwinian Society, 104
 Florence, the Sanitary State of, 19
 Florida, Opening of a Burial Mound in, C. B. Moore, 567
 Flower (William Henry, F.R.S.), the Horse, a Study in Natural History, 436
 Flowers, Travels of a Painter of, 602
 Foerste (A. S.), Relationship of Autumn- to Spring-Blossoming Plants, 478
 Foerster (Dr.), New Compounds of Carbonyl Platinum Chloride and Bromide with Ammonia Derivatives, 236
 Fog in London, 1871-90, the Prevalence of, F. J. Brodie, 215
 Fogs, Effect of, on Plants grown in the Houses at Kew, W. Watson, 16
 Fogs, Town, and their Effects, 53; Dr. W. J. Russell, F.R.S., 10
 Foot as a Prehensile Organ in Hindoos, the, F. Regnault, 192
 Footprints, supposed Human, on Æolian Rocks at Warrnambool, 115
 Foote (Prof. A. E.), a New Locality for Meteoric Iron, with a Preliminary Notice of the Discovery of Diamonds in the Iron, 178
 Forbes (Prof. Henry O.): Evidence of a Wing in *Dinornis*, 257; New Extinct Rail, 416; on a Recent Discovery of the Remains of Extinct Birds in New Zealand, 416; Aphanapteryx in the New Zealand Region, 580
 Forel (Prof. F. A.), the Recent Earthquake in Japan, 199
 Forestry in America, Prof. W. R. Fisher, 611
 Forestry in India, Government, Dr. Ribbentrop, 41
 Fossil Birds in the British Museum, Catalogue of, Richard Lydekker, 33
 Fossil Fauna in Central Iowa, C. R. Keyes, 208
 Fossil Lepidodendrons, on the Discovery of Two Specimens of, in the Neighbourhood of Bathurst, New South Wales, W. J. C. Ross, 424
 Fossil Ornithology: Aphanapteryx in the New Zealand Region, Prof. Henry O. Forbes, 580
 Fossil Ungulates, Aberrant, of South America, 608
 Fossils recently discovered near Boston, Warren Upham, 622
 Foster (Michael), proposed Portrait of, 18
 Foster (W.), the Carbon deposited from Gas Flames, 525
 Fowler (A.), Telescopic Objectives, 204; the Draper Catalogue of Stellar Spectra, 426
 Foxes, California, Prof. Edward S. Holden, 8
 France: Learned Societies in, 20; Les Coquilles Marines des Côtes de France, A. Locard, 219; Earthquake in, 304
 Franchimont (M.), Ethylaldehyde, 576
 Francis (Gerald B.), Double Orange, 534, 607
 Frank (Herr von), Cause of Floating of Particles of Cloud or Fog, 259
 Frankfurt International Electrical Exhibition, some Notes on the, 54, 105
 Frankland (Prof. Percy F., F.R.S.), an Elementary Hand-book on Potable Water, Floyd Davis, 25
 Frankland (P. F.), a Pure Fermentation of Mannitol and Dulcitol, 383
 Fream (Dr. W.), Elements of Agriculture, 388
 French (C.), Hand-book of the Destructive Insects of Victoria, 246
 Freshwater and Terrestrial Fauna of Tasmania, Prof. W. Baldwin Spencer, 425
 Frew (W.), a Pure Fermentation of Mannitol and Dulcitol, 383
 Fridlander (E. D.), a Lecture Experiment in Surface Tension, 463
 Friend (Rev. Hilderic), a Rare British Earthworm, 365
 Friswell (R. G.), the Action of Dilute Nitric Acid on Coal, 383
 Fritz (Dr. Adolf), the Fauna of Yezo, 89
 Frog, Discovery of New Species of, in New Jersey, 208
 Frogs, a Plague of Small, R. Haig Thomas, 8; Lieutenant B. A. Muirhead, 30
 Fruit Culture, Practical, J. Cheal, 579
 Fruit-growers' Conference at Sydney, 420
 Function of a University, the, Prof. W. E. Ayrtton, F.R.S., 439
 Functions of Universities, Prof. Geo. Fras. Fitzgerald, F.R.S., 513
 Fungi, British Edible, M. C. Cooke, 75
 Fungi, British: Phycomyces and Ustilagineæ, G. Massee, 411
 Furniture Woods, D. Denning, 459
 Fuzziness of some Variable Stars, Cuthbert G. Peek, 497
 Gadolinia, Molecular Weight of, 237
 Gale of November 11, the Severe, Chas. Harding, 181
 Game, Big in India, Harold Littledale, 158
 Gamgee (John), Superheated Steam, 438
 Gases under the Electric Discharge, Heat Radiation of various Rarefied Gases, Herr Ångström, 306
 Gases, Experiments on Cause of Emission of Light of, Dr. Pringsheim, 312
 Gases and Vapours, on the Virial Equation for, Prof. P. G. Tait, 199
 Gasparis (Prof. Annibale de), Death and Obituary Notice of, 612
 Gauge, Proposed Standard, G. Johnstone Stoney, F.R.S., 598
 Gautier (A.), Fixation of Nitrogen by Arable Soils, 192
 Gautier (G.), Medical Utilization of Alternating Currents of High Potential, 456
 Gautier (H.), the Direct Combination of Metals with Chlorine and Bromine, 47
 Geikie (Sir Archibald, F.R.S.), Outlines of Field Geology, Prof. A. H. Green, F.R.S., 97; Volcanic Action in the British Isles, 398
 Gems, Precious Stones and their History, Sources, and Characteristics, Edwin W. Streeter, 531

- Geneva, Temperature Observations at, M. Chaix, 304
Genoa, Botanical International Congress to be held at, in connection with Celebration of Quatercentenary of Discovery of America by Columbus, 545
Genvresse (M.), New Mode of Synthesizing Tartaric Acid, 472
Geodesy, New Mode of Measurement of Perpignan Base, General Derrécaigaix, 384
Geodetic Bureau of Vienna, the Government and the International, 495
Geography: M. Grum-Grzimalo's Journey to Central Asia, 40; Tibet Expedition, General Pevtsoff, 45; the Sierra Leone Anglo-French Frontier Delimitation Commission, 64; Projected East African Expedition by Dr. Oscar Baumann, 65; Mr. and Mrs. Littledale's Journey across the Pamirs, 90; the Land of the Lamas, William Woodville Rockhill, 98; the Physical Geology and Geography of Ireland, Edward Hull, F.R.S., 102; the Ouse, A. J. Taylor, 102; Geographical Nomenclature, 115; Delagoa Bay, Rosa Monteiro, 124; Carl Lumholtz's Explorations in Northern Mexico, 136; the Eastern Taurus and the Anti-Taurus, D. G. Hogarth, 138; Reported Discovery of Ultimate Source of the Nile, 154; the Royal Geographical Society's System for Spelling Geographical Names, 183; Proposed Expedition for Relief of Lieutenant Peary, 183; Orthography of Geographical Names, 186; Korea, Chas. W. Campbell, 307; Expedition to Explore the Glaciers of the Karakoram Range, 279; Formation of Crimean Alpine Club, 349; the Gran Chaco, J. G. Kerr, 351; Journeys in the Pamirs and Adjacent Countries, Captain Younghusband, 353; the Zimbabwe Ruins, Theodore Bent, 402; Captain Pasco on Early Discoveries in Australia, 425; Dr. Murray on Mr. Lindsay's Expedition in Western Australia, 425; J. P. Thomson on Recent Explorations and Discoveries in British New Guinea, 425; the Advanced Class-book of Modern Geography, W. Hughes and J. Francon Williams, 460; the Position of Mount St. Elias, Israel C. Russell, 472; Mr. Alexander Ross's Journey to Head Waters of the Ecayali, Central Peru, 519; Travels among the Great Andes of the Equator, Edward Whymper, Prof. T. G. Bonney, F.R.S., 561; Handy Atlas of Modern Geography, 605; Captain Bower's Journey from China to Simla, 615; Lieutenant Vedel on the Polynesians, 615; Branch of Royal Scottish Geographical Society Established in London, 544; Captain Dundas's Expedition to Mount Kenia, Ernest Gedge, 566
Geology: Geological Photographs, 64; Annals of British Geology, 1890, J. F. Blake, 77; Geological Society, 94, 165, 263, 287, 359, 453, 525, 597; Geological Society Medals, 257; Geological Society, Election of Officers, 402; *Dacrytherium ovinum*, R. Lydekker, 94; Supplementary Remarks on Glen Roy, T. F. Jamieson, 94; Outlines of Field Geology, Sir Archibald Geikie, F.R.S., Prof. A. H. Green, F.R.S., 97; the Physical Geology and Geography of Ireland, Edward Hull, F.R.S., 102; Geology of Lake Winnipeg, J. B. Tyrell, 115; the Tertiary Silicified Woods of Eastern Arkansas, R. Ellsworth Call, 119; Pfaff's Allgemeine Geologie als Exacte Wissenschaft, J. Joly, 126; New Railway from Upminster to Romford, Essex, T. V. Holmes, 151; Comparison of South Devon Coast Red Rocks with those of Midland and Western Counties, Prof. Edward Hull, F.R.S., 165; High Level Glacial Gravels near Oswestry, A. C. Nicholson, 165; Geology of Pantelleria, G. Jervis, 207; Geology of New Guinea, R. L. Jack, 209; Geological Excursion in Maryland, a, Prof. G. H. Williams, 235; Formation of Cordierite in Sedimentary Rocks fused by Coal Fires, A. Lacroix, 240; Gravels South of the Thames, from Guildford to Newbury, H. W. Monckton, 263; Fresh Evidence concerning the Distribution of Arctic Plants during the Glacial Epoch, Dr. A. G. Nathorst, 273; the Geology of the Himalayas, 308; Theory of an Interglacial Submergence in England, G. F. Wright, 310; the Permian of Texas, R. S. Tarr, 310; Relation of Melting-Point to Pressure in Igneous Rock Fusion, C. Barus, 311; Cirques, Prof. G. Frederick Wright, 317; Prof. Israel C. Russell, 317; Prof. T. G. Bonney, F.R.S., 391; Note on Specimens of Rock Exposed to High Temperatures, Prof. T. G. Bonney, 357; the Hornblende-Schists, Gneisses, and other Crystalline Rocks of Sark, Rev. Edwin Hill and Prof. T. G. Bonney, 359; the Plutonic Rocks of Garabal Hill and Meall Breac, Dakyns and Teall, 360; the Cause of an Ice Age, Sir Robert S. Ball, F.R.S., 365; Prof. G. H. Darwin, F.R.S., 289; Henry Howorth, 440; the Sponge Remains in Lower Tertiary Strata, near Oamaru, New Zealand, Hinde and Holmes, 384; Report on the Scientific Results of the Voyage of H. M. S. *Challenger* during the years 1873-76, Prof. John Judd, F.R.S., 409; Geologists' Association Proposed Excursion to Hornchurch, 420; Geology of Ohio, in connection with the average yield of Wheat, 420; the Stratigraphic Position of the Bear River Formation, T. W. Stanton, 450; the Raised Beaches and Rubble-Drift of the South of England, Joseph Prestwich, F.R.S., 453; the *Olenellus* Zone in the North-West Highlands, B. N. Peach and J. Horne, 453; the Pleistocene Deposits of the Sussex Coasts, Clement Reid, 454; the Basal Conglomerate of Howth, Prof. Sollas, F.R.S., 455; the Varolite of Annalong, County Down, Prof. G. A. J. Cole, 455; Proposed Austrian Geological Expedition to Central Himalayas, 495; the North-West of England Boulder Committee, 495; Striated Surface under the Cromer Drift, William Sherwood, 511; the Part played in the Growth of Geological Opinion by Regions near great Universities, Prof. G. H. Williams, 519; New Railway Cutting between Upminster and Romford, T. V. Holmes, 525; Drift Beds of North and Mid Wales Coast, T. M. Reade, 525; the Alleged Submergence in Scotland during the Glacial Epoch, Dugald Bell, 527; Testimonial to Mr. W. H. Hudleston, F.R.S., by the Geologists' Association, 544; Mr. A. S. Woodward appointed Assistant-Keeper of Geological Department at the British Museum, 566; on the Microscopic Structure and Residues Insoluble in Hydrochloric Acid in the Devonian Limestone of South Devon, Edward Wethered, 597; Rocks Collected by M. Lopatin on the Podkamennaya Tunguska, 597; Geology of the Gold-bearing Rocks of the Southern Transvaal, Walcot Gibson, 598; the Precipitation and Deposition of Sea-borne Sediment, R. G. Mackley Browne, 598
Geometry: Prof. Kikuchi's Treatise on, 20; Euclid's Elements of Geometry, A. E. Layng, 149; Non-Euclidian Geometry, Prof. H. Poincaré, 404; a Treatise on the Geometry of the Circle, and some Extensions to Conic Sections by the Method of Reciprocation, W. J. McClelland, 412; a Defect in the Oxford Pass Examination Papers, 443
Gedge (Ernest), Captain Dundas's Expedition to Mount Kenia, 566
German Anthropological Society, 39
German Mathematical Association, 278
German Technology for English Manufacturers, Prof. T. E. Thorpe, F.R.S., 121
Germany and Austria, Health Springs of, Dr. F. O. Buckland, 510
Germany, Workmen Killed and Wounded in Accidents in, M. Vacher, 350
Giard (Prof. A.), a New Case of Mimicry, 379
Gibson (Dr.), Rules for Determining whether a given Benzene Mono-Derivative shall give a Meta-di-derivative or a Mixture of Ortho- and Para-di-derivatives, 525
Gibson (Walcot), Geology of the Gold-bearing Rocks of the Southern Transvaal, 598
Gifford (W.), the Resolution of *Amphipleura pellucida*, 143
Gilbault (Henri), New Condensation Hygrometer, 288
Gilbert (Dr. J. H., F.R.S.), Results of Experiments at Rothamsted on the Question of the Fixation of Free Nitrogen, 32
Gill (D.), Photography at the Cape Observatory, 600
Ginger-beer Plant, the, Prof. H. M. Ward, F.R.S., 190
Giraffe at the Zoological Gardens, the Death of the, 518
Giraffes, 585
Glacial Epoch, Fresh Evidence concerning the Distribution of Arctic Plants during the, Dr. A. G. Nathorst, 273
Glacial Period, the Astronomical Theory of the, Sir Robert Ball, F.R.S., Prof. G. H. Darwin, F.R.S., 289
Glacialists' Association, the, 495
Glaciers of the Karakoram Range, Expedition to Explore the, 349
Glaciers, Measures of Variations in Lengths of Dauphiny, Prince Roland Bonaparte, 576
Glasgow Geological Society, 527
Glass, Measurement of Process of Dissolution of, by Change in Electric Conductivity of Water, Herr Pfeiffer, 209
Glazebrook (R. T.), some Notes on Clark's Cells, 47
Globe, a new Precessional, Dr. K. Haas, 250
Godman (F. D., F.R.S.), Presidential Address to Entomological Society, 359
Godwin-Austen (Mrs. Jessie) a Swan's Secret, 416
Goiran (A.), Earthquakes and Vegetation, 478, 520
Gold-bearing Rocks of the Southern Transvaal, Geology of the, Walcot Gibson, 598

- Gonimophyllum Buffhami*, a new Marine Alga, E. A. L. Batters, 596
- Gonner (E. C. K.), Ricardo's Principles of Political Economy and Taxation, 4
- Goodale (Prof.), Botanical Museums and Gardens of Australasia, 65
- Goode (G. B.), Museums of the Future, 421
- Gooseberries, the Prolongation of the Season for, D. Thomson, 157
- Gordyagin (A.), Biology of the Sunflower, 597
- Gore (J. Ellard): Star Groups, 52; Observations of μ Cephei, 137
- Gore (Dr. G., F.R.S.), Relation of Voltaic Electromotive Force to Molecular Velocity, 596
- Goschen (Right Hon. G. J.), on the Use of the Imagination, 87
- Goss (H.): the New Forest Bill, 1892, 295; the New Forest in Danger, 343
- Gothard (Herr), New Star in Auriga, 473
- Gould (Dr. B. A.), Variation of Latitude, 521
- Gouy (M.), Electro-capillary Phenomena and Differences of Potential produced by Contact, 264
- Grafted Plants, W. H. Beeby, 151
- Grafts and Heredity, Prof. George Henslow, 198
- Grain-production of Russia, the, M. Borkovsky, 67
- Gran Chaco, the, J. G. Kerr, 351
- Granger (F. S.), Psychology, a Short Account of the Human Mind, 76
- Grant (Col. J. A.), Obituary Notice of, 376
- Grantham (R. B.), Obituary Notice of, 183
- Grape-culture in Ontario, 209
- Grasses of the South-West, Dr. George Vasey, 390
- Gravitation, a Theory of, 100
- Gray (Prof. A.): Electricity and Magnetism by Amédée Guillemin, 1; Electro-Magnetism, S. P. Thompson, F.R.S., 73; Electrodynamic Theories and the Electromagnetic Theory of Light, M. Poincaré, 367
- Gray (Dr. Elisha), on the International Congress of Electricians to be held at Chicago, 19
- Gray (J. Macfarlane), Superheated Steam, 413, 486
- Great Bower Bird, Depredations of the, in Queensland, 588
- Greece: Earthquakes in, 259; Forest Land in, 588
- Greek Literary Style, on the most Recent Phases of, Prof. Blackie, 624
- Greely (General), International Monthly Charts of Mean Barometric Pressures and Wind Directions, 350
- Green (A. G.), Ortho- and Para-nitro-ortho-toluidine, 92
- Green (Prof. A. H., F.R.S.), Outlines of Field Geology, Sir Archibald Geikie, F.R.S., 97
- Green (G. C.), Tame Jackdaws, 545
- Green (W. Edridge), Colour Blindness and Colour Perception, 195
- Grenfell (J. G.), the Occurrence of Pseudopodia in Diatomaceous Genera *Melosira* and *Cyclotella*, 140
- Greenhill (Prof. A. G., F.R.S.), Thermodynamics of the Steam Engine and other Heat Engines, Cecil H. Peabody, 172
- Greenhill (Prof., F.R.S.), Rectification of the Cartesian Oval, 503
- Greenland, Angelo Heilprin on Summer Tour to, 88
- Greenland, proposed Expedition for relief of Lieut. Peary, 183
- Gregory (J. W.): *Archaeopneustes abruptus*, a new Echinoid from Barbados, 287; the Tudor Specimen of Eozoon, 486
- Grensted (Rev. Fred. F.), Orientation of Ancient Monuments, 464
- Gresham College, Lectures on the Eye at, 586
- Gresham University, the Proposed, 323, 442, 517; Bedford College and the, Dr. W. J. Russell, F.R.S., Lucy J. Russell, 391
- Grevy's Zebra, Skin of, brought from Somaliland, 598
- Griffiths (A. B.), Ptomaines Extracted from Urine in some Infectious Maladies, 72
- Griffiths (Dr.), *Bacterium Allii*, 624
- Gross (Dr.), Decomposition of Sulphur tested Electrolytically, 599
- Growth of the Pilchard or Sardine, Prof. J. T. Cunningham, 255
- Grum-Grzimalo's (M.) Journey to Central Asia, 40
- Guardafui, Cape, and the Neighbouring Sea, 36
- Guatemala, the Climate of Alta Verapaz, Dr. Sapper, 41
- Gude (G. K.), Peculiar Eyes, 151
- Guillemin (Amédée), Electricity and Magnetism, Prof. A. Gray, 1
- Gulbenkian (Calouste S.), La Transcaucasie et la Péninsule d'Apchéron, 52
- Gumlich (Dr.), on the Urinary Excretion of Nitrogen, 599
- Guns: Calculation of Trajectories of Elongated Projectiles, Rev. F. Bashforth, 473
- Guutz (Dr.), Action of Carbon Monoxide on Iron and Manganese, 311
- Guye (Dr. P. A.), the Various Forms given to the General Equation expressing Behaviour of Liquids and Gases under Different Conditions of Volume, Temperature, and Pressure, 142
- Haarlem, Prize Subjects proposed by Dutch Academy of Sciences, 37
- Haas (Dr. K.): Mental Arithmetic, 198; a New Precessional Globe, 250
- Haeckel (Prof. Ernst), Anthropogenie oder Entwicklungsgeschichte des Menschen, 482
- Haerdtl (Dr. G. F.), Winnecke's Comet, 617
- Hainan, 286
- Hale (Prof.): the Aurora Spectrum, 522; Solar Investigation, 473; Solar Prominence Photography, 326
- Haliburton (R. G.), the Dwarfs of Mount Atlas, 66
- Hall (Prof. A.), the Relative Motion of 61 Cygni, 547
- Hall (Maxwell), Rainfall Atlas of Jamaica, 324
- Haller (A.), Researches in Ethyl Monochlor-, Monobrom-, and Monocyanacetates, 432
- Halliburton (W. D.), a Text-Book of Chemical Physiology and Pathology, Dr. E. H. Starling, 51
- Halske and Siemens, Experiments on the Production of Ozone by Electric Silent Discharge, 39
- Hamberg (Dr. H. E.), Radiation of Upper Cloud round Barometric Minima, 156
- Hamilton (W. B. Lefroy), Working of the Search Light, 587
- Hamlet (W. M.), on the Progress of Chemistry in Australasia, 423
- Hampson (G. F.), Stridulation in certain Lepidoptera, 503
- Hann (Dr. J.), Meteorological Observations at Cairo, 1868-1888, 156
- Harding (Chas.), the Severe Gale of November 11, 1811
- Harley (Dr. Vaughan), Note on the Behaviour of Sugar in Blood, 407
- Harmer (S. F.), the Excretory Process in Marine Polyzoa, 480
- Harries (H.), the Origin of Influenza Epidemics, 431
- Harrison (W. Jerome), Guide to the Examinations in Chemistry, 342
- Harrington (Mark W.), United States Weather Bureau, 86
- Harrow Birds, G. E. H. Barrett-Hamilton, 342
- Hart (J. H.), a New West Indian Form of *Agave rigida*, 445
- Harting (J. E.), Ornithology of the Sandwich Isles, 532
- Hartlaub (Dr. Clemens), 544
- Hartley (W. N.), the Acid Action of Drawing-papers, 430, 453
- Hartmann (Dr.), Increase of the Earth's Shadow during Lunar Eclipses, 498
- Hartnup (John), Death of, 612
- Hartog (Prof. Marcus), a Difficulty in Weismannism, 102
- Harvard University, Remarkable Development of Botanical Establishment of, by the Munificence of Prof. G. L. Goodale, 545
- Haupt (Prof. L. M.), Proposed Ship Canal between New York and Philadelphia, 497
- Hausser (J.), a Study of the Velocity of Decomposition of Diazo-Compounds by Water, 480
- Hayden (Everett), the Samoan Hurricane, 461
- Hayward (Robert B., F.R.S.): the Salts in Natural Waters, 176; on the Variation of Latitude, 465
- Hazen (Prof.), High Balloon Voyages, 189
- Hazen (Prof. H. A.), Wind-rush at Washington, 597
- Health Springs of Germany and Austria, Dr. F. O. Buckland, 510
- Health Resorts, Value of Meteorological Instruments in Selection of, Dr. C. Theodore Williams, 551
- Heat, Theory of, J. Clerk Maxwell, 222
- Heat-radiation of various rarefied Gases under the Electric Discharge, Herr Ångström, 306
- Heat: the Thermal Conductivities of Crystal and other Bad Conductors, C. H. Lee, 382
- Heat, Solar, Dr. Joseph Morrison, 589
- Heat-Engine, a Simple, Fred. J. Smith, 294; Prof. Konstantin Karamate, 416; Nickel, W. B. Croft, 392

- Heat-Engines and Saline Solutions, Lord Rayleigh, F.R.S., 438, 510
 Heath (Thos.), a Brilliant Meteor, 295
 Hector (Sir James), Mr. Albert Koebele and the Enemies of Insect Pests, 65
 Heider (Dr. K.), Lehrbuch der vergleichenden Entwickelungsgeschichte der Wirbellosen Thiere, 145
 Heilprin (Angelo), on a Summer Tour to Greenland, 88
 Held (A.), Researches on Ethyl Monochlor-, Monobrom-, and Monocyanacetate, 432
 Heligoland, the New Imperial German Zoological Station at, 544
 Hellmann (Prof.), the First Balloon Voyage for Scientific Purposes, 471; Experiments on Rainfall Records, 545
 Hellebore as an Insecticide, W. W. Smith, 546
 Helmholtz (Prof. von), Celebration of His Seventieth Birthday, 18
 Hemsley (W. Botting, F.R.S.): Biology of Seaside Plants, 3; Botanical Nomenclature, Dr. Otto Kuntze, 169
 Henslow (Rev. Prof.), a Theory of Heredity based on Forces, 93
 Henslow (Prof. Geo.), Grafts and Heredity, 198
 Herbarium Pest, a New, Dr. C. V. Riley, 235
 Heredity, Grafts and, Prof. Geo. Henslow, 198
 Heredity, a Theory of, based on Forces, Rev. Prof. Henslow, 93
 Héricourt (J.), the Tubercular Vaccination of the Dog, 576
 Hering on the "Valence" of a Coloured Radiation, 115
 Heron, Taming a, Colonel W. S. Hore, 588
 Herroun (Prof.), Electromotive Forces of Gold and Platinum Cells, 574
 Hesehus (Herr), Refraction and Velocity of Sound in Porous Bodies, 156
 Heurtault (M.), the Tides of the Bay of St. Malo, 143
 Heycock (C. T.), the Change of Zero of Thermometers, 526
 Hibbert (W.), a Permanent Magnetic Field, 191
 Hicks (Dr. H., F.R.S.), Discovery of Remains of Prehistoric Animals in Endsleigh Street, 566
 Hickson (Dr. S. J.): the Medusæ of *Millepora Murrayi* and the Gonophores of *Allopora* and *Distichopora*, 140; the Hydrocorallinæ collected by Prof. Haddon in Torres Straits, 407; Anatomy and Habits of *Alcyonium*, 455
 High Temperature, Metals at, Prof. W. C. Roberts-Austen, F.R.S., 534
 Hill (Rev. Edwin), the Hornblende-Schists, Gneisses, and other Crystalline Rocks of Sark, 359
 Hill (Prof. M. J. M.), the Loci of Singular Points and Lines occurring in connection with the Theory of Locus of Ultimate Intersections of a System of Surfaces, 141
 Hillebrand (W. F.), New Analysis of Uraninite, 119
 Hills, Story of the, Rev. H. N. Hutchinson, 364
 Himalayas, the Geology of the, 308
 Himalayas, Proposed Austrian Geological Expedition to Central, 495
 Hinde (G. J.), the Sponge Remains in Lower Tertiary Strata, near Oamaru, N.Z., 382
 Hindoos, the Foot as a Prensile Organ in, F. Regnault, 192
 Hindu Period in Java, Relics of, 88
 Himmel und Erde, 237, 568
 Hinsdale (E. B.), the Historic Copper Mines on Lake Superior, 39
 Hirst (Dr. Thos. Archer), Obituary Notice, 399
 Hitchcock (Prof.), Ancient Tombs and Burial Mounds of Japan, 381
 Hobart (J. F.), the Paper-making Industry in the United States, 279
 Hobson (Bernard), Ice Crystals, 365
 Hobson (E. W.), Harmonic Functions for the Elliptic Cone, 335
 Hodgkins (Mr. Thos.), Gift to Smithsonian Institution by, 37
 Hodgkinson (W. R.): New Method of Preparing β -dinaphthylene Oxide, 93; Action of Sodium on Ethereal Salts, iii., Benzylic Orthotoluete, 214; Ethyldimethylamidobenzene, 551
 Hoffmann (Dr. H. K. H.), Death of, 18
 Hogarth (D. G.), the Eastern Taurus and the Anti-Taurus, 138
 Holden (Prof. Edward S.): California Foxes, 8; the Discovery of Neptune, 522; Influenza in America, 582
 Hollis (W. Ainslie), on the Relation of Natural Science to Art, 319
 Holmes (T. V.), New Railway from Upminster to Romford, Essex, 151, 525
 Holmes (W. M.), the Sponge Remains in Lower Tertiary Strata near Oamaru, N.Z., 384
 Holt (E. W. L.): Rarer Shore and Deep-Sea Fishes obtained during *Harlequin* Cruise on West Coast of Ireland (1891), 167; Destruction of Immature Sea Fish, 249
 Homing Pigeons, Utilization of, W. B. Tegetmeier, 320
 Hoogewerff (S.), Action of Aqueous Solution of Ammonia on Phthalic Chloride, 72
 Hooker's *Icones Plantarum*, third series, 86
 Hopkins (F. Gowland): Pigment in Yellow Butterflies, 197; Pigments of Lepidoptera, 581
 Hopkinson (John), the Water-Supply of London, 88
 Hore (Col. W. S.), Taming a Heron, 588
 Horizon, Apparent Size of Objects near the, T. W. Backhouse, 7
 Hornchurch, Proposed Excursion of Geologists' Association to, 420
 Horne (J.), the *Olenellus* Zone of the North-West Highlands, 453
 Horology, the Use of a Free Pendulum as a Time Standard, T. C. Mendenhall, 450
 Horse Doctor, Mayhew's Illustrated, 27
 Horse, the, a Study in Natural History, William Henry Flower, F.R.S., 436
 Horticulture: the Place of Horticulture in Technical Education, W. Wilks, 38; Olive Culture in Australia, Principal J. L. Thomson, 135; Horticulture in South Australia, 184; Experimental Perfume Farming in Victoria, 305; Instruction in, W. T. Thiselton Dyer, 402; Proposed Exhibition for the Development of, 613
 Hose's (Charles) Collections, 517
 Houses of Parliament, Examination of the Standards of Measure and Weight immured in the, 534
 Howorth (Henry H.), Sir R. Ball's Cause of an Ice Age, 440
 Hubbard (Gardiner G.), Evolution of Commerce, 588
 Hubrecht, Placentation of certain Lemurs and Insectivora, 600
 Hudleston (W. H., F.R.S.), Presentation of Testimonial of Geologists' Association to, 544
 Hudson (Miss Hilda), Simple Proof of Euclid II. 9 and 10, 189
 Hudson (W. H.), the Naturalist in La Plata, Dr. Alfred R. Wallace, 553
 Hudspeth (R. N.), Auroras at Toronto, 7
 Hughes (R. E.), Action of Dry Hydrochloric Gas on Dry Carbonates, 503
 Hughes (William) and J. Francon Williams, the Advanced Class-book of Modern Geography, 460
 Hull (Prof. Edward, F.R.S.): the Physical Geology and Geography of Ireland, 102; Comparison of the South Devon Coast Red Rocks with those of Midland and Western Counties, 165
 Human Footprints on the Rocks at Warrnambool, 115
 Human Physiology, an Introduction to, Augustus D. Waller, Dr. E. H. Starling, 340
 Hunfalvy (Paul), Death and Obituary Notice of, 207
 Hunt (A. E.), the Manufacture and Use of Aluminium from an engineering point of view, 568
 Hunt (A. R.), the Formation and Erosion of Beaches, 415
 Hunt (Dr. T. Sterry), Obituary Notice of, W. Topley, 400
 Hurricane, the Samoan, Everett Hayden, 461
 Hurter (F., Ph.D.), and George Lunge, Ph.D., the Alkali-Maker's Hand-book, Prof. T. E. Thorpe, F.R.S., 121
 Hutchinson (Rev. H. N.), Story of the Hills, 364
 Hutton (Prof.), on the Origin of the Struthious Birds of Australasia, 425
 Huxley, (T. H.), *La Place de l'Homme dans la Nature*, 197
 Huygens (Christiaan), *Cœuvres Complètes de*, A. M. Clerke, 434
 Hyades (P.), and J. Deniker, *Mission Scientifique de Cap Horn*, 577
 Hydrodynamics: Experiments in Aërodynamics, Lord Rayleigh, F.R.S., 108
 Hydrogen and Oxygen, Silent Combination of, Prof. Victor Meyer and Herr Askenasy on, 616
 Hydrography: Austrian Government Deep Sea Explorations in Eastern Mediterranean, 518
 Hydrostatics, Method of Experimental Proof of Principle of Archimedes, M. Paquet, 209
 Hydroxylamine, Free, Isolation of, 20
 Hygiene of Water-Supply, Floyd Davis, Prof. Percy F. Frankland, F.R.S., 25
 Hygienic Congress: Dr. W. J. Russell, F.R.S., on Town Fogs and their Effects, 10
 Hygrometer, New Condensation, Henri Gilbault, 288

- Hydro-Idealism, 389
 Hypsometry, the Aneroid in, Edward Whymper, 339; Herbert Tomlinson, F.R.S., 440
- Ice, a Tortoise inclosed in, Frank Finn, 320
 Ice Age, the Cause of an, Sir Robert Ball, F.R.S., 365; Prof. G. H. Darwin, F.R.S., 289; Henry H. Howorth, 440
 Ice Age of America, Prof. G. Frederick Wright, 317; Prof. Israel C. Russell, 317
 Ice Crystals, Gilbert Rigg, 319; Bernard Hobson, 365
Jeerya purchasi at St. Helen's, 115
 Ichthyology: Destruction of Immature Sea-Fish, Alfred O. Walker, 176; Ernest W. L. Holt, 249; Marine, Rarer Shore and Deep Sea Fishes obtained during the *Harlequin* Cruise on West Coast of Ireland, 1891, E. W. L. Holt, 167; the Lateral Sense-Organs of Elasmobranchs, 239; the Electric Organ of the Skate, Prof. J. G. Ewart, 451; Pilchards, Matthias Dunn, 511
 Ilford Manual of Photography, C. H. Bothamley, 460
 Imagination, the Use of the, Rt. Hon. G. J. Goschen, 87
 Immature Sea-Fish, Destruction of, Alfred O. Walker, 176; Ernest W. L. Holt, 249
 Implications of Science, Dr. St. George Mivart, F.R.S., 60, 82, 223, 343; Edward T. Dixon, 125, 272, 391; Miss E. E. C. Jones, 223, 366
 Incandescent Iron, First Visible Colour of, Capt. A. Noble, F.R.S., 484; T. C. Porter, 558
 India: Government Forestry in, Dr. Ribbentrop, 41; Catalogue of Mammalia in the Indian Museum, Calcutta, W. L. Sclater, 50; Meteorological and Physical Atlas of the Indian Ocean, 101; the Publications of the Meteorological Department of India, 113; Report on the Meteorology of India in 1889, John Eliot, 217; Reports on the Administration of the Meteorological Department of the Government of India, 217; Beast and Man in India, John Lockwood Kipling, 131; Strange Symbolical Marriage Custom in India, Dr. Post, 135; Big Game in India, Harold Littledale, 158; List of the Snakes in the Indian Museum, W. L. Sclater, 817; Rain and Mildew in India, Dr. A. Barclay, 477; the Winter Storms of Northern India, Henry F. Blanford, F.R.S., 490; the Wild Silk Insects of India, E. C. Cotes, 520; Agricultural Needs of India, 588
 India-rubber, the Solution of Vulcanised, Carl Barus, 118
 Indians: North American, Exhibit at Chicago Exhibition, 184; Prints of Havesu-paio Indians, Dr. Shufeldt, 235; the Ceremonial Circuit of the Cardinal Points among the Tusayan Indians, J. W. Fewkes, 546
 Indo-China, Proposed Expedition of Dr. H. Jagor to, 258
 Indonesia, Use of the Sumpitan and Bow in, C. M. Pleyte, 235
 Industrial Organic Chemistry, Samuel P. Sadtler, 125
 Inertia, Force of, the Terms Centrifugal Force and, George S. Carr, 463
 Infectious Diseases, a Study of Influenza and the Laws of England concerning, R. Sisley, 556
 Influenza in America, Prof. Edward S. Holden, 582
 Influenza Bacillus, Reported Discovery of, 250; Dr. Richard Pfeiffer, 233
 Influenza Epidemics, the Origin of, H. Harries, 431
 Influenza, a Study of, and the Laws of England concerning Infectious Diseases, R. Sisley, 556
 Ingle (H.), Structure and Chemistry of Flames, 214
 Inheritance of Acquired Characters, Alfred W. Bennett, 53
 Insect Colours, F. H. Perry Coste, 513, 541
 Insect Pests, C. French, 246
 Insecticide, Hellebore as an, W. W. Smith, 546
 Insectivora, Placentation of certain Lemurs and, Hubrecht, 600
 Insectivorous Plants, R. Lindsay, 157
 Institution of Civil Engineers, 37
 Institution of Electrical Engineers, 155
 Institution of Mechanical Engineers, 22, 355, 585
 Institution of Naval Architects, 570
 Instruments, the Bow as Origin of Stringed, Dr. E. B. Tylor, 184
 Intelligence in Birds, A. Wilkins, 151, 177
 International Sanitary Conference, 233
 Intracranial Circulation and its Relation to the Physiology of the Brain, James Cappie, M.D., 26
 Iowa, Central, Fossil Faunas in, C. R. Keyes, 208
- Ipoh Poison of the Malay Peninsula, the, Leonard Wray, Junior, 278
 Ireland, Free Education in, 403
 Ireland, the Physical Geology and Geography of, Edward Hull, F.R.S., 102
 Irish Giant Cornelius Magrath, the Skeleton of the, Dr. D. J. Cunningham, F.R.S., 147
 Irish Naturalist, the, 567
 Iron: Iron Carbonyl from Water Gas, A. E. Tutton, 36; some Experiments made with the view of ascertaining the Rate of Propagation of Induced Magnetism in Iron, Fred. T. Trouton, 42; Magnetization of Iron, Prof. C. G. Knott, 431; Iron Production in the United States, Berkley, 65; Meteoric Iron, E. Cohen, E. Weinschenk, 69; a New Locality for Meteoric Iron, with a Preliminary Notice of the Discovery of Diamonds in the Iron, Prof. A. E. Foote, 178; Action of Water Gas on Iron, Roscoe and Scudder, 92; the Spectrum of Iron and the Periodic Law, John Parry, 253; on the Rusting of Iron, A. Liversidge, F.R.S., 424; First Visible Colour of Incandescent Iron, Capt. A. Noble, F.R.S., 484; T. C. Porter, 558; Native Iron of Cañon Diablo, Arizona, M. Mallard, 575
 Irrigation Canals of Arizona, the Prehistoric, 185
 Irvine (Robert), Manganese Nodules in the Marine Deposits of the Clyde Sea-area, 527
 Isothermal Equation, Prof. D. T. Korteweg on Van der Waals's, 152, 277
 Italy, Earthquakes in, 259
 Izvestia of the Russian Geographical Society, 92
- Jack (R. L.), Geology of New Guinea, 209
 Jackdaws, Tame, G. C. Green, 545
 Jackson (B. Daydon), Index of Genera and Species of Flowering Plants, 39
 Jagor (Dr. H.), Proposed Expedition to Indo-China, 258
 Jamaica, Disease among the Cocoa-nut Palms of, 88; Earthquake in, 207; the proposed Columbus Marine Biological Station at, Prof. Ray Lankester, 420
 Jamieson (T. F.), Supplementary Remarks on Glen Roy, 94
 Janssen (M.), Presidential Address to French Meteorological Society, 350
 Japan: Earthquakes in, 19, 86; Effects of Japanese Earthquake of October 28, 1891, 38; Seismometry and Engineering in Relation to the Recent Earthquake in Japan, Prof. John Milne, F.R.S., 127; the Recent Earthquake in Japan, Prof. F. A. Forel, 199; Earthquake-observing Stations in, 471; Avifauna of, 40; Flora of, 40; Tokyo Botanical Magazine, 46; Illustrations of the Flora of Japan to serve as an Atlas to the Nippon-Shokubutsushi, Tomitaro Makino, 149; Annual (1889) Meteorological Report, 184; Proposed Construction of numerous Meteorological Observatories in Japan, 258; the Meteorological Station of Naha, Liukiu Islands, 597; Science in Japan, Prof. E. Ray Lankester, F.R.S., 256; the English Language in Japanese Schools, 303; the Ancient Tombs and Burial Mounds of Japan, Prof. Hitchcock, 381
 Java, Relics of the Hindu Period in, 88
 Jephson (Major I. A. M.), Botany of the Emin Relief Expedition, 9
 Jervis (G.), Geology of Pantelleria, 207
 Jeserich (Dr. Paul), Photography applied to the Detection of Crime, 568
 Joannis (M.): Curious Compound of Lead, Sodium, and Ammonium, 158; some well-defined Alloys of Sodium, 504
 Johns Hopkins University, Report for 1891, 259
 Joly (J.): Pfaff's Allgemeine Geologie als Exacte Wissenschaft, 126; a Shutter for Use in Stellar Photography, 167
 Jones (A. Coppen), Arrow Poison, 343
 Jones (Miss E. E. C.), Implications of Science, 223, 366
 Jones (Herbert), the Silchester Remains, 259
 Jones (T. Wharton, F.R.S.), Death of, 86
 Journal, a New Astronomical, 307
 Journal of Botany, 46, 287, 477, 596
 Journal of the Royal Agricultural Society, 568
 Judd (Prof. John W., F.R.S.), the October Eruption Northwest of Pantelleria, G. W. Butler, 154; Report on the Scientific Results of the Voyage of H.M.S. *Challenger* during the Years 1873-76, 409
 Junker (Dr. Wilhelm), Travels in Africa during the Years 1879-83, 507
 Junker (Dr. Wilhelm), Obituary Notice of, 376

- Jupiter, the Planet, 521; Outburst of Dark Spots on, 41; the Rotation of, A. Belopolsky, 70; W. F. Denning, 473; Jupiter and his First Satellite, E. G. Barnard, 159; Jupiter's Satellites, Measurement of, by Interference, A. A. Michelson, 160; the Red Spot on, W. F. Denning, 272
- Kalm's² Account of his Visit to England on his way to America in 1748, 412
- Karakoram Range, Expedition to explore the Glaciers of the, 349
- Karamate (Prof. Konstantin), a Simple Heat Engine, 416
- Karsten (G.), Ueber die Mangrove-Vegetation im Malayischen Archipel, 3
- Kefyr in Use in Canada and United States, Milk-ferment identical with, C. L. Mix, 471
- Kellicott (Dr.), Fresh-water Sponges in the Buffalo Bay and Niagara Region, 305
- Keltie (J. Scott), Statesman's Year-Book for the Year 1892, 437
- Kennedy (Admiral), Sporting Sketches in South America, 390
- Kerr (J. G.), the Gran Chaco, 351
- Kew Bulletin, Proposed Discontinuance of the, 494
- Kew Bulletin: Collection of Dried Plants from the Solomon Islands, 586
- Kew, Effects of Fog on Plants grown in the Houses at, W. Watson, 16
- Kew Gardens, Jubilee of, 378; Collections of Plants at, 586
- Kew Observatory, Two new Forms of Anemometer in use at, 587
- Keyes (C. R.), Fossil Fauna in Central Iowa, 208
- Kikuchi (Prof.), Treatise on Geometry, 20
- Kilgour (H.): the Thermal Emissivity of Thin Wires in Air, 162; Interference with Alternating Currents, 238
- Kilima-Njaro District, Discovery of Saltpetre and Soda in, 379
- Kinetic Energy, on the Boltzmann-Maxwell Law of Partition of, Rev. H. W. Watson, F.R.S., 512
- Kipling (John Lockwood), Beast and Man in India, 131
- Kipping (F. S.): Camphrene, 263; Production of Ketone 1:2:4-Acetorthoxylene from Camphor by Action of Sulphuric Acid and Zinc Chloride, 551
- Kleiber (Dr. J.), Displacement of Radiant Points, 570
- Klein's Modulant Functions, F. N. Cole, 597
- Klinge (Herr), Peat-bog Eruptions, 472
- Klobb (M.), Anhydrous Sulphates of Zinc, Nickel, Copper, and Cobalt obtained in Crystals, 569
- Knott (Prof. C. G.), Magnetization of Iron, 431
- Koebele (Mr. Albert): and the Enemies of Insect Pests, Sir James Hector, 65; *Orcus chalybeus* an important enemy of the Red Scale, 323
- Koh-i-Nur, the, Prof. N. Story Maskelyne, F.R.S., 5; Dr. V. Ball, F.R.S., 126
- König (Prof.), the Curves of Luminosity of Spectral Colours under very feeble Illumination, 432
- Kopp (Prof. Hermann): Death of, 419; Obituary Notice of, Prof. T. E. Thorpe, F.R.S., 441
- Korea, Charles W. Campbell, 307
- Korschelt (Dr. E.), Lehrbuch der Vergleichenden Entwicklungsgeschichte der Wirbellosen Thiere, 145
- Korteweg (Prof. D. J.) on Van der Waals's Isothermal Equation, 152, 277
- Korthals (Dr. P. W.), Death and Obituary Notice of, 377
- Krueger (Prof.), Motions of Periodic Comets, 446
- Krüger (Dr.), Chemical Constitution of Adenin and Hypoxanthin, 168
- Kuntze (Dr. Otto), Revisio Genera Plantarum Vascularium omnium, atque Cellularium Multarum, secundum Leges Nomenclaturæ Internationales, cum Enumeratione Plantarum in Itinere Mundi collectarum, W. Botting Hemsley, F.R.S., 169
- Kurdistan, Journeys in Persia and, Mrs. Bishop, 248
- La Plata, the Naturalist in, W. H. Hudson, Dr. Alfred R. Wallace, 553
- Laboratory at Berlin, Prof. Pictet's, Prof. R. du Bois-Reymond, 31
- Laborde (M.), Arrow-poison of Sarro Savages, 278
- Lachlan (R.), Theorems relating to a Series of Coaxial Circles, 335
- Lachmann (Dr.), Research on Extremes of Temperature in Europe, 576
- Lacroix (A.), Formation of Cordierite in Sedimentary Rocks fused by Coal Fires, 240
- Lacroix (M. A.) on the Relations Existing between the Form and Nature of the Beds of Andalusite at Ariège, 624
- Lagrange et Hoho (E.), Study of Light and Heat Phenomena accompanying Electrolysis, 216
- Lake Superior, Prehistoric Mines on, E. B. Hinsdale, 39
- Lamarck, 1799, "Meretrix," versus "Cytherea," Lamarck, 1806, C. R. Osten Sacken, 30
- Lamas, the Land of the, William Woodville Rockhill, 98
- Lancashire Boilers, Modern, Samuel Boswell, 22
- Landauer (J.), Blowpipe Analysis, 580
- Lang (Arnold), Text-book of Comparative Anatomy, Prof. E. Ray Lankester, F.R.S., 145
- Langley (Prof. S. P.): Smithsonian Standards for Physical Apparatus, 197; Report for the year, Smithsonian Institution, 261
- Lankester (Prof. E. Ray, F.R.S.): Obituary Notice of Henry Nottidge Moseley, F.R.S., 80; Text-book of Comparative Anatomy, Arnold Lang; Lehrbuch der Vergleichenden Entwicklungsgeschichte der Wirbellosen Thiere, Dr. E. Korschelt und Dr. K. Heider, 145; Election to Linacre Professorship of, 183; Science in Japan, 256; the late Dr. Carpenter's Microscope and its Revelations, Seventh Edition, by Rev. W. H. Dallinger, F.R.S., 313; University of London, 413; the proposed Columbus Marine Biological Station at Jamaica, 420; a Zoologist on Disease, Dr. Elie Metschnikoff, 505; Exchange of Professorial Duties, Prof. T. P. Anderson Stuart, 557
- Lapworth (Prof. Charles, F.R.S.), Royal Society Medallist, 111
- Larat (L.), Medical Utilization of Alternating Currents of High Potential, 456
- Larkin (F. Charles), Outlines of Practical Physiological Chemistry, 292
- Larmor (J.): Effect of Flaws on Strength of Materials, 166; Equations of Propagation of Disturbances in Gyrostatically Loaded Media, 214; the Simplest Equivalent of a given Optical Path, 502
- Larynx, the Mechanism of the Closure of the, Prof. T. P. A. Stuart, 357
- Lasne (H.), Barometric Gradients, 350
- Latham (Baldwin): Evaporation and Condensation, 335; Observations on the Flow of Underground Water, 336
- Latitude: the Variation of, 117, 210; Dr. S. C. Chandler, 404; Robt. B. Hayward, F.R.S., 465; Dr. B. A. Gould, 521; M. Faye, 570; Periodic Variations in, Chandler, 589
- Latus (Johann), the Case of, 349
- Lauder (A.), Corydaline, 383
- Laurence (G. F.), a Curious Stone Hammer found in the Thames, 324
- Laurat (Em.), the Fixation of Free Nitrogen by Plants, 143
- Laurie (Malcolm): some Points in Development of *Scorpio fulvipes*, 140; Development of Lung Books of *Scorpio*, 311; some Eurypterid Remains from Upper Silurian Deposit of Pentland Hills, 239
- Law of Limiting Apertures, Dr. E. J. Spitta, 186
- Lawrence-Hamilton (J.), Self-Registering Weather-Cock, 559
- Lawson (Dr. T. A.), Ortho- and Paranitro-ortho-toluidine, 92
- Layng (A. E.), Euclid's Elements of Geometry, 149
- Le Chatelier (H.): Metallic Borates, 240; the Theory of Regulation, 288; Optical Determination of High Temperatures, 360; the Temperature of the Sun, 547
- Le Dentu, on the Implanting of Large Pieces of Decalcified Bones to fill up Losses of Substance of Skeleton, 95
- Leahy (A. H.), Law of Distribution of Velocities in a System of Moving Molecules, 527
- Leather Industry at the Chicago Exhibition, 587
- Lecture Experiment on Sound, Reginald G. Durrant, 415
- Lees (C. H.), the Thermal Conductivities of Crystal and other Bad Conductors, 382
- Leeward Islands, Meteorological Report for 1890, 258
- Lefebvre (Julien), the Dielectric Power, 95
- Lefebvre (Julien), the Attraction between Two Disks separated by a Dielectric, 575
- Lehmann (Dr. Paul), the Elements of the Minor Planets, 42
- Lehmann (Herr) on the Camel, 87
- Leibius (Dr. A.) on Scientific and Technical Education in New South Wales, 88
- Leigh (Hon. M. Cordelia E.), an Account of British Flies (Diptera), 173
- Leigh (Randle), Outlines of Practical Physiological Chemistry, 292

- Leloir (M.), Prevention of Hiccough by Pressure on the Phrenic Nerve, 312
- Lemming, Migration of the, F. Howard Collins, 149; W. Duppa-Crotch, 199, 294; Prof. Geo. J. Romanes, F.R.S., 249; W. Mattieu-Williams, 294
- Lemurs and Insectivora, Placentation of certain, Hubrecht, 600
- Lepidodendrons, Fossil, on the Discovery of Two Specimens of, in the Neighbourhood of Bathurst, New South Wales, W. J. C. Ross, 424
- Lepidoptera: of Winchester, 115; Stridulation in certain Lepidoptera, G. F. Hampson, 503; the Gradual Extinction of many Species of Lepidoptera in the Fens, Dr. Wheeler, 567; Pigments of, F. Gowland Hopkins, 581; T. H. Perry Coste, 605; Prof. R. Meldola, F.R.S., 605
- Lesage (P.), Chloride of Sodium in Plants, 312
- Leslie (Robert C.), Eclipse of the Moon, 53
- Lester's (Dr. Brown) Collection of the Flora of the River Gambia, 278
- Leucocytes, Influence of, on the Clotting of Blood, Dr. Lilienfeld, 599
- Levasseur (Emile), Surfaces and Population of European States, 528; Population of the Five Continents, 552
- Leveau (G.), Tables of Vesta, 95
- Levels, J. A. C. Oudemans, 240
- Levett (R.), the Elements of Plane Trigonometry, 509
- Lévy (Albert), Ammonia in Atmospheric Waters, 168
- Levy (Dr. Max), Influence of Blood Supply to Skin on Sweat Secretion as seen in Paw of Cat, 312
- Lévy (M.), Titanium Phenylate and other Compounds in which Hydroxylic Hydrogen of Phenols is replaced by Titanium, 589
- Lewes (V. B.), the Luminosity of Coal Gas Flames, 382; the Origin of Acetylene in Flames, 525; Air and Water, 531
- Ley (Annie), Sun Pillar, 484
- Libraries, Free Public, in Manchester, 157
- Lick Spectroscope, the, 473
- Liège School of Mines and Engineering, 116
- Ligation of the Great Arteries in Continuity, a Treatise on the, with Observations on the Nature, Progress, and Treatment of Aneurism, Charles A. Ballance and Walter Edmunds, Dr. M. Armand Ruffer, 530
- Light, Sir H. Trueman Wood, 269
- Light, Zodiacal, O. T. Sherman, 381
- Light, Electrodynamic Theories and the Electro-magnetic Theory of, M. Poincaré, Prof. A. Gray, 367
- Light on Silver Chloride, Thermodynamical View of Action of, H. M. Elder, 524
- Light, Crystalline Absorption and the Choice between the Different Theories of, E. Carvallo, 528
- Light, Magnesium as a Source of, Fred. J. Rogers, 622
- Lighthouses, Burning Oils for, E. P. Edwards, 379
- Liquids, the Flow of, in Capillary Tubes, Albert Colson, 120
- Lilienfeld (Dr.), Influence of Leucocytes on the Clotting of Blood, 599
- Limpach (L.), New Method of Preparing β -Dinaphthylene Oxide, 93; Ethyldimethylamidobenzene, 551
- Limpet's Power of Adhesion, the, Percy A. Aubin, 464
- Limpet's Strength, the, J. Lawrence Hamilton, 487
- Linder (S. E.), Metallic Hydrosulphides, 262; Solution and Pseudo-Solution, ii., 263
- Lindsay (R.), Insectivorous Plants, 157
- Lindsay's (Mr.) Expedition in Western Australia, D. Murray, 425
- Line of Sight, Motion of Stars in the, Prof. H. C. Vogel, 280
- Line Spectra of the Elements, on the, Prof. C. Runge, 607
- Linearger (C. E.), on the Nature of Colloid Solutions, 622
- Linnean Society, 93, 120, 166, 215, 335, 383, 454, 479, 526
- Lippmann's Colour Photography, 119
- Liquids, the Mechanical Stretching of, A. M. Worthington, 358
- Liverpool, Telephone Installation at Adelphi Hotel, 184
- Littledale's (Mr. and Mrs.) Journey across the Pamirs, 90
- Littledale (Harold), Big Game in India, 158
- Liversidge (A., F.R.S.), on the Rusting of Iron, 424
- Living World, the, Whence it Came and Whither it is Drifting, Prof. H. W. Conn, 317
- Lizard, Enormous American, L. Stejneger, 40
- Locard (A.), Les Coquilles Marines des Côtes de France, 219
- Lock (Rev. J. B.), the First Book of Euclid's Elements, 460
- Lockyer (Prof. J. Norman, F.R.S.), Motion of Stars in the Line of Sight, 117; on some Points in Ancient Egyptian Astronomy, 296, 373; the New Star in Auriga, 429, 473; the Origin of the Year, 487
- Locust of New South Wales, the Plague, A. S. Olliff, 520
- Lodge (Prof. Oliver J., F.R.S.), Vacuum Tubes and Electric Oscillations, 366; Aberration Problems, 549
- Lohse (Dr.), Observations of Mars, 326
- London County Council, the New, and Technical Education, 566
- London Hospital, Mr. F. J. M. Page appointed to Chair of Chemistry and Physics at, 566
- London, Royal Commission to Investigate the Question of a Teaching University for, 612
- London Town, Within an Hour of, 557
- London, University of, W. T. Thiselton-Dyer, F.R.S., 392; Prof. E. Ray Lankester, F.R.S., 413; Prof. W. F. R. Weldon, F.R.S., 440
- London, the Water-supply of, John Hopkinson, 88; Appointment of Commission on, 470
- Loney's Elementary Dynamics, 20
- Longridge (James Atkinson), the Artillery of the Future and the New Powders, 146
- Lopatin (M.), Rocks Collected by, on the Podkamennaya Tunguska, 597
- Loschardt (Herr), Rotation of Venus, 210
- Love (J.), Aurora Borealis, 223
- Lovén (Prof. Svén), Resignation of his Position as Senior Keeper in the Stockholm Natural History Museum, 613
- Lucas (F. A.), Animals recently Extinct or Threatened with Extinction, 305
- Lumholtz's (Carl), Explorations in Northern Mexico, 136
- Luminous Clouds, Proposals for a Co-operative Observation of the so-called, 117
- Lunar Eclipse, Total, of November 15, 42
- Lunar Eclipses, Increase of the Earth's Shadow during, Dr. Hartmann, 498
- Lunge (George, Ph.D.), the Manufacture of Sulphuric Acid, Prof. T. E. Thorpe, F.R.S., 121
- Lunge (George, Ph.D.), and F. Hurter, Ph.D., the Alkali Maker's Hand-book, Prof. T. E. Thorpe, F.R.S., 121
- Lydekker (Richard), Catalogue of Fossil Birds in the British Museum, 33; *Dacrytherium ovinum*, 94
- Lynn, Large Greenland Shark stranded at, T. Southwell, 546
- Lyons (A. B.) the Salt Lake of Aalia Paakia, 29
- Lyons (C. L.), Features of Hawaiian Climate, 190
- Macadamising Roads, Warning against the use of Rotten Flints for, C. Carus-Wilson, 379
- McAuley (A.), Quaternions as a Practical Instrument of Physical Research, 423
- MacBride (E. W.), the Development of the Oviduct in the Frog, 450
- McClellan (F.), Spectra of the Sun and Metals, 159
- McClelland (W.), a Treatise on the Geometry of the Circle, and some Extensions to Conic Sections by the Method of Reciprocation, 412
- Macdonald (H. M.), the Self-Induction of Two Parallel Conductors, 166
- Macgowan (Dr.), the Origin of the Ass, the Cat, and the Sheep in China, 285
- MacGregor (Prof. J. G.), Auroras at Halifax, 7
- Mackenzie (J. E.), Synthesis of Hexahydroterephthalic Acid, 383
- McKinley Tariff and Scientific Instruments, 208
- McLachlan (R., F.R.S.), Sparrows and Crocuses, 441
- McLachlan (R., F.R.S.), Abbreviated Wings of the Male Caddis-fly, 623
- Maclay (Sir Wm.), Death and Obituary Notice of, 303
- Macpherson (A. Holte), Torpid Cuckoo, 416
- Macro-Lepidoptera and Birds of Winchester, 115
- Madras Observatory, Proposed Removal of, 258
- Magnesium as a Source of Light, Fred. J. Rogers, 622
- Magnetism: Electricity and Magnetism, by Amédée Guillemin, Prof. A. Gray, 1; some Experiments made with the View of ascertaining the Rate of Propagation of Induced Magnetism in Iron, Fred. T. Trouton, 42; Electro-magnetism, S. P. Thompson, F.R.S., Prof. A. Gray, 73; Magnetic Rotary Power of Solutions of Ammonium and Sodium Salts of Fatty Acids, Dr. W. H. Perkin, F.R.S., 92; Attraction of Liquid Oxygen by Faraday Magnet, Prof. Dewar, 154; a Permanent Magnetic Field, W. Hibbert, 191; Magnetic Disturbance, G. M. Whipple, 364; Magnetic Perturbation of February 13-14, 1892, M. Moureaux, 408; Magnetic Storm of February 13-14, 1892, 493; H. Wild, 480; Magnetic Storms, Dr. M. A. Veeder, 557; a First Book of Electricity and Magnetism, W. Perren Maycock, 248; Influence of

- Electric Discharge during Thunderstorms on Apparatus registering Terrestrial Magnetism, Em. Marchand, 264; Absolute Values of Magnetic Elements on January 1, 1892, M. Moureaux, 264; Magnetization of Iron, Prof. C. G. Knott, 431
- Maiden (J. A.), Panax Gum, 567
- Maize as Food, the Value of, 234
- Maize, Wild, found in Mexico, 39
- Makino (Tomitarō), Illustrations of the Flora of Japan to serve as an Atlas to the Nippon-Shokubutsushi, 149
- Malacology, French, A. Locard, 219
- Malay Peninsula, the Ipho Poison of the, Leonard Wray, Junior, 278
- Mallard (M.), the Native Iron of Cañon Diablo, Arizona, 575
- Mallet (F. R.), Physiological Action of Diminished Atmospheric Pressure, 606
- Mammalia, Catalogue of, in the Indian Museum, Calcutta, W. L. Sclater, 50
- Man, Beast and, in India, John Lockwood Kipling, 131
- Man, Evolution of, Prof. Ernst Haeckel, 482
- Man in Nature, Paul Topinard, 457
- Man's Place in Nature, Prof. N. S. Shaler, 220
- Manchester, Free Public Libraries in, 157
- Manchester Field Naturalists' Society, Programme of Summer Excursions, 614
- Manchu Race, the, 523
- Mangrove Vegetation in the Malay Archipelago, W. B. Hemsley, 3
- Mangrove as a Source of Tannin, the, Dr. J. T. Rothrock, 546
- Manipulation of the Microscope, Edward Bausch, 342
- Manitoba, the Prairie Larks of, E. E. Thompson, 135
- Mannerling (Geo. Edward), With Axe and Rope in the New Zealand Alps, Prof. T. G. Bonney, F.R.S., 147
- Maquenne (M.); Direct Combination of Nitrogen with Alkaline-Earthly Metals, 264; Barium and Strontium Nitrides, 360; Interesting Compound of Carbon and Barium, 404
- Marcano (V.), the Ammonia in the Air and Rain of a Tropical Region, 143
- Marchand (Em.), Influence of Electric Discharge during Thunderstorms on Apparatus registering Terrestrial Magnetism, 264
- Marchand (M.), Solar Observations, 352
- Marey (M.), Use of Chronophotography for Study of Aërial Locomotive Machines, 71
- Marine Biological Association, 116
- Mariotti (W.), Investigation into the Thunderstorms of 1888-89, 215
- Mars, Observations of, Dr. Lohse, 326
- Marshall (Arthur), Aurora, 605
- Marsupialia, Teeth-Development in the, M. F. Woodward, 335
- Maryland, a Geological Excursion in, Prof. G. H. Williams, 235
- Mascart (M.), Theory of Astronomical Aberration, 68; the Mass of the Atmosphere, 311
- Maskelyne (Prof. N. Story, F.R.S.), the Koh-i-Nur, 5, 126
- Mason (Prof. O. T.), Eskimo Throwing-sticks, 66
- Mason Science College, Birmingham, Report on Educational Work of, 519
- Massee (G.), British Fungi, Phycomycetes and Ustilagineæ, 411
- Massol (G.), Thermal Data concerning active Malic Acid and Potassium and Sodium Malates, 167; Tartronic Acid and the Tartronates of Sodium and Potassium, 432; the Heats of Formation of Potassium Carballylates, 456; Citric Acid, 504
- Mathematics: Prof. Kikuchi's Treatise on Geometry, 20; Loney's Elementary Dynamics, 20; "W = Mg," Prof. Arthur G. Webster, 29; an Introduction to the Differential and Integral Calculus, T. Hugh Miller, 52; Lemoine's Two Problems of Stamps, Prof. Schoute, 72; Mechanics for Beginners, Part I., Rev. J. B. Lock, 101; Mathematical Society, 119, 214, 335, 407, 502, 623; Bulletin of the New York Mathematical Society, 124, 341; Mathematical Exercises, A. T. Richardson, 125; the Loci of Singular Points and Lines occurring in Connection with Theory of Locus of Ultimate Intersections of a System of Surfaces, Prof. M. J. M. Hill, 141; Prof. D. T. Korteweg on Van der Waals's Isothermal Equation, 152; Equations of Propagation of Disturbances in Gyrostatically Loaded Media, J. Larmor, 214; Theory of Elastic Wires, A. B. Basset, F.R.S., 215; Harmonic Functions for the Elliptic Cone, E. W. Hobson, 335; Theorems relating to a Series of Coaxial Circles, R. Lachlan, 335; Stamp-folding Problem, Prof. Schoute, 335; the Logical Foundations of Applied Mathematical Sciences, Mr. Dixon, 407; Mathematical Analogies between various Branches of Physics, Prof. Bragg, 423; the Theory of Determinants in the Historical Order of its Development, Thos. Muir, 481; the Simplest Equivalent of a given Optical Path, Dr. J. Larmor, 502; Dualistic Differential Transformations, E. B. Elliott, F.R.S., 503; Rectification of the Cartesian Oval, Prof. Greenhill, F.R.S., 503; Elementary Mathematical Astronomy, C. W. C. Barlow and G. H. Bryan, 579; Klein's Modular Functions, F. N. Cole, 597
- Mathews (F. E.), α and β Modifications of Chlorobenzene Hexachloride, 263
- Matignon (M.), Heat of Formation of Hydrazine and Hydrazoic Acid, 95
- Mattieu-Williams (W.), Migration of the Lemming, 294
- Maudslay (Alfred P.), Ancient Civilization of Central America, 617
- Maunder (E. W.), Spectrum of Nova Aurigæ, 616
- Maxwell (J. Clerk), Theory of Heat, 222
- Maxwell, M. Poincaré and, Prof. Geo. Francis Fitzgerald, F.R.S., 532
- Mayal (John), Proposed Fund for the Family of the late, 86
- Maycock (W. Perren), a First Book of Electricity and Magnetism, 248
- Mayhew's Illustrated Horse Doctor, 27
- Measure and Weight, Examination of the Standards of, immured in the Houses of Parliament, 534
- Mechanical Engineers, Institution of, 22, 585; Annual Meeting, 355, 585
- Mechanics, Celestial, Two New Laws of, H. Struve, 70
- Mechanics for Beginners, Part I., Rev. J. B. Lock, 101
- Mechanics, American Superiority in, Coleman Sellers, 157
- Mechanics, Applied, Sheets and Tie-rods Laterally Loaded, Prof. J. Perry, F.R.S., 192
- Mechanics: the Law of Elastic Lengthening, J. O. Thompson, 311; the Flexure of Long Pillars under their own Weight, Prof. M. Fitzgerald, 479
- Medical Students, Physiological Chemistry for, F. Charles Larkin Randle Leigh, 292
- Mediterranean, Austrian Government Deep-Sea Exploration in, 518
- Medium for Preserving the Colours of Fish and other Animals, 212
- Medoc District, the Wines of the, 279
- Milk Ferment identical with Kefyr in use in Canada and United States, C. L. Mix, 471
- Meldola (Prof. R., F.R.S.), Photography as a Branch of Technology, 331; Pigments of Lepidoptera, 605
- Mendeléeff (D.), the Principles of Chemistry, 529
- Mendenhall (T. C.), the Use of a Free Pendulum as a Time Standard, 450
- Mental Arithmetic, Clive Cuthbertson, 78; Dr. K. Haas, 198
- Mercury Mining in Russia, 305
- "Meretrix," Lamarck, 1799, *versus* "Cytherea," Lamarck, 1806, C. R. Osten Sacken, 30
- Mergui, Tin Mining in, 496
- Merope, Measures of the Nebulæ near, 352
- Merrill (Geo. P.), Stones for Building and Decoration, 222
- Merz (Dr.), Lithium Nitride, 307; Magnesium Nitride, 280
- Meslans (M.), Synthesisization of Two New Liquids containing Fluorine, 547
- Metallurgy: Iron Production in United States, Berkley, 65; Production of Pig-Iron in United States, John Birkinbine, 208; Value of Metallurgical Science, Prof. Roberts-Austen, 257; Prince Louis Lucien Bonaparte's Collection of Metals, 348; Art Metal Work; Bronze in the London Atmosphere, Prof. Roberts-Austen, 443; Metals at High Temperatures, Prof. W. C. Roberts-Austen, F.R.S., 534
- Meteoritic Iron, E. Cohen, E. Weinschenk, 69
- Meteoritic Iron, a New Locality for, with a Preliminary Notice of the Discovery of Diamonds in the Iron, Prof. A. E. Foote, 178
- Meteorology: U.S. Pilot Chart for October, 1891, 38; the Hydrology of Mitta Mitta, James Stirling, 40; the Climate of Alta Verapaz (Guatemala), Dr. Sapper, 41; Phenomenal Barometrical Depression (November 11, 1891), G. J. Symons, 65; Catalogue of Deutsche Seewarte Library, 65; the Magdeburg Zeitung for 1890, 65; Cloud-Observation at Sea, Prof. C. Abbe, 70; the Weather Bureau of the United States, 86; Meteorology of Finland, 87; International Conference of

- Meteorologists at Munich, 87; Electric Self-recording Rain-gauge, W. J. E. Binnie, 95; Wet and Dry Bulb Formulæ, Prof. J. D. Everett, F.R.S., 95; Results of Observations at Akasso, F. Russell, 95; Atlas of the Meteorology and Physical Data of the Indian Ocean, 101; the Publications of the Meteorological Department of India, 113; Rainfall and Thunderstorms of Berlin, 114; Cyclones in Europe, 114; the Temperature of the Rivers of Central Europe, 114; Proposals for a Co-operative Observation of the So-called Luminous Clouds, 117; Cyclones in the Arabian Sea, 276; Cyclone Memoirs of the Arabian Sea, W. L. Dallas, 135; the Tides of the Bay of St. Malo, M. Heurtault, 143; the Ammonia in the Air and Rain of a Tropical Region, Marciano and Muntz, 143; Wind Direction, 149; Radiation of Upper Clouds round Barometric Minima, Dr. H. E. Hamberg, 156; Meteorological Observations at Cairo, 1868-88, Dr. J. Hann, 156; Meteorological Observations during Balloon Voyages, Dr. Assmann, 168; the Severe Gale of November 11, Chas. Harding, 181; Mr. E. Engelenburg, the new Director of the Dutch Observations on Land, 183; Annual Meteorological Report for Japan (1889), 184; Prof. Hazen's High Balloon Voyages, 189; Meteorology at French Association at Marseilles, A. L. Rotch, 189; Features of Hawaiian Climate, C. L. Lyons, 190; Instructions Météorologiques, A. Angot, 196; Annals of Meteorological Office of Paris (1889), 208; a Weather Lexicon, Herr Seemann, 208; Investigation into Thunderstorms of 1888-89, W. Marriott, 215; the Prevalence of Fog in London, 1871-90, F. J. Brodie, 215; Report on the Meteorology of India in 1889, John Eliot, 217; Report on the Administration of the Meteorological Department of the Government of India, 217; Plan for Observations to determine Local Distribution and Altitude of Aurora, 234; Temperature Observations made in 1890 on Eiffel Tower, Angot, 234; Meteorological Observations at San José (1889), H. Pittier, 234; Pilot Chart of North Atlantic Ocean for December 1891, 258; Meteorological Report for Leeward Islands for 1890, 258; Frequency and Geographical Distribution of heavy Daily Rainfalls in European Russia, E. Berg, 258; Proposed Removal of Madras Observatory, 258; Proposed Construction of numerous fresh Meteorological Observatories in Japan, 258; Cause of Floating of Particles of Cloud and Fog, Herr von Frank, 259; Sun-spots and Air Temperature, 271; Harmonic Analysis of Hourly Observations of Air-temperature and Pressure at British Observatories, 279; the Year's Sunshine in the British Isles, 1881-90, 279; the Quantity of Sugar produced in various Plants as a Means of determining the Meteorological Elements concerned, Abbé Buvé, 279; new Condensation Hygrometer, Henri Gilbault, 288; on the Number of Dust Particles in the Atmosphere of various Places in Great Britain and on the Continent, with Remarks on the Relation between the Amount of Dust and Meteorological Phenomena, John Aitken, F.R.S., 299; Curves showing Fluctuations of Temperature and Pressure at Base and Summit of Mount Washington, 304; Temperature Observations at Geneva, M. Chaix, 304; Prof. Wiborgh's Air-pyrometers, John Crum, 304; Thermometer-Temperature and Skin-Temperature, M. Vincent, 304; Curious Nocturnal Rosy Sky Light at Berlin, 324; Rainfall Atlas of Jamaica, Maxwell Hall, 324; Evaporation and Condensation, Baldwin Latham, 335; Observations on the Flow of Underground Water, Baldwin Latham, 335; Ammonia in Rain-water, A. Muntz, 336; Presidential Address of M. Janssen to French Meteorological Society, 350; Barometric Gradients, H. Lasne, 350; International Monthly Charts of Mean Barometric Pressures and Wind Directions, General Greely, 350; Ferrel's View of the General Circulation of the Atmosphere, Prof. W. M. Davis, 357; Cold Waves, Dr. A. Woeikof, 357; Nacreous Clouds, T. W. Backhouse, 365; Remarkable Display of Aurora Borealis in America, 378; Causes of the Famine in Russia, Dr. A. Woeikof, 378; Silver Thaw at Ben Nevis Observatory, R. C. Mossman, 378; the Mountain Meteorological Stations of the United States, A. L. Rotch, 403; the Blue Hill Meteorological Observatory, 418; Untenability of Atmospheric Hypothesis of Epidemics, Hon. R. Russell, 431; the Origin of Influenza Epidemics, H. Harries, 431; the Phenological Observations for 1891, E. Mawley, 431; Relationship of Atmospheric Electrical Phenomena to Terrestrial Magnetism, Dr. Assmann, 432; Observations made in a Captive Balloon, Dr. Assmann, 432; the Service of Roumania, 444; the Danish Meteorological Institute and Deutsche Seewarte Daily Synoptic Weather Charts for North Atlantic Ocean, 444; Influence of Total Solar Eclipse on Air Pressure; Herr Steen, 444; the Samoan Hurricane, Everett Hayden, 461; the Magnetic Storm of February 13-14, 1892, 493; H. Wild, 480; the Winter Storms of Northern India, Henry F. Blanford, F.R.S., 490; Atlantic Weather and its Connection with British Weather, R. H. Scott, 496; Report of the Meteorological Council, 518; Cloud Pictures, Dr. Singer, 518; Prof. G. Hellmann's Rain-fall Record Experiments, 545; Value of Meteorological Instruments in Selection of Health Resorts, Dr. C. Theodore Williams, 551; Magnetic Storms, Dr. M. A. Veeder, 557; Meteorological Council's Issue of Tables of Monthly Means for Pressure, Temperature, and Rainfall, 567; Research on Extremes of Temperature in Europe, Dr. Lachmann, 576; Dust-Counting on Ben Nevis, Angus Rankin, 582; Deutsches Meteorologisches Jahrbuch, 1890, 587; the General Circulation of the Atmosphere, Dr. J. M. Pernter, 593; the Meteorological Station of Naha, Liukiu Islands, Japan, 597; Aurora, George M. Seabroke, 605; Arthur Marshall, 605; Arthur E. Brown 605; the Changefulness of Temperature as an Element of Climate, 610; Royal Meteorological Society, 623; Anemometer Comparisons, W. H. Dines, 623; Meteorological Society (see Royal)
- Meteors: Fall of Meteorites in Madras, 20; the Tonganoxie Meteorite, by E. H. S. Bailey, 119; a Brilliant Meteor, Thomas Heath, 295; Large Meteor of January 24, 1892, W. F. Denning, 317
- Metschnikoff (Dr. Elie): Leçons sur la Pathologie Comparée de l'Inflammation faites à l'Institut Pasteur en Avril et Mai, 1891, Prof. E. Ray Lankester, F.R.S., 505
- Mexican Atlal, 66, 102
- Mexican Leatherwork, Surviving Specimens of Ancient, 66
- Mexican Shields, Ancient, Zelia Nuttall, 520
- Mexico, Northern, Carl Lummholtz's Explorations in, 136
- Mexico, Projected Abandonment of Villages near Colina in Consequence of Activity of Neighbouring Volcano, 158
- Mexico, Wild Maize found in, 39
- Meyer (Lothar), Outlines of Theoretical Chemistry, Prof. M. M. Pattison Muir, 601
- Meyer (Prof. Victor): Royal Society Medallist, 111; Silent Combination of Hydrogen and Oxygen, 616
- Mica, Use of, at the Chicago Exhibition, 615
- Michael (A. D.), Association between Gamasids and Ants, 164
- Michelson (A. A.), Measurement of Jupiter's Satellites by Interference, 160
- Michigan Mining School, 88
- Micrometric Measurements, on the Influence of Ring and Disk Blinds in, Dr. Walter Wislicenus, 137
- Microscopy: Sir W. J. Sendall's Apparatus for making Accurate Measurements with Camera Lucida, 46; the Leach Lantern Microscope, W. I. Chadwick, 47; Microscopic Structure of Hard Steel, Behrens, 48; Photography Applied to the Microscope, F. W. Mills, 77; the Kenal Organs of Certain Decapod Crustacea, W. F. R. Weldon, 140; Nephridium of Lumbricus and its Blood-supply, Dr. W. B. Benham, 140; *Pelomyxa viridis*, Dr. A. G. Bourne, 140; the Medusæ of *Millepora Murrayi* and the Gonophores of *Allopora* and *Distichopora*, Dr. S. J. Hickson, 140; the Formation and Fate of the Primitive Streak in the Frog, Dr. A. Robinson and R. Assheton, 140; Some Points in Development of *Scorpio fulvipes*, M. Laurie, 140; the Occurrence of Pseudopodia in Diatomaceous Genera *Melosira* and *Cyclotella*, J. G. Grenfell, 140; the Resolution of *Amphipleura pellicuda*, J. W. Gifford, 143; a New Form of Mechanical Stage, H. Bernard, 239; Resolution of Podura, Hon. J. G. P. Vereker, 239; the late Dr. Carpenter's Microscope and its Revelations, Seventh Edition of, by Rev. W. H. Dallinger, F.R.S., Prof. E. Ray Lankester, F.R.S., 313; Manipulation of the Microscope, Edward Bausch, 342; Wandering Cells in Echinoderms, &c., H. E. Durham, 450; the Excretory Processes in Marine Polyzoa, S. F. Harmer, 450; the Differentiation of Leprosy and Tubercle Bacilli, Chas. Slater, 450; *Onchinosoma Steenstrupii*, A. E. Shipley, 450; Note on a Sieve-like Membrane across Oscula of a Species of Leucosolenia, E. A. Minchin, 450; the Development of the Oviduct in the Frog, E. W. MacBride, 450; the Nauplius Eye persisting in some Decapods, Margaret Robinson, 450; a New Genus of Synascidians from Japan, Oka and Willey, 450; Microscopic Structure of Oolitic Iron from Lorraine, M. Bleicher, 504; the Calculable Limit of Microscopic Vision, Prof. Czapski, 575; on the Microscopic

- Structure and Residues Insoluble in Hydrochloric Acid in the Devonian Limestone of South Devon, Edward Wethered, 597
- Migration of the Lemming, F. Howard Collins, 149; W. Duppa-Crotch, 199, 294; Prof. Geo. J. Romanes, F.R.S., 249; W. Mattieu-Williams, 294
- Milk, R. Henry Rew on the Statistics of the Production and Consumption of, in Great Britain, 614
- Milk and Diphtheria, Dr. R. Thorne Thorne, 123
- Milky Way, the Grouping of Stars in the Southern Part of the, H. C. Russell, F.R.S., 423
- Milky Way, New Star in the, Ralph Copeland, 325
- Mill (Dr. Hugh Robert): The Realm of Nature, 390; appointed Librarian to Royal Geographical Society, 566
- Miller (Dr. A. K.), Frangulin, ii., 214
- Miller (T. Hugh), an Introduction to the Differential and Integral Calculus, 52
- Mills (F. W.), Photography applied to the Microscope, 77
- Milne (Prof. John, F.R.S.), Seismometry and Engineering in Relation to the Recent Earthquake in Japan, 127
- Mimicry, Topical Selection and, David Syme, 30; Dr. Alfred R. Wallace, 30
- Minchin (E. A.), Note on a Sieve-like Membrane across Oscula of a Species of *Leucosolenia*, 450
- Mineralogy: Mineralogical Society, 19; Boleite, a New Mineral, 23; New Analysis of Uraninite, W. F. Hillebrand, 119; the Koh-i-Nur, Prof. N. Story-Maskelyne, F.R.S., 5, 126; Dr. Valentine Ball, F.R.S., 126; the Sillimanite Group and the Part played by Aluminium in the Silicates, W. Wernadsky, 141; Economic British Minerals at the Chicago Exhibition, 155; Discovery of Uranium in Swedish Anthracitic Minerals, Baron Nordenskiöld, 209; the Mineral Wealth of Brazil, 235; Microscopic Structure of Oolitic Iron from Lorraine, M. Bleicher, 504; Manganese Nodules in the Marine Deposits of the Clyde Sea-area, Murray and Irvine, 527; the Native Iron of Cañon Diablo, Arizona, M. Mallard, 575
- Mines, Copper, of French Congo, 135
- Mines and Mining, a Handy List of Books on, 116
- Mines, Royal School of, 257
- Mining, Electricity in Relation to, Ernest Scott, 184
- Mining, the Michigan School of, 88
- Mining in Russia, Mercury, 305
- Mining, Tin, in Mergui, 496
- Minor Planets, the Elements of the, Dr. Paul Lehmann, 42
- Missouri Botanical Garden, Pupils at the, 88
- Mistletoe to its Parent Tree, the Relation of the, Dr. G. Bonnier, 421
- Misunderstanding, a Possible, Thos. H. Blakesley, 441
- Mitchell (Hubbard Winslow), Evolution of Life, or Cause of Change in Animal Forms, 364
- Mitchell (J. C.), the Lateral Sense-organs of Elasmobranchs, 239
- Mivart (Dr. St. George, F.R.S.), Implications of Science, 60, 82, 222, 343
- Mix (C. L.), Milk-ferment identical with Kefyr in use in Canada and United States, 471
- Model, Wave Motion, F. Cheshire, 347
- Moissan (Henri): Two New Phospho-iodides of Boron, 67; Phosphides of Boron, 136; Action of Alkaline Metals on Boric Acid, 408; the Preparation of Amorphous Boron, 421; the Properties of Amorphous Boron, 527; Crystallization of Tetra-iodide of Carbon, 209; Colour and Spectrum of Free Gaseous Fluorine, 260
- Molecular Velocity, Relation of Voltaic Electromotive Force to, Dr. G. Gore, F.R.S., 596
- Molecular Weight of Gadolinia, 237
- Monck (W. H. S.), Proper Motions of the Stars, 8
- Monckton (H. W.), Gravel South of the Thames, Guildford to Newbury, 263
- Monkeys, Tender Feeling in, Robert Morley, 350
- Monteiro (Rosa), Delagoa Bay, its Natives and Natural History, 124
- Montelius (Prof.), the Chronology of the Neolithic Age in Scandinavia and the Bronze Age in the East and Southern Europe, 39
- Moon, a Double, Rose Mary Crawshay, 224
- Moon, Eclipse of the, Robert C. Leslie, 53
- Moon, Photography of the Eclipsed, 117
- Moon, the Recent Eclipse of the, Mrs. R. M. Crawshay, 134
- Moon, Secular Acceleration of the, and the Length of the Sidereal Day, 137
- Moore (C. B.), Opening a Burial Mound in Florida, 567
- Moreno (Señor), Discovery of Aboriginal Skulls in the Argentine, 278
- Morgan (C. Lloyd), Animal Sketches, 291
- Morgue, the, in Paris, 116
- Moritz (E. R.) and G. H. Morris, a Text-book of the Science of Brewing, 100
- Morley (Robert), Tender Feeling in Monkeys, 350
- Morris (D.), the *Icerya Purchasi* at St. Helens, 115
- Morris (D.), on the Phenomena concerned in the Production of Forked and Branched Palms, 598
- Morris (G. H.) and E. R. Moritz, a Text-book of the Science of Brewing, 100
- Morris (Prof.), on Universities in Australia, 426
- Morrison (Dr. Joseph), Solar Heat, 589
- Moseley (Henry Nottidge, F.R.S.): Death of, 64; Obituary Notice of, Prof. E. Ray Lankester, F.R.S., 80
- Mossman (R. C.), Silver Thaw at Ben Nevis Observatory, 378
- Moths, Silk-producing, Colonel Swinhoe, 38
- Moureaux (Th.), Absolute Values of Magnetic Elements on January 1, 1892, 264; Magnetic Perturbation of February 13-14, 1892, 408
- Mueller (Baron von), the Protection of Birds in Victoria, 280; Diagnoses of New Papuan Plants, 496
- Muir (Prof. M. M. Pattison), Outlines of Theoretical Chemistry, Lothar Meyer, 601
- Muir (Dr. Thomas): appointed Superintendent-General of Education for Cape Colony, 443; the Theory of Determinants in the Historical Order of its Development, 481
- Muirhead (Lieutenant B. A.), a Plague of Frogs, 30
- Müller (Dr.): on the Telluric Spectrum, 21; Photometric Observations, 90
- Müller (Dr. Fritz), Dismissal of, 156
- Müller (Dr. Hugo, F.R.S.), the Chemistry of Paints and Paintings, A. H. Church, F.R.S., 241
- Muller (P. T.), a Study of the Velocity of Decomposition of Diazo-Compounds by Water, 480
- Munro (J.), Heroes of the Telegraph, 5
- Muntz (A.), the Ammonia in the Air and Rain of a Tropical Region, 143; Ammonia in Rain-Water, 336
- Murchison (Sir Roderick), Centenary of, 398
- Murray (D.) on Mr. Lindsay's Expedition in Western Australia, 425
- Murray (Dr. John), Manganese Nodules in the Marine Deposits of the Clyde Sea-Area, 527; Deep-Sea Deposits, 409
- Murray (Dr. T. S.), Electrolysis of Potassium Acetate Solutions, 93
- Muscat, Projected Tidal Observatory at, 134
- Musical Instruments, the Bow as Origin of Stringed, Dr. E. B. Tylor, 184
- Museum of Natural History, Paris, Reorganization of, 183
- Museum, the Science, and the Tate Gallery, 385, 433
- Museum, Proposed County, for Bucks, 114
- Museums of the Future, G. B. Goode, 421
- Museums, Typological, General Pitt-Rivers, 184
- Mussel-poisoning in Tierra del Fuego, M. Segers, 134
- Mycology: British Edible Fungi, M. C. Cooke, 75
- Nachtigal (Gustav), Bust of, 566
- Nacreous Clouds, T. W. Backhouse, 365
- Naden (Constance), Further Reliques of, 389
- Nathorst (Dr. A. G.), Fresh Evidence Concerning the Distribution of Arctic Plants during the Glacial Epoch, 273
- National Electric Light Association, Fifteenth Convention of the, 470
- Natural History: Opportunity for a Naturalist, Dr. P. L. Sclater, F.R.S., 174, 269; Reorganization of Paris Museum of Natural History, 183; Natural History of Isolated Ponds, Clement Reid, 325; Obituary Notice of Henry Walter Bates, Naturalist of the Amazons, 398; the Horse, a Study in Natural History, William Henry Flower, F.R.S., 436; Natural History Society of Buda Pesth, 471; Preference of certain Birds for certain Trees, 471; the Naturalist in La Plata, W. H. Hudson, Dr. Alfred R. Wallace, 553; the Gradual Extinction of many Species of Lepidoptera in the Fens, 567
- Natural Science, 421, 521
- Natural Science to Art, on the Relation of, Prof. E. du Bois-Reymond, F.R.S., 200, 224; W. Ainslie Hollis, 319
- Natural Waters, the Salts in, 78; F. H. Perry Coste, 176; Robert B. Hayward, F.R.S., 176

- Nature, L'Électricité dans la, Georges Dary, 460
 Nature, La Place de l'Homme dans la, T. H. Huxley, 197
 Nature, Man in, Paul Topinard, 457
 Nature, Man's Place in, Prof. N. S. Shaler, 220
 Nature, the Realm of, Hugh Robert Mill, 390
 Nature Teachings, Cyclopædia of, H. Macmillan, 248
 Navajo Indians, Weaving as practised by the, Dr. Shufeldt, 260
 Naval Architects, Institution of, 570
 Nebulæ, some Apparently Variable, Lewis Swift, 261
 Nebulæ near Merope, Measures of the, 352
 Nebulæ and Star Clusters, Observations of, M. Bigourdan, 352
 Nebulæ, Variability of, Dr. Lewis Swift, 522
 Neesen (Prof.), Measurements of Latent Heats of Evaporation by means of a Condensation Calorimeter, 456
 Negreano (D.), Variation, with Temperature, of Dielectric Constant of Liquids, 408
 Neolithic Age in Scandinavia, Chronology of the, Prof. Montelius, 39
 Nephrite Axe found at Ohlau, Silesia, the, Dr. O. Schoetensack, 379
 Neptune, the Discovery of, Prof. Holden, 522
 New Forest Bill, the, H. Goss, 295
 New Forest in Danger, the, Herbert Goss, 343
 New Fragments, John Tyndall, F.R.S., 508
 New Guinea, British, J. P. Thomson on Recent Explorations and Discoveries in, 425
 New Guinea, Geology of, R. L. Jack, 209
 New South Wales: the Acclimatization of the Avocado Pear in, F. Turner, 66; Scientific and Technical Education in, 88; Tea Culture in, W. T. Robertson, 260
 New York Mathematical Society, 124; Bulletin of the, 341
 New York and Philadelphia, Proposed Ship Canal between, Prof. L. M. Haupt, 497
 New York Scientific Alliance, the, 544
 New York State, Earthquake in, 259
 New Zealand Alps, with Axe and Rope in the, Geo. Ed. Man-nering, Prof. T. G. Bonney, F.R.S., 147
 New Zealand, on a Recent Discovery of the Remains of Extinct Birds in, Prof. Henry O. Forbes, 416
 New Zealand Region, Aphanapteryx in the, Prof. Henry O. Forbes, 580
 Newcomb (Prof.), Periodic Perturbations of the Four Inner Planets, 548; N.P.D.'s observed with Greenwich and Washington Transit Circles, 548
 Newton (Prof. Alfred, F.R.S.), Ornithology of the Sandwich Isles, 465, 532
 Newton (Prof. H. A.), Capture of Comets by Planets, 186
 Nicaragua, Earthquake in, 471
 Nicholson (A. C.), High-level Glacial Grounds near Oswestry, 165
 Nickel Heat Engine, W. B. Croft, 392; Rev. Frederick J. Smith, 464
 Nile, Reported Discovery of Ultimate Source of, 154
 Nitrogen, Results of Experiments at Rothamsted on the Question of the Fixation of Free, Dr. J. H. Gilbert, F.R.S., 32
 Nitrogen, the Urinary Secretion of, Dr. Gumlich, 599
 Noble (Capt. A., F.R.S.), First Visible Colour of Incandescent Iron, 484
 Nomenclature in Biology, Suggestions for securing Greater Uniformity of, Prof. T. Jeffery Parker, F.R.S., 68
 Nomenclature, Botanical, Dr. Otto Kuntze, W. Botting Hems-ley, 169
 Nomenclature, Scientific, H. St. A. Alder, 104
 Non-Euclidian Geometry, Prof. H. Poincaré, 404
 Non-Metallic Chemistry, Synopsis of, W. Briggs, 604
 Nordenskiöld (Baron), Discovery of Uranium in Swedish An-thracitic Minerals, 209
 Norfolk and Norwich Naturalists' Society, 567
 North (Marianne), Recollections of a Happy Life, 602
 North America, Nature and Man in, Prof. N. S. Shaler, 220
 North Atlantic Weather Charts, Synoptic, 444
 Nova Aurigæ, Observations of the Spectrum of, Dr. Henry Crew, 569
 Nova Aurigæ, Spectrum of, E. W. Maunder, 616
 Nova Cygni, Photographs of the Region of, 617
 Novelists, Technical Education for, 487
 Nuovo Giornale Botanico Italiano, 46, 478
 Nurhagi of Sardinia, Dr. Erlming on the, 114
 Nuttall (Zelia), Ancient Mexican Shields, 520
 Oak, The, a Popular Introduction to Forest Botany, H. Marshall Ward, F.R.S., 509
 Object Glasses, Diffraction Effects produced by placing Screens in Front of, Prof. Pritchard, 237
 Objective Prism, the, Prof. Pickering, 521
 Objectives, Telescopic, A. Fowler, 204
 Observatories: Proposed Removal of Madras Observatory, 258; Report of the U.S. Naval Observatory, 352; the Warner Observatory, 422; Cordova Observatory, 446; Photography at the Cape Observatory, D. Gill, 600
 Observatories, Meteorological: Projected Tidal Observatory at Muscat, 134; Blue Hill Meteorological Observatory, 418
 Oddone (Dr. Emil), on Earth Vibrations, 510
 Ogilby (J. D.), Dr. Stirling's new Australian Animal (*Noto-ryctes typhlops*), 135
 Ohio, Excavations of the Prehistoric Mounds in, 20
 Ohio: Discovery of Remarkable Prehistoric Tomb, 157; the Geology of, in connection with the Average Yield of Wheat, 420
 Oka (Asajiro), a New Genus of Synascidians from Japan, 450
 Olive Culture in Australia, Principal J. L. Thomson, 135
 Olliff (A. S.), the Plague Locust of New South Wales, 520
 Ontario, Grape Culture in, 209
 Opium Question, the, G. H. M. Batten, 545
 Opossum, Ring-tailed, Curious Death of a, J. E. Dixon, 88
 Optics: Optical Proof of the Existence of Suspended Matter in Flames, on an, Sir G. G. Stokes, F.R.S., 133; Optical Determination of High Temperatures, H. Le Chatelier, 360; Optics of Photography and Photographic Lenses, J. Traill Taylor, 364; Optical Lantern as an Aid in Teaching, C. H. Bothamley, 437; the Simplest Equivalent of a Given Optical Path, Dr. J. Larmor, 503; an Aerial Graplescope for showing Effects of Persistence of Vision, E. S. Bruce, 574; the Dis-persion of the Ultra-red Rays, Dr. Rubens, 576
 Orange, Double, Gerald B. Francis, 534, 607
 Organic Chemistry, a Hand-book of Industrial, Samuel P. Sadtler, 125
 Orientation of Ancient Monuments, Rev. Fred. F. Grensted, 464
 Orientation, a Preliminary Statement of an Investigation of the Dates of some of the Greek Temples as derived from their, F. C. Penrose, 395
 Origin of the Year, J. Norman Lockyer, F.R.S., 487
 Orkneys, Supernumerary Rainbows Observed in the, Robert H. Scott, F.R.S., 223; M. Spence, 223
 Ornithology: Migratory Birds passing over Dublin, 20; the Prairie Larks and Cranes of Manitoba, E. E. Thompson, 135; Intelligence in Birds, A. Wilkins, 151; Bird Gallery in the British Museum, 154; Capture of a Spotted Eagle near Colchester, 158; Threatened Extermination of Kentish Plover, W. Verner, 236; Spotted Eagle, Pratt and Son, 259; Additional Observations on Development of Apteryx, T. J. Parker, F.R.S., 311; Utilization of Homing Pigeons, W. B. Tegetmeier, 320; Harrow Birds, G. E. H. Barrett-Hamilton, 342; Nest of Eggs of Bird of Paradise, A. J. Campbell, 379; Remarkable Case of Humming Birds Nesting and Hatching in a Drawing-room, 383; Torpid Cuckoo, A. Holte Macpherson, 416; a Swan's Secret, Mrs. Jessie Godwin-Austen, 416; on the Origin of the Struthious Birds of Australasia, Prof. Hutton, 425; Ornithology of the Sandwich Isles, Prof. Alfred Newton, F.R.S., 465, 532; Albert F. Calvert, 485, 558; J. E. Harting, 532; Preference of Certain Birds for Certain Trees, 471; White's Thrush (*Turdus varius*), H. Seebohm, 479; Tame Jackdaws, E. C. Green, 545; the Great Skua in Shetland, W. E. Clarke, 545; Depredations of the Great Bower Bird in Northern Queensland, 588
 Orthochromatic Plates for Astronomical Photography, M. M. Fabre and Andoyer, 280
 Orthography of Geographical Names, 186
 Osmond (M.), and the Alloys Research Committee of the Insti-tution of Mechanical Engineers, 22
 Ostwald (Prof. W.), Theory of Solutions, 193, 293, 415, 606; the Magnetic Rotation of Dissolved Salts, 383; the Dissocia-tion of Nitrogen Peroxide, 383; Recent Advances in Physical Chemistry, 590
 O'Sullivan (C. C.), Gedda Gums, the Dextro-Rotatory Varieties, 93
 O'Sullivan (J.), Specific Rotatory and Cupric Reducing Power of Invert Sugar and of Dextrose obtained from Cane Sugar by means of Invertase, 551
 Oudemans (Dr. A. C.), the Great Sea Serpent, 614
 Oudemans (J. A. C.), Levels, 240

- Ouse, the, A. J. Taylor, 102
 Owens (Prof. W. G.), Report of Solar Halos and Parhelia, 518
 Oxford: Election of Mr. E. R. Lankester to the Linacre Professorship, 183
 Oxford, Pass Examination Papers, a Defect in the, 443
 Oxford University, Junior Scientific Club, 455, 503
 Oxford University Museum, Fourth Annual Report of the Delegates of the, 572
 Oxide, Phosphorous, A. E. Tutton, 446
 Oxygen and Hydrogen, Silent Combination of, Prof. Victor Meyer and Herr Askenasy on, 616
 Oyster Culture in Queensland, Saville-Kent, 66
 Oysters at the Antipodes, 43
 Ozone by Electric Silent Discharge, Experiments on the Production of, Siemens and Halske, 339
- Pacific, Eastern, Dredging Operations in the, Prof. Alex. Agassiz, 281
 Page (Mr. F. J. M.), Appointed to Chair of Chemistry and Physics at London Hospital, 566
 Palatability, Comparative, E. B. Titchener, 53
 Palæolithics: a Curious Stone Hammer found in the Thames, G. F. Lawrence, 324
 Palæolithic and Neolithic Period, the Continuity of the, J. A. Brown, 503
 Palæontology: Catalogue of Fossil Birds in the British Museum, R. Lydekker, 33; Discovery of Mammalian Tooth near Hastings, 39; some Eurypterid Remains from Upper Silurian Deposits of Portland Hill, Malcolm Laurie, 239; the Silchester Remains, Herbert Jones, 259; Fresh Evidence concerning the Distribution of Arctic Plants during the Glacial Epoch, Dr. A. G. Nathorst, 273; on a Recent Discovery of the Remains of Extinct Birds in New Zealand, Prof. Henry O. Forbes, 416; Discovery of Remains of Prehistoric Animals in Endsleigh Street, Dr. H. Hicks, F.R.S., 566; Aberrant Fossil Ungulates of South America, 608
 Palms, on the Phenomena Concerned in the Production of Forked and Branched, D. Morris, 598
 Pamily (Caleb), Colliery Manager's Hand-book, 77
 Pamir, Le, et sa Faune lépidoptérologique, 115
 Pamirs, a Journey across the, 90
 Pamirs, Journeys in the, and Adjacent Countries, Capt. F. E. Younghusband, 353
 Pantelleria: Earthquakes at, 120; the October Eruption, North-West of, G. W. Butler, Prof. John W. Judd, F.R.S., 154; on the Matter thrown up during the Submarine Eruption North-West of, October 1891, Gerard W. Butler, 251; Geo. H. Perry, 251; Abstract of Mr. A. Ricco's Account of the Submarine Eruption North-West of, October 1891, G. W. Butler, 584; Geology of, G. Jervis, 207
 Paper-making Industry in the United States, the, J. F. Hobart, 279
 Parasitic Fungi and Moulds, G. Masee, 411
 Paris: Academy of Sciences, 23, 47, 71, 95, 120, 143, 167, 192, 215, 239, 264, 287, 311, 336, 360, 384, 408, 431, 456, 480, 504, 527, 552, 575, 599, 624; Astronomy at the, March 21, 522; April 11, MM. Périgaud and Boquet, 589; the Morgue in, 116; Paris Museum of Natural History, Prof. Chauveau's Laboratory, 86; Reorganization of, 183; 1889 Annals of Meteorological Office of Paris, 208; Les Fleurs à Paris, Culture et Commerce, Philippe L. de Villmorin, 510
 Parke (Thos. Heazle), My Personal Experiences in Equatorial Africa as Medical Officer of the Emin Pasha Relief Expedition, 265
 Parker (J.), Elementary Thermodynamics, 314
 Parker (Prof. T. Jeffery, F.R.S.): Suggestions for securing Greater Uniformity of Nomenclature in Biology, 68; Additional Observations on Development of Aptyryx, 311
 Parmentier (F.), Chlorosulphide and Bromosulphide of Lead, 384
 Parry (John), the Spectrum of Iron and the Periodic Law, 253
 Pasco (Captain), on Early Discoveries in Australia, 425
 Pasquale (F.), a New Carpellary Theory, 478; a New Theory of the Morphology of the Carpel in Flowering Plants, 546
 Passmore (F. W.), the Aconite Alkaloids, iii., 525
 Pathology: a Text-book of Chemical Physiology and Pathology, W. D. Halliburton and Dr. E. H. Starling, 51; Prevention of Hiccough by Pressure on the Phrenic Nerve, M. Leloir, 312; Animals rendered immune to Anthrax, Dr. Th. Weyer, 312; a New Epidemic in Vienna, 319; the Differentiation of Leprosy and Tubercle Bacilli, Chas. Slater, 450; the Tubercular Vaccination of the Dog, Héricourt and Richet, 576
 Paton (Dr. Noel), Action of the Auriculo-Ventricular Valves, 311
 Paul (R. W.), some Electrical Instruments, 574
 Peabody (Cecil H.), Thermodynamics of the Steam Engine and other Heat Engines, Prof. A. G. Greenhill, F.R.S., 172
 Peach (B. N.), the Olenellus Zone of the North-West Highlands, 453
 Pear in New South Wales, the Acclimatization of the Avocado, F. Turner, 66
 Peary (Lieut.), Proposed Expedition for Relief of, 183
 Peat-bog Eruptions, Herr Klinge, 472
 Pechard (E.), the Estimation of Molybdenum, 336
 Peculiar Eyes, Jas. Shaw, 104; G. K. Gude, 151; E. B. Titchener, 177
 Peek (Cuthbert G.), Fuzziness of some Variable Stars, 497
 Pekelharing (Prof.), Composition of Fibrin Ferment, 408; Coagulation of the Blood, 600
 Penfield and Wells (Messrs.), Remarkable Series of Compounds of Halogen Salts of Cæsium with Two or more Atoms of Chlorine, Bromine, or Iodine, 325
 Penrose (F. C.), a Preliminary Statement of an Investigation of the Dates of some of the Greek Temples as derived from their Orientation, 395
 Percival and Co., Simple Proof of Euclid II. 9 and 10, 250
 Perfume Farming in Victoria, Experimental, 305
 Périgaud (M.), Astronomy at the Paris Academy, April 11, 589
 Periodic Law, the Spectrum of Iron and the, John Parry, 253
 Periodic Perturbations of the Four Inner Planets, Prof. Newcomb, 548
 Periodic Variations in Latitude, Chandler, 589
 Perkin (A. G.), Action of Nitric Acid on Oxanilide and its Analogues, 551
 Perkin (Dr. W. H., F.R.S.), Magnetic Rotary Powers of Solutions of Ammonium and Sodium Salts of Fatty Acids, 92
 Perkin (W. H., Jun.), Synthesis of Hexahydroterephthalic Acid, 383; a New Acid from Camphoric Acid, 551
 Perkins (R. C. L.), selected to Investigate the Zoology of the Sandwich Islands, 322
 Pernter (Dr. J. M.), the General Circulation of the Atmosphere, 593
 Perot (A.), on Hertz Oscillations, 336
 Perry (Geo. H.), on the Matter thrown up during the Submarine Eruption North-West of Pantelleria, October 1891, 251
 Perry (Prof. J., F.R.S.), Struts and Tie-Rods Laterally Loaded, 192; Choking Coils, 524
 Perseids observed in Russia in 1890, Th. Bredichin, 597
 Persia and Kurdistan, Journeys in, Mr. Bishop, 248
 Personal Equations in Transit Observations, 617
 Peru, Central, Mr. Alexander Ross's Journey to Head Waters of the Ecayali, 519
 Petermann's Mittheilungen, 588
 Petrie (W. M. Flinders), Prehistory of Egypt, 580
 Pevtsoff (General), Tibet Expedition, 45
 Pfaff's Allgemeine Geologie als Exacte Wissenschaft, J. Joly, 126
 Pfeiffer (Herr), Measurements of Process of Dissolution of Glass in Water by Change in Conductivity of Latter, 209
 Pharaohs, Egypt under the, H. Brugsch-Bey, 363
 Pharmaceutical Society at Edinburgh, 88
 Phasemeter, a, John Trowbridge, 622
 Phenomenon, a Rare, Alex. Graham Bell, 79
 Philadelphia and New York, Proposed Ship Canal between, Prof. L. M. Haupt, 497
 Philosophical Notes on Botanical Subjects, E. Bonavia, 483
 Phoronomy, Dr. W. H. Besant, F.R.S., 462; A. B. Basset, F.R.S., 486; M. Am Ende, 486
 Phosphorous Oxide, A. E. Tutton, 446
 Photography: Photographic Pastimes, a Hand-book for Amateurs, by Hermann Schnauss, 5; Praktisches Taschenbuch der Photographie, Dr. E. Vogel, 51; Geological Photographs, 64; Applied to the Microscope, F. W. Mills, 77; Colour Photography by Lippmann's Process, 119; Aluminium and its Application to Photography, G. L. Addenbrooke, 134; a Shutter for Use in Stellar Photography, J. Joly, 167; Chronophotography, or Photography as Applied to Moving Objects, 228; Use of Chronophotography for Study of Aerial Locomotive Machines, Marey, 71; Orthochromatic Plates for Astronomical Photography, MM. Fabre and Andoyer, 280;

- Solar Prominence, Prof. G. E. Hale, 326; Photography of Solar Prominences, M. Deslandres, 405, 522; Photography as a Branch of Technology, Prof. R. Meldola, F.R.S., 331; Optics of Photography and Photographic Lenses, J. Traill Taylor, 364; Photographic Magnitudes of Stars, 380; the Draper Catalogue of Stellar Spectra, A. Fowler, 426; the Iford Manual of Photography, C. H. Bothamley, 460; Photography Applied to the Detection of Crime, Dr. Paul Jeserich, 568; Photography at the Cape Observatory, D. Gill, 600; Spectrum of Nova Aurigæ, 616; Photographs of the Region of Nova Cygni, 617; Photographs of a Part of Cygnus, M. Faye, 624
- Photometric Observations, Dr. Müller, 90
- Photometry, Colour, Capt. Abney, F.R.S., 213
- Phycomycetes and Ustilagineæ, British Fungi, G. Masee, 411
- Phyllium, the, Dr. Sharp, 623
- Physics: Some Experiments Made with the View of Ascertaining the Rate of Propagation of Induced Magnetism in Iron, Fred. T. Trouton, 42; on the Virial of a System of Hard Colliding Bodies, Lord Rayleigh, F.R.S., 80; Van der Waals's Generalization regarding Corresponding Temperatures, Pressures, and Volumes, Prof. Sydney Young, 93; Physical Society, 93, 142, 191, 238, 358, 478, 524, 574; Annual General Meeting, 452; Dynamic Action and Ponderosity of Matter, by "Waterdale," 100; Experimental, on an Optical Proof of the Existence of Suspended Matter in Flames, Sir G. G. Stokes, F.R.S., 133; the Various Forms given to the General Equation expressing Behaviour of Liquids and Gases under Different Conditions of Volume, Temperature, and Pressure, Dr. P. A. Guye, 142; a New Theory concerning the Constitution of Matter, Dr. C. W. Burton, 142; Refraction and Velocity of Sound in Porous Bodies, Herr Hesehus, 156; the Thermal Emissivity of Thin Wires in Air, Ayrton and Kilgour, 162; Effect of Flaws on the Strength of Materials, J. Larmor, 166; Physical Theory of Solutions, W. Ostwald, 193; Smithsonian Standards for Physical Apparatus, Prof. S. P. Langley, 197; on the Virial Equation for Gases and Vapours, Prof. P. G. Tait, 199; Experimental Measurement of Process of Dissolution of Glass in Water by Change in Conductivity of Latter, Herr Pfeiffer, 209; the Theory of Regelation, H. Le Chatelier, 288; the Cause of an Ice Age, Sir Robert Ball, F.R.S., Prof. G. H. Darwin, F.R.S., 289; the Law of Elastic Lengthening, J. O. Thompson, 311; Experiments on Cause of Emission of Light by Gases, Dr. Pringsheim, 312; Wave Motion Model, F. Cheshire, 347; Experimental, the Mechanical Stretching of Liquids, A. M. Worthington, 358; Optical Determination of High Temperatures, H. Le Chatelier, 260; Collection de Mémoires relatifs à la Physique, Prof. J. J. Thomson, F.R.S., 361; Superheated Steam, Lord Rayleigh, 375; J. Macfarlane Gray, 413, 486; Prof. James A. Cotterill, F.R.S., 414; G. H. Bailey, 414; John Gamgee, 438; Quaternions as a Practical Instrument of Physical Research, A. McAuley, 423; Mathematical Analogies between various branches of Physics, Prof. Bragg, 423; Heat Engines and Saline Solutions, Lord Rayleigh, F.R.S., 438, 510; Experimental, Supplementary Colours, Prof. S. P. Thompson, F.R.S., 452; the Relation between Kinetic Energy and Temperature in Liquids, Prof. Tait, 455; Long Rotating Circular Cylinders, C. Chree, 455; Measurements of Latent Heats of Evaporation by means of a Condensation Calorimeter, Prof. Neesen, 456; a Lecture Experiment in Surface Tension, E. D. Fridlander, 463; the Terms "Centrifugal Force" and "Force of Inertia," Geo. S. Carr, 463; a Nickel Heat Engine, W. B. Croft, 392; Rev. Fred. J. Smith, 464; Aberration, Lord Rayleigh, Sec. R.S., 499; Changes in Dimensions of Elastic Solids due to given Systems of Forces, M. C. Chree, 527; Law of Distribution of Velocities in a System of Moving Molecules, A. H. Leahy, 527; on the Tensions of Saturated Vapours of Different Liquids at same Pressure, Edmond Colot, 528; a Standard Condenser, H. Abraham, 528; Crystalline Absorption and the Choice between the Different Theories of Light, E. Carvallo, 528; Aberration Problems, Prof. O. Lodge, F.R.S., 549; Radiations of Incandescent Bodies and Optical Measure of High Temperatures, J. Violle, 552; Recent Advances in Physical Chemistry, Prof. W. Ostwald, 590; Physiological Action of Diminished Atmospheric Pressure, F. R. Mallet, 606
- Physiography: Elementary Stage, J. Spencer, 27; the Realm of Nature, Hugh Robert Mill, 390
- Physiology: a Text-book of Chemical Physiology and Pathology, W. D. Halliburton and Dr. E. H. Starling, 51; Prof. Stokvis on Mutual Antagonism, 72; on the Implanting of Large Pieces of Decalcified Bones to fill up Losses of Substance of Skeleton, Le Dentu, 95; the Renal Organs of certain Decapod Crustacea, W. F. R. Weldon, 140; the Nephridium of Lumbricus and its Blood Supply, Dr. W. B. Benham, 140; the Formation and Fate of the Primitive Streak in the Frog, Robinson and Assheton, 140; some Points in the Development of *Scorpio fulvipes*, M. Laurie, 140; a New Mode of Respiration in the Myriapoda, F. G. Sinclair, 164; the Foot as a Prehensile Organ in Hindoos, F. Regnault, 192; Outlines of Practical Physiological Chemistry, F. Charles Larkin and Randle Leigh, 292; Development of Lung-books of Scorpio, Malcolm Laurie, 311; Action of the Auriculo-Ventricular Valves, Dr. Noel Paton, 311; Influence of Blood Supply to Skin in Sweat-secretion as seen in Paw of Cat, Dr. Max Levy, 312; Extraordinarily Rapid Evaporation on Glacier, Prof. Boernstein, 312; Teeth Development in the Marsupialia, M. F. Woodward, 335; an Introduction to Human Physiology, Augustus D. Waller and Dr. E. H. Starling, 340; the Mechanism of the Closure of the Larynx, Prof. T. P. A. Stuart, 357; Note on the Behaviour of Sugar in Blood, Dr. Vaughan Harley, 407; Composition of Fibrin Ferment, Prof. Pekelharing, 408; the Development of the Oviduct in the Frog, E. W. MacBride, 450; Contributions to the Physiology and Pathology of the Mammalian Heart, Roy and Adami, 451; Action of Lymph in producing Intravascular Clotting, Dr. Shore, 455; the Abductor and Adductor Fibres of the recurrent Laryngeal Nerve, J. S. R. Russell, 573; Dr. Werigo's Experiments respecting Influence of Oxygen on Elimination of Carbon Dioxide by the Lungs, Prof. Zuntz, 576; Physiological Action of Diminished Atmospheric Pressure, F. R. Mallet, 606; Physiology of Respiratory Centres, Dr. Alfred Bienfait, 624
- Pickering (Prof.), Distribution of Energy in Stellar Spectra, 159; Stars having Peculiar Spectra, 210; Astronomical Possibilities at Considerable Altitudes, 498; the Objective Prism, 521
- Pictet's (Prof.) Laboratory at Berlin, Prof. R. du Bois-Reymond, 31
- Picton (H.), Metallic Hydrosulphides, 262; Physical Constitution of some Sulphide Solutions, 263; of Solution and Pseudo-solution, ii., 263
- Pigment in Yellow Butterflies, F. Gowland Hopkins, 197
- Pigments of Lepidoptera, F. Gowland Hopkins, 581; F. H. Perry Coste, 605; Prof. R. Meldola, F.R.S., 605
- Pilchard or Sardine, Growth of the, Prof. J. T. Cunningham, 255
- Pilchards, Matthias Dunn, 511; J. T. Cunningham, 558
- Pillar, Sun, Annie Ley, 484
- Piltshikoff (N.), Polarization of Atmosphere by Light of Moon, 456
- Pinches (Thos. G.), the Tower of Babel and the Confusion of Tongues, 210
- Pisciculture, the Salmon Industry in British Columbia, 279
- Pitt-Rivers (General), Typological Museums, 184
- Pittier (H.), Meteorological Observations at San José during 1889, 234
- Pittsburg Electric Club, the, 568
- Placentation of certain Lemurs and Insectivora, Hubrecht, 600
- Plane Trigonometry, the Elements of, R. Levett and C. Davison, 509
- Planets, Capture of Comets by, Prof. H. A. Newton, 186
- Planets, Minor, the Elements of the, Dr. Paul Lehmann, 42
- Planets, Periodic Perturbations of the Four Inner, Prof. Newcomb, 548
- Plants, the Diseases of, New Journal devoted to, 20
- Plants, Grafted, W. H. Beeby, 151
- Plarr (Dr. Gustav), Obituary Notice of, 419
- Pleyte (C. M.), Use of the Sumpitan and Bow in Indonesia, 235
- Plover, Kentish, Threatened Extermination of the, W. Verner, 236
- Podkamennaya Tunguska, Rocks collected by M. Lopatin on the, 597
- Poincaré (Prof. H.): Poincaré's Thermodynamics, 245, 414, 439, 485, 532; Electrodynamical Theories and the Electromagnetic Theory of Light, Prof. A. Gray, 367; Non-Euclidian Geometry, 404; Poincaré and Maxwell, Prof. Geo. Fras. Fitzgerald, F.R.S., 532
- Poison, Arrow, A. Coppen Jones, 343

Poison, Arrow, of Sarro Savages, Laborde and Rondeau, 278
 Poison of the Malay Peninsula, the Ipoh, Leonard Wray,
 Jun., 278
 Polaris, on the Observation of North Polar Stars in the Vertical
 of, Truman Saffard, 159
 Polarization of Atmosphere by Light of Moon, N. Piltshikoff,
 456
 Political Economy and Taxation, David Ricardo, 4
 Pollination, Evolution in Methods of, Miss Alice Carter, 596
 Polynesians, Lieut. Vedel on the, 615
 Polytechnic Institute, Regent Street, Appeal on behalf of the,
 250
 Polytechnics and Recreation, Miss E. Cons, 28
 Ponds, Isolated, Natural History of, Clement Reid, 325
 Population in Austria-Hungary, the Increase of, 158
 Population of the Five Continents, E. Levasseur, 552
 Population and Surface of European States, Emile Levasseur,
 528
 Porter (T. C.), Alum Solution, 29; First Visible Colour of
 Incandescent Iron, 558
 Portland, Oregon, Earthquake at, 586
 Post (Dr. A. H.), Strange Symbolical Marriage Custom in
 India, 135
 Poulenc (C.), Action of Potassium Fluoride on Anhydrous
 Chlorides, 552
 Poulton (Edward B., F.R.S.), a Difficulty in Weismannism, 52;
 Warning Colours, 174
 Pratt and Son, Spotted Eagle, 259
 Precessional Globe, a New, Dr. K. Haas, 250
 Precious Stones and Gems, their History, Sources, and
 Characteristics, Edwin W. Streeter, 531
 Preece (W. H., F.R.S.), the Specification of Insulated Con-
 ductors for Electric Lighting, &c., 155
 Prehistoric Animals in Endsleigh Street, Discovery of Remains
 of, Dr. H. Hicks, F.R.S., 566
 Prehistoric Antiquities, Russian; the Slavonians of the First
 Centuries of our Era, Prof. Samokvasoff, 577
 Prehistoric Mounds in Ohio, Excavation of the, 20
 Prehistoric Remains, Opening of a Burial Mound in Florida,
 C. B. Moore, 567
 Prehistoric Tomb in Ohio, Discovery of Remarkable, 157
 Prehistoric Weapons: the Nephrite Axe found at Ohlau,
 Silesia, Dr. O. Schoetersack, 379
 Prehistory of Egypt, W. M. Flinders Petrie, 580
 Prestwich (Joseph, F.R.S.), the Raised Beaches and Rubble-
 drifts of the South of England, 453
 Pringsheim (Dr.), Experiments on Cause of Emission of Light
 by Gases, 312
 Prior (Dr. R. C. A.), Ripe Seeds of the Monkey-Puzzle Tree
 (*Araucaria imbricata*) of Chill, grown in England, 421
 Prism, the Objective, Prof. Pickering, 521
 Pritchard (Prof.), the Diffraction Effects produced by placing
 Screens in Front of Object Glasses, 237
 Professorial Duties, Exchange of, Prof. E. Ray Lankester,
 F.R.S., Prof. T. P. Anderson Stuart, 557
 Projectiles, Calculation of Trajectories of Elongated, Rev. F.
 Bashforth, 473
 Propagation of Induced Magnetism in Iron, some Experiments
 made with the view of ascertaining the Rate of, Fred. T.
 Trouton, 42
 Pseudopods of Diatoms, Alleged, Alf. W. Bennett, 177
 Psychology: a Short Account of the Human Mind, F. S.
 Granger, 76
 Psychology, Experimental, 234
 Psychology as a Science in the United States, the Study of, C.
 W. Scripture, 568
 Ptomaines Extracted from Urine in some Infectious Maladies,
 A. B. Griffiths, 72
 Pullinger (W.), Platinum Tetrachloride, 551
 Puma, the, F. W. Tree, 445
 Pupin (Dr. M. I.), on the Action of Vacuum Discharge
 Streamers upon each other, 622
 Putnam's (Prof.) Anthropological Exhibit at Chicago Exhibition,
 259
 Quantitative Chemical Analysis, Frank Clowes and J. Bernard
 Coleman, 578
 Quarterly Journal of Microscopical Science, 140, 450
 Quaternions as a Practical Instrument of Physical Research,
 A. McAuley, 423

Quatrefages (Prof. de), Death and Obituary Notice of, 278;
 Proposed Monument to, 612
 Queensland: Oyster Culture in, Saville-Kent, 66; on the
 Habits of *Ceratodus*, the Lung Fish of, Prof. Spencer, 425;
 Depredations of the Great Bower Bird in, 588
 Race, the Manchu, 523
 Radiant Points, Displacement of, Dr. J. Kleiber, 570
 Rail, New Extinct, Prof. Henry O. Forbes, 416
 Railway, New, from Upminster to Romford, Essex, T. V.
 Holmes, 151
 Railways, English, the Working and Management of, 116
 Rainbows, Supernumerary, observed in the Orkneys, Robt. H.
 Scott, F.R.S., 223; M. Spence, 223
 Rainfall Experiments, Prof. G. Hellmann's Recent, 545
 Ramsay (Sir Andrew Crombie), Obituary Notice of, 151
 Ramsay (E. P.), Ethnological Purchases for the Australian
 Museum, Sydney, 324
 Ramsay (W.), Pedetic Motion in Relation to Colloidal Solu-
 tions, 429
 Rankin (Angus), Dust Counting on Ben Nevis, 582
 Raoult (M.), Determination of the Freezing Point of very
 Dilute Solutions, as Applied to Cane Sugar, 384
 Rare Phenomenon, a, Alexander Graham Bell, 79
 Ráthay (Dr.), the Ants attracted by *Cynips calycis*, a Protec-
 tion to *Quercus pedunculata*, 546
 Ratzel (Friedrich), Anthropogeographie, 557
 Rayet (G.), the Temporary Star in Auriga, 408
 Rayleigh (Right Hon. Lord, F.R.S.): on the Virial of a System
 of Hard Colliding Bodies, 80; Experiments in Aerodyna-
 mics, 108; Superheated Steam, 375; Heat Engines and
 Saline Solutions, 438, 510; Aberration, 499
 Reade (T. M.), Drift Beds of North and Mid Wales Coast,
 525
 Realm of Nature, the, Hugh Robert Mill, 390
 Reboul (E.), Butylene Monobromides, 47
 Recollections of a Happy Life, being the Autobiography of
 Marianne North, 602
 Records of the Australian Museum, 421
 Recoura (A.), a Green Solid Chromic Sulphate, 192
 Recreation, Polytechnics and, Miss E. Cons, 28
 Red Light after Sunset, Dr. M. A. Veeder, 30
 Red Spot on Jupiter, W. F. Denning, 272
 Reflection, on Selective and Metallic, A. B. Basset, F.R.S.,
 119
 Refractive Power of Cometary Matter, E. E. Barnard, 237
 Refrigerating Machinery: Prof. Pictet's Laboratory at Berlin
 Prof. R. du Bois-Reymond, 31
 Regelation, the Theory of, H. Le Chatelier, 288
 Regnault (F.), the Foot as a Prehensile Organ in Hindoos,
 192
 Reid (Clement), Natural History of Isolated Ponds, 325; the
 Pleistocene Deposits of the Sussex Coasts, 454
 Reinholm, the late Dr., 496
 Relation of Natural Science to Art, on the, W. Ainslie Hollis,
 319
 Religion, Savage, the Limits of, Dr. Tylor, 71
 Reliques of Constance Naden, Further, 389
 Renard (Rev. A. F.), Deep-sea Deposits, 409
 Respiratory Centres, on the Physiology of, Dr. Alf. Bienfait,
 624
 REVIEWS and OUR BOOK SHELF:—
 Electricity and Magnetism, translated from the French of
 Amédée Guillemin, Revised and Edited by Silvanus P.
 Thompson, F.R.S., Prof. A. Gray, 1
 Die indo-malaysische Strandflora, A. F. W. Schimper, 3
 Ueber die Mangrove-Vegetation im malayischen Archipel,
 G. Karsten (Bibliotheca Botanica, Heft 22), W. Botting
 Hemsley, F.R.S., 3
 Principles of Political Economy and Taxation, David Ricardo, 4
 Photographic Pastimes, a Hand-book for Amateurs, Hermann
 Schnauss, 5
 On Surrey Hills, by a Son of the Marshes, 5
 Heroes of the Telegraph, J. Munro, 5
 An Elementary Hand-book on Potable Water, Floyd Davis,
 M.Sc., Ph.D., Prof. Percy F. Frankland, F.R.S., 25
 The Intra-cranial Circulation and its Relation to the Physio-
 logy of the Brain, James Cappie, M.D., 26
 Physiography, Elementary Stage, J. Spencer, 27

Reviews—continued.

- Mayhew's Illustrated Horse Doctor, Revised and Improved, James Irvine Lupton, 27
- Handleiding tot de Kennis der Flora van Nederlandsch Indië, Dr. J. G. Boerlage, 28
- By Seashore, Wood, and Moorland, Peeps at Nature, Edward Step, 28
- The Ninth Annual Report of the Fishery Board for Scotland, being for the Year 1890, 49
- Catalogue of Mammalia in the Indian Museum, Calcutta, W. L. Sclater, 50
- A Text-book of Chemical Physiology and Pathology, W. H. Halliburton, Dr. E. H. Starling, 51
- Practisches Taschenbuch der Photographie, Dr. E. Vogel, 51
- An Introduction to the Differential and Integral Calculus, J. Hugh Miller, 52
- Star Groups, J. Ellard Gore, 52
- The Universal Atlas, 52
- La Transcaucasie et la Péninsule d'Apchéron, Calouste S. Gulbenkian, 52
- How to Organize a Cruise on the Broads, E. R. Suffling, 52
- The Electro-magnet and Electro-magnetic Mechanism, S. P. Thompson, F.R.S., Prof. A. Gray, 73
- British Edible Fungi, how to Distinguish and how to Cook them, M. C. Cooke, 75
- Psychology: a Short Account of the Human Mind, F. S. Granger, M. A., 76
- Arithmetical Exercises in Chemistry, Leonard Dobbin, Ph.D., with Preface by Prof. Crum Brown, 76
- The Colliery Manager's Hand-book, Caleb Pameley, 77
- Photography Applied to the Microscope, F. W. Mills, 77
- Copernic et la Découverte du Système du Monde, Camille Flammarion, 77
- Annals of British Geology, 1890, J. F. Blake, 77
- Outlines of Field Geology, Sir Archibald Geikie, F.R.S., 97
- The Land of the Lamas, Notes of a Journey through China, Mongolia, and Tibet, William Woodville Rockhill, 98
- A Text-book of the Science of Brewing, E. R. Moritz and G. H. Morris, 100
- Fresh Light on the Dynamic Action and Ponderosity of Matter, "Waterdale," 100
- Indischer Ozean: Ein Atlas die physikalischen Verhältnisse und die Verkehrs-Strassen darstellend, 101
- Mechanics for Beginners, Part I., Dynamics and Statics, Rev. J. B. Lock, 101
- The Physical Geology and Geography of Ireland, Edward Hull, F.R.S., 102
- The Ouse, A. J. Foster, M.A., 102
- A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali, George Lunge—Vol. I., Sulphuric Acid, Prof. T. E. Thorpe, F.R.S., 121
- The Alkali Maker's Hand-book, George Lunge, Ph.D., and F. Hurter, Prof. T. E. Thorpe, F.R.S., 121
- Diphtheria, its Natural History and Prevention, R. Thorne Thorne, F.R.S., 123
- Bulletin of the New York Mathematical Society, a Historical and Critical Review of Mathematical Science, 124
- Delagoa Bay, its Natives and Natural History, Rosa Monteiro, 124
- A Hand-book of Industrial Organic Chemistry, Samuel P. Sadler, 125
- Progressive Mathematical Exercises, A. T. Richardson, 125
- Text-book of Comparative Anatomy, Arnold Lang, Prof. E. Ray Lankester, F.R.S., 145
- Lehrbuch der Vergleichenden Entwicklungsgeschichte der Wirbellosen Thiere, Dr. E. Korschelt und Dr. K. Heider, Prof. E. Ray Lankester, F.R.S., 145
- The Artillery of the Future and the New Powders, James Atkinson Longridge, 146
- The Skeleton of the Irish Giant Cornelius Magrath, Dr. D. J. Cunningham, F.R.S., 147
- With Axe and Rope in the New Zealand Alps, George Edward Manning, Prof. T. G. Bonney, F.R.S., 147
- Manual of the Science of Religion, P. D. Chantpie de la Saussaye, translated by Beatrice S. Colyer Fergusson, 148
- Euclid's Elements of Geometry, Book XI., A. E. Layng, 149
- Illustrations of the Flora of Japan, to serve as an Atlas to the Nippon-Shokubutsushi, Tomitaro Makino, 149
- About Ceylon and Borneo, Walter J. Clutterbuck, 149
- Revisio Genera Plantarum Vascularium omnium, atque

Reviews—continued.

- Cellularium multarum, secundum Leges Nomenclaturæ Internationales, cum Enumeratione Plantarum in Itinere Mundi collectarum, Dr. Otto Kuntze, 169
- Thermodynamics of the Steam Engine and other Heat Engines, C. H. Peabody, 172
- An Account of British Flies (Diptera), Hon. M. Cordelia E. Leigh and F. V. Theobald, 173
- Principles of Agriculture, R. P. Wright, 173
- Elementary Trigonometry, J. M. Dyer and Rev. R. H. Whitcombe, 174
- Solutions, W. Ostwald, translated by M. M. Pattison Muir, 193
- Colour-blindness and Colour-perception, F. W. Edridge Green, 195
- Instructions Météorologiques, A. Angot, 196
- Chambers's Encyclopædia, Vol. VIII., 196
- La Place de l'Homme dans la Nature, Prof. T. H. Huxley, F.R.S., 197
- Report on the Meteorology of India in 1889, John Eliot, 217
- Reports on the Administration of the Meteorological Department of the Government of India, 1885-91, 217
- Les Coquilles Marines des Côtes de France, Description des Familles et Espèces, A. Locard, 219
- Nature and Man in North America, N. S. Shaler, 220
- Stones for Building and Decoration, George P. Merrill, 222
- Les Champignons, A. Acloque, 222
- Theory of Heat, J. Clerk Maxwell, 222
- The Chemistry of Paints and Painting, A. H. Church, F.R.S., Dr. Hugo Müller, F.R.S., 241
- Thermodynamique, H. Poincaré, 245
- Hand-book of the Destructive Insects of Victoria, C. French, 246
- Farm Crops, John Wrightson, 247
- Arithmetic for Schools, Charles Smith, 247
- Journeys in Persia and Kurdistan, Mrs. Bishop (Isabella L. Bird), 248
- A First Book of Electricity and Magnetism, W. Perren Maycock, 248
- A Cyclopædia of Nature Teachings, Hugh Macmillan, 248
- My Personal Experiences in Equatorial Africa as Medical Officer of the Emin Pasha Relief Expedition, T. H. Parke, 265
- An Introduction to the Theory of Value, William Smart, 268
- Across Tibet, Gabriel Bonvalot, translated by C. B. Pitman, 269
- Light, Sir Henry Trueman Wood, 269
- The Cause of an Ice Age, Sir Robert Ball, Prof. G. H. Darwin, F.R.S., 289
- Animal Sketches, C. Lloyd Morgan, 291
- Outlines of Practical Physiological Chemistry, F. C. Larkin and Randle Leigh, 292
- Problems in Chemical Arithmetic, E. J. Cox, 293
- The Microscope and its Revelations, the late Dr. Carpenter's, Seventh Edition by Rev. W. H. Dalliger, F.R.S., Prof. E. Ray Lankester, F.R.S., 313
- Elementary Thermodynamics, J. Parker, 314
- The Century Dictionary, an Encyclopædic Lexicon of the English Language, William Dwight Whitney, Ph.D., LL.D., 316
- List of the Snakes in the Indian Museum, W. L. Sclater, 317
- The Living World, Whence it Came and Whither it is Drifting, H. W. Conn, 317
- Adventures amidst the Equatorial Forests and Rivers of South America, also in the West Indies and the Wilds of Florida, Villiers Stuart, 317
- Catalogue of Scientific Papers compiled by the Royal Society of London, 338
- How to Use the Aneroid Barometer, Edward Whymper, 339
- An Introduction to Human Physiology, Augustus D. Waller, 340
- Bulletin of the New York Mathematical Society, 341
- Guide to the Examinations in Chemistry, W. Jerome Harrison, 342
- Manipulation of the Microscope, Edward Bausch, 342
- Harrow Birds, G. E. H. Barrett-Hamilton, 342
- Collection de Mémoires relatifs à la Physique, La Société Française de Physique, Prof. J. J. Thomson, F.R.S., 361
- Sul Regime delle Spiagge, e sulla Regolazione dei Porti, Signor P. Cornaglia, 362
- Egypt under the Pharaohs, H. Brugsch-Bey, M. Brodrick, 363

Reviews—continued.

- The Story of the Hills, a Popular Account of Mountains, and how they were made, Rev. H. N. Hutchinson, 364
- The Optics of Photography and Photographic Lenses, J. Traill Taylor, 364
- The Evolution of Life, or Causes of Change in Animal Forms, Hubbard Winslow Mitchell, M.D., 364
- Manual of Chemical Technology, Rudolf von Wagner, translated by William Crookes, F.R.S., 386
- Elements of Agriculture, W. Fream, 388
- Further Reliques of Constance Naden, George M. McCrie, 389
- The Realm of Nature, Hugh Robert Mill, 390
- Grasses of the South-West, Dr. George Vasey, 390
- Sporting Sketches in South America, Admiral Kennedy, 390
- Report on the Scientific Results of the Voyage of H.M.S. *Challenger* in 1873-76, prepared by the late Sir Wyville Thomson, F.R.S., and John Murray, Prof. J. W. Judd, F.R.S., 409
- British Fungi, Phycomyces and Ustilagineæ, G. Masee, 411
- A Treatise on the Geometry of the Circle and some Extensions to Conic Sections by the Method of Reciprocatation, W. J. McClelland, M.A., 412
- Kalm's Account of his Visit to England on his Way to America in 1748, translated by Joseph Lucas, 412
- Œuvres Complètes de Christiaan Huygens, A. M. Clerke, 434
- The Horse, a Study in Natural History, William Henry Flower, C.B., F.R.S., 436
- A System of Sight-Singing from the Established Musical Notation, based on the Principle of Tonic Relation, Sedley Taylor, 437
- The Statesman's Year-book for the Year 1892, J. Scott Keltie, 437
- The Optical Lantern as an Aid in Teaching, C. H. Bothamley, 437
- L'Homme dans la Nature, par Paul Topinard, 457
- The Art and Craft of Cabinet Making, D. Denning, 459
- L'Électricité dans la Nature, Georges Dary, 460
- The First Book of Euclid's Elements, Rev. J. B. Lock, 460
- The Ilford Manual of Photography, C. H. Bothamley, 460
- The Advanced Class-book of Modern Geography, William Hughes and J. Francon Williams, 460
- The Theory of Determinants in the Historical Order of its Development, Thomas Muir, 481
- Anthropogenie, oder Entwicklungsgeschichte des Menschen, Prof. Ernst Haeckel, 482
- Philosophical Notes on Botanical Subjects, E. Bonavia, 483
- The Zoological Record for 1890, Frank E. Beddard, 483
- Leçons sur la Pathologie comparée de l'Inflammation faites à l'Institut Pasteur en Avril et Mai, 1891, Élie Metschnikoff, Prof. E. Ray Lankester, F.R.S., 505
- Travels in Africa during the Years 1879-83, Dr. Wilhelm Junker, translated by A. H. Keane, 507
- My Second Journey through Equatorial Africa, Hermann von Wissmann, translated from the German by Minna J. A. Bergmann, 507
- New Fragments, John Tyndall, F.R.S., 508
- A Treatise on Chemistry, Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S., 509
- The Oak, a Popular Introduction to Forest Botany, H. Marshall Ward, F.R.S., 509
- The Elements of Plane Trigonometry, R. Levett and C. Davison, 509
- Les Fleurs à Paris, Culture et Commerce, Philippe L. de Vilmorin, 510
- Health Springs of Germany and Austria, F. O. Buckland, 510
- The Principles of Chemistry, D. Mendeléeff, translated from the Russian by George Kamensky, and edited by A. J. Greenaway, 529
- A Treatise on the Ligation of the Great Arteries in Continuity with Observations on the Nature, Progress, and Treatment of Aneurism, C. A. Ballance and Walter Edmunds, Dr. M. Armand-Ruffier, 530
- Precious Stones and Gems, their History, Sources, and Characteristics, Edwin W. Streeter, 531
- Air and Water, Vivian B. Lewes, Professor of Chemistry at Royal Naval College, Greenwich, 531

Reviews—continued.

- The Naturalist in La Plata, W. H. Hudson, Dr. Alfred R. Wallace, 553
- A Study of Influenza and the Laws of England concerning Infectious Diseases, Richard Sisley, 556
- Anthropogeographie, Zweiter Theil, Die Geographische Verbreitung des Menschen, Friedrich Ratzel, 557
- Within an Hour of London Town, among Wild Birds and their Haunts, by a Son of the Marshes, edited by J. A. Owen, 557
- Mission Scientifique de Cap Horn, tome vii., Anthropologie, Ethnographie, P. Hyades et J. Deniker, 577
- Quantitative Chemical Analysis, Frank Clowes and J. Bernard Coleman, 578
- Elementary Mathematical Astronomy, C. W. C. Barlow and G. H. Bryan, 579
- Practical Fruit Culture, J. Cheal, 579
- Blowpipe Analysis, J. Landauer, edited by James Taylor, 580
- Outlines of Theoretical Chemistry, Lothar Meyer, translated by P. Phillips Bedson and W. Carleton Williams, Prof. M. Pattison Muir, 601
- Recollections of a Happy Life, being the Autobiography of Marianne North, edited by Mrs. John Addington Symonds, 602
- Our Trees, John Robinson, 603
- Synopsis of Non-Metallic Chemistry, William Briggs, 604
- Chemical Calculations, R. Lloyd Whiteley, with Preface by Prof. E. Clowes, 604
- The Year-book of Science, edited by Prof. T. G. Bonney, F.R.S., 604
- Handy Atlas of Modern Geography, 605
- Rew (R. Henry), on the Statistics of the Production and Consumption of Milk in Great Britain, 614
- Reynolds (J. E.), Silver Compounds of Thiourea, 383
- Ribbentrop (Dr.), Government Forestry in India, 41
- Ricardo (David), Principles of Political Economy and Taxation, 4
- Ricco (A.), Earthquakes at Pantelleria, 120; Account of the Submarine Eruption North-west of Pantelleria, October 1891, Abstract of ditto, G. W. Butler, 584
- Richardson (A. T.), Mathematical Exercises, 125
- Richardson (Dr. B. W., F.R.S.), New Year's Address to Sanitary Inspectors' Association, 234
- Richet (Prof.), Death of, 258
- Richet (Ch.), the Tubercular Vaccination of the Dog, 576
- Rigg (Gilbert), Ice Crystals, 319
- Riley (Dr. C. V.), a New Herbarium Pest, 235
- Ring and Disk Blinds in Micrometric Measurements, on the Influence of, Herr Dr. Walter Wislicenus, 137
- Rings, Atmospheric, Dr. Sprung, 599
- Rivers of Central Europe, the Temperature of, 114
- Roberts (Thomas), Death and Obituary Notice of, 303
- Roberts-Austen (Prof., F.R.S.): the Report to the Alloys Research Committee of the Institution of Mechanical Engineers, 22; Value of Metallurgical Science, 257; Bronze in the London Atmosphere, 443; Metals at High Temperature, 534
- Robertson (W. T.), Tea-culture in New South Wales, 260
- Robinson (Dr. A.) the Formation and Fate of the Primitive Streak in the Frog, 140
- Robinson (John), Our Trees, 603
- Robinson (Margaret), the Nauplius Eye persisting in some Decapods, 450
- Rochester Academy of Sciences, U.S., 588
- Rockhill (William Woodville), the Land of the Lamas, 98
- Rocks collected by M. Lopatin on the Podkamennaya Tunguska, 597
- Rodger (J. W.), Theory of Solutions, 342, 487
- Roemer (the late Ferdinand), Proposed Memorial of, 322
- Rogers (Fred. J.), Magnesium as a Source of Light, 622
- Rolling of Ships, 559
- Romanes (Prof. Geo. J., F.R.S.), Migration of the Lemming, 249
- Rome (Province), Earthquakes in, 304
- Roscoe (Sir H. E., F.R.S.): Action of Water-Gas on Iron, 92; a Treatise on Chemistry, 509
- Rosenberg (Dr.), Assimilation of Diet investigated in a Dog Working on a Treadmill, 599
- Ross (Alexander), Journey to Head Waters of Ecayali, Central Peru, 519

- Ross (W. J. C.), on the Discovery of Two Specimens of Fossil Lepidodendrons in the Neighbourhood of Bathurst, New South Wales, and the Inferences to be drawn from their Occurrence, 424
- Rossiter (E. C.), Sulphochloride of Isomeric Dibromonaphthalene, 263; Action of Alcohols on Sulphonic Chlorides as Means of producing Ethereal Salts of Sulphonic Acids, 263; Action of Bromine on Mixture of Ortho- and Paranitro-*a*-Acenaphthalide, 263
- Rotation of Jupiter, W. F. Denning, 473
- Rotation of Venus, Herr Loschardt, 210
- Rotch (A. L.), Meteorology of French Association at Marseilles, 189; the Mountain Meteorological Stations of the United States, 403
- Rothamsted, Results of Experiments at, on the Question of the Fixation of Free Nitrogen, Dr. J. H. Gilbert, F.R.S., 32
- Rothney (E. A. J.), Two Species of Indian Ants, 454
- Roumania, the Meteorological Service of, 444
- Rousseau (G.), Manganates of Potash, 288
- Roy (Prof., F.R.S.), Contributions to the Physiology and Pathology of the Mammalian Heart, 451
- Royal Academy of Sciences of Lisbon, Sir Joseph Fayrer, F.R.S., elected Corresponding Member of, 585
- Royal College of Physicians, Sir Andrew Clark elected (fifth time) President, 566
- Royal Geographical Society, 183; Appointment of Mr. J. S. Keltie to the Assistant-Secretaryship in room of late Mr. H. W. Bates, 402; Dr. H. R. Mill appointed Librarian to, 566
- Royal Institution, Lectures at the, 155, 586
- Royal Meteorological Society, 95, 215, 335, 431, 551, 623
- Royal Microscopical Society, 46, 143, 165, 239, 311, 479, 574
- Royal Military Academy, Science at the, 563
- Royal Scottish Geographical Society, Branch established in London, 544
- Royal Society, 37, 141, 162, 190, 212, 311, 357, 381, 407, 429, 451, 549, 573; Anniversary Meeting, 110; Sir William Thomson's Anniversary Address, 110; Medallists, 111; Officers and Council, 112; Catalogue of Scientific Papers, 338
- Royal Society of New South Wales, 95; Prizes Offered by, 443; Award of Clarke Memorial Medal to Mr. W. T. Thiselton-Dyer, 495
- Royal Statistical Society, R. Henry Rew on the Statistics of the Production and Consumption of Milk in Great Britain, 614
- Rubens (Dr.): New Method of Determining Dispersion and Refraction in Ultra-Violet Rays, 48; the Dispersion of the Ultra-Red Rays, 576
- Rubi, Alpine, T. D. A. Cockerell, 320
- Rücker (Prof., F.R.S.): Royal Society Medallist, 111; Speech at the Royal Society Dinner, 112
- Ruffer (Dr. M. Armand), a Treatise on the Ligation of the Great Arteries in Continuity, with Observations on the Nature, Progress, and Treatment of Aneurism, Charles A. Ballance and Walter Edmunds, 530
- Rugby School Natural History Society, 520
- Runge (Prof. C.), on the Line Spectra of the Elements, 607
- Russell (F.) Results of Meteorological Observations at Akassa, 95
- Russell (H. C., F.R.S.), the Grouping of Stars in the Southern Part of the Milky Way, 423
- Russell (H. L.), the Effect of Mechanical Movement on the Growth of Certain Plants, 478
- Russell (Prof. Israel C.): Cirques, 317; Geographical Position of Mount St. Elias, 472
- Russell (J. S. R.), the Abductor and Adductor Fibres of the Recurrent Laryngeal Nerve, 573
- Russell (Lucy J.), Bedford College and the Gresham University, 391
- Russell (Hon. Rollo), Untenability of Atmospheric Hypothesis of Epidemics, 431
- Russell (Dr. W. J., F.R.S.): Town Fogs and their Effects, 10; Bedford College and the Gresham University, 391
- Russia: the Grain Production of, Borkovsky, 67; Russian Geographical Society, 92; Awards, 444; European, Frequency and Geographical Distribution of Heavy Daily Rainfall in Russia, E. Berg, 258; Mercury Mining in, 305; Causes of the Famine in, Dr. A. Woeikof, 378; Russian Prehistoric Antiquities, the Slavonians of the First Centuries of our Era, Prof. Samokvasoff, 547; Sunflower Cultivation in Southern Russia, 568
- Rust Fungus in Wheat, 615
- Rusting of Iron, A. Liversidge, F.R.S., on the, 424
- Rutherford's Photographs, Catalogue of, 21
- Sabatier (Paul), Sulphides and Selenides of Boron and Silicon Selenide, 41
- Sacken (C. R. Osten), *Meretrix*, Lamarck 1799, *versus Cytherea*, Lamarck 1806, 30
- Sadtler (Samuel P.), a Hand-book of Industrial Organic Chemistry, 125
- Saffard (Truman), on the Observation of North Polar Stars in the Vertical of Polaris, 159
- St. Malo Bay, the Tides of, M. Heurtault, 143
- St. Petersburg Electrical Exhibition, 303
- St. Thomas's Hospital, Lectures on Systematic Botany at, 586
- Saline Solutions, Heat Engines and, Lord Rayleigh, F.R.S., 438, 510
- Salmon Industry in British Columbia, 279
- Salt Lake of Aalia Paakai, A. B. Lyons, 29
- Salts in Natural Waters, 78; F. H. Perry Coste, 176; Robert B. Hayward, F.R.S., 176
- Samoa Cyclone of March 16, 1889, 161
- Samoa Hurricane, Everett Hayden, 461
- Samokvasoff (Prof.) the Slavonians of the First Centuries of our Era, 547
- Sanderson (Prof. J. Burdon, F.R.S.), Obituary Notice of Sir William Bowman, 564
- Sandwich Islands, Mr. R. C. L. Perkins Selected to Investigate the Zoology of the, 322
- Sandwich Isles, Ornithology of the, Prof. Alfred Newton, F.R.S., 465, 532; Albert F. Calvert, 485, 558; J. E. Harting, 532
- Sanitary Conference, International, 233
- Sanitary Engineering, C. Napier Bell on; 426
- Sanitary Inspectors' Association, New Year's Address, Dr. B. W. Richardson, F.R.S., 234
- Sanitation in Schools, 185
- Sapper (Dr.), the Climate of Alta Verapaz, 41
- Sardine, Growth of the Pilchard or, Prof. J. T. Cunningham, 255
- Sardinia, the Nurhagi of, Dr. Erlming, 114
- Sarro Savages, Arrow-Poison of, Laborde and Rondeau, 278
- Saussaye (P. D. Chantpie de la), Manual of the Science of Religion, 148
- Saville-Kent (W.), Oyster-Culture in Queensland, 66
- Scandinavia, Chronology of the Neolithic Age in, Prof. Montelius, 39
- Scheele (Carl Wilhelm), Letters and Memoirs of, 207
- Scheurer-Kestner (M.), Decomposition of Sulphurous Acid by Water at very High Temperatures, 384
- Schimper (A. F. W.), Die indo-malayische Strandflora, W. Botting Hemsley, F.R.S., 3
- Schloesing (Th., Jun.), the Fixation of Free Nitrogen by Plants, 143
- Schnauss (Hermann), Photographic Pastimes, a Hand-book for Amateurs, 5
- Schöstensack (Dr. O.), the Nephrite Axe found at Ohlau, Silesia, 379
- Schorlemmer (C., F.R.S.), a Treatise on Chemistry, 509
- Schorr (Dr. R.), Denning's Comet (*b* 1892), 569
- Schoute (Prof.): Lemoine's Two Problems of Stamps, 72; the Stamp-folding Problem, 335
- Schweizer (Dr.), the Behaviour of Spermatozoa towards Electric Currents, 599
- Science: Electricity in Relation to, Prof. W. Crookes, F.R.S., 63; Examinations in, 85; Elizabeth Thompson Science Fund, 91; a Text-book of the Science of Brewing, E. R. Moritz and G. H. Morris, 100; Scientific Nomenclature, H. St. A. Alder, 104; Manual of the Science of Religion, P. D. Chantpie de la Saussaye, 148; Implications of Science, Dr. St. George Mivart, F.R.S., 60, 82, 222, 343; Edward T. Dixon, 125, 272, 391; Miss E. E. C. Jones, 223, 366; on the Relation of Natural Science to Art, Prof. E. du Bois-Reymond, F.R.S., 200, 224; Science in Japan, Prof. E. Ray Lankester, F.R.S., 256; Royal Society Catalogue of Scientific Papers, 338; Science Museum and Gallery of British Art at South Kensington, 348; Science Museum and the Tate Gallery, 385, 433; Forthcoming Scientific Books, 476; Science at the Royal Military Academy, 563; the New York "Scientific Alliance," 544; the Year-book of Science, 1891, Prof. T. G. Bonney, F.R.S., 604

- Sclater (Dr. P. L., F.R.S.), Opportunity for a Naturalist, 174, 269
 Sclater (W. L.), Catalogue of Mammalia in the Indian Museum, Calcutta, 50
 Scotland, the Ninth Annual Report of the Fishery Board for, 49
 Scotland, Technical Education in, 377
 Scott (Ernest), Electricity in Relation to Mining, 184
 Scott (Robt. H., F.R.S.): Supernumerary Rainbows observed in the Orkneys, 223; Atlantic Weather and its connection with British Weather, 496
 Scottish Meteorological Society, 470
 Scottish Zoology, Prof. Cossar Ewart on, 17
 Scripture (E. W.), the Study of Psychology as a Science in the United States, 568
 Scudder (F.), Action of Water Gas on Iron, 92
 Sea, Cloud-Observations at, Prof. C. Abbe, 70
 Sea-borne Sediment, the Precipitation and Deposition of, R. G. Mackley Browne, 598
 Sea-Fish, Destruction of Immature, Alfred O. Walker, 176; Ernest W. L. Holt, 240
 Sea-Serpent, Dr. A. C. Oudemans on the, 614
 Sea-shore, Wood, and Moorland, By, Edward Step, 28
 Seabroke (Geo. M.), Aurora, 605
 Search Light, Working of the, W. B. Lefroy Hamilton, 587
 Searle (G. F. C.), an Experiment of Sir Humphry Davy's, 47
 Seaside Plants, Biology of, W. Botting Hemsley, F.R.S., 3
 Secular Acceleration of the Moon and the Length of the Sidereal Day, 137
 Secular Variation of Latitudes, 210
 Seebohm (H.), White's Thrush (*Turdus varius*), 479
 Seemann (Herr), a Weather Lexicon, 208
 Segers (M.), Mussel-Poisoning in Tierra del Fuego, 134
 Seismometry and Engineering in Relation to the Recent Earthquake in Japan, Prof. John Milne, F.R.S., 127
 Seismology: Earthquake at Nipon, Japan, 19; Earthquake in Japan, 86, 199; Seismology in Japan, 471; Seismological Phenomena in Australasia, 423; Earthquake at Nicaragua, 471; at Portland, Oregon, 586; Earthquake in California, 471, 614 (see also Earthquakes)
 Selection, Topical, and Mimicry, David Syme, 30; Dr. Alfred R. Wallace, 30
 Selective and Metallic Reflection, A. B. Basset, F.R.S., 119
 Self-registering Weathercock, J. Lawrence Hamilton, 559
 Sellers (Coleman), American Superiority in Mechanics, 157
 Sendall's (Sir W. J.) Apparatus for making Accurate Measurements with Camera Lucida, 46
 Sensitive Water Jets, W. B. Croft, 506
 Shaler (Prof. N. S.), Nature and Man in North America, 220
 Shark, Large Greenland, Stranded at Lynn, T. Southwell, 546
 Sharp (Dr.), on the Phyllium, 623
 Shaw (Jas.), Peculiar Eyes, 104
 Sheep, Origin of the, in China, Dr. Macgowan, 285
 Sherman (O. T.), Zodiacal Light, 381
 Sherwood (William), Striated Surface under the Cromer Drift, 511
 Shields, Ancient Mexican, Zelia Nuttall, 520
 Shipbuilding: the Steadying of Vessels at Sea, J. T. Thornycroft, 570; the Influence of Shallow Water upon the Trial Trip Speeds of Modern Vessels, W. H. White, F.R.S., 571; on Balancing Marine Engines and the Vibration of Vessels, A. F. Yarrow, 571
 Ships, Rolling of, 559
 Shipley (A. E.), *Onchesoma Steenstrupii*, 450
 Shore (Dr.), Action of Lymph in Producing Intravascular Clotting, 455
 Shufeldt (Dr.): Prints of Havesu-pai Indians, 235; Weaving as Practised by the Navajo Indians, 260
 Sidereal Day, the Secular Acceleration of the Moon and the Length of the, 137
 Sidgreaves (Rev. Walter), Stonyhurst Drawings of Sun-spots and Faculae, 261
 Siemens and Halske, Experiments on the Production of Ozone by Electric Silent Discharge, 39
 Sierra Leone Anglo-French Frontier Delimitation Commission, the, 64; Government Mission to Investigate Botany of, 64
 Sight, Motion of Stars in the Line of, Prof. H. C. Vogel, 280
 Sight-singing from the Established Musical Notation, a System of, based on the Principle of Tonic Relation, Sedley Taylor, 437
 Silk Insects of India, the, Wild, E. C. Cotes, 520
 Silk-producing Moths, Col. Swinhoe, 38
 Simla, Capt. Bower's Journey from China to, 615
 Sinclair (F. G.), a New Mode of Respiration in the Myriapoda, 164
 Singer (Dr.), Cloud Pictures, 518
 Sirius System, the, Dr. A. Auwers, 617
 Sisley (R.), a Study of Influenza and the Laws of England concerning Infectious Diseases, 556
 Skate, the Electric Organ of the, Prof. J. G. Ewart, 451
 Skinner (S.), Some Notes on Clark's Cells, 47; Properties of Alcoholic and other Solutions of Mercuric and other Chlorides, 430
 Skua in Shetland, the, Great, W. E. Clarke, 545
 Slater (Chas.), the Differentiation of Leprosy and Tubercle Bacilli, 450
 Slater's (Prof. J. S.) Improved Armillary Sphere, 134
 Slavonians of the First Centuries of our Era, the, Prof. Samokvasoff, 547
 Sleep: Causation of, James Cappie, M.D., 26; Peculiar Case of Prolonged, 323, 349
 Smart (William), an Introduction to the Theory of Value, 268
 Smith (Charles), Arithmetic for Schools, 247
 Smith (Fred. J.), a Simple Heat-Engine, 294, 464
 Smith (W. W.), Hellebore as an Insecticide, 546
 Smithells (A.): Structure and Chemistry of Flames, 214; Structure of Luminous Flames, 214
 Smithells (Prof.), Origin of Flame Coloration, 306
 Smithsonian Institution: Gift by Mr. Thomas Hodgkins to, 37; Prof. S. P. Langley's Report for the Year, 261
 Smithsonian Standards for Physical Apparatus, Prof. S. P. Langley, 197
 Snakes in the Indian Museum, List of the, W. L. Sclater, 317
 Snow-Sweeper, Electric, 39
 Snowstorms, Severe, in the Channel Islands and South of England, 586
 Société de Biologie, Prof. A. Chauveau elected President of the, 612
 Society of Arts, Lecture Arrangements, 19
 Solar Activity, State of, Prof. Tacchini, 137
 Solar Activity in 1891, Rodolf Wolf, 307
 Solar Disturbances of 1891, June 17, H. H. Turner, 404
 Solar Heat, Dr. Joseph Morrison, 589
 Solar Investigation, Prof. Hale, 473
 Solar Observations, Prof. Tacchini, M. Marchand, 352
 Solar Parallax, Determination of the, A. Auwers, 89
 Solar Prominences: Measurement of, M. Fizeau, 422; Photography of, Prof. G. E. Hale, 326; M. Deslandres, 404, 522
 Soilas (Prof., F.R.S.), the Basal Conglomerate of Howth, 455
 Solomon Islands, Collection of Dried Plants from the, 586
 Solutions: Prof. W. Ostwald, 193, 293, 415, 606; J. W. Rodger, 487, 342
 Somaliland, Skin of Grevy's Zebra brought from, 598
 Sorby (Dr.), True Relation of Technical Education to Study of Pure Science, 38
 Sound, a Lecture Experiment on, Reginald G. Durrant, 415
 South America: Adventures amidst the Equatorial Forests and Rivers of, Villiers Stuart, 317; Sporting Sketches in, Admiral Kennedy, 390; Aberrant Fossil Ungulates of, 608
 South Kensington, the Science Museum and Gallery of British Art at, 348
 South-West, Grasses of the, Dr. George Vasey, 390
 Southwell (T.), Large Greenland Shark Stranded at Lynn, 546
 Sowerby (William), Intermediate Forms of Azaleas, 519
 Spanish Quatercentenary Exhibition of Discovery of America, Projected, 64
 Sparrows and Crocuses, B. McLachlan, F.R.S., 441
 Spectrum Analysis: Dr. Müller on the Telluric Spectrum, 21; Note on the Chromosphere Spectrum, Prof. C. A. Young, 28; the Chromosphere Line Ångström 6676'9, 103; the Chromosphere Line λ 6676'9, Prof. C. A. Young, 198; New Method of Determining Dispersion and Refraction in Ultra-Violet Rays, Dr. Rubens, 48; Spectra of the Sun and Metals, F. McClean, 159; Analysis of Spectrum of Sodium, Dr. G. J. Stoney, F.R.S., 166; Stars having Peculiar Spectra, Prof. Pickering, 210; a New Spectrometer, C. Féry, 239; Spectrum of Iron and the Periodic Law, John Parry, 253; Colour and Spectrum of Free Gaseous Fluorine, M. Moissan, 260; Observations of the Spectrum of Nova Aurigæ, 345; Dr.

- Henry Crew, 569; J. Norman Lockyer, F.R.S., 429; E. W. Maunder, 619; the Curves of Luminosity under very Feeble Illumination, Prof. König, 432; the Lick Spectroscope, 473; Researches on Samarium, Lecoq de Boisbaudran, 504; Periodic Heat Maxima observed in Spectra from Flint and Crown Glass and Rock-salt, M. Aymonnet, 504; the Aurora Spectrum, Prof. Hale, 522; the Spark Spectra of Gallium, Lecoq de Boisbaudran, 575; on the Line-Spectra of the Elements, Prof. C. Runge, 607
- Spence (M.), Supernumerary Rainbows observed in the Orkneys, 223
- Spencer (J.), Physiography, Elementary Stage, 27
- Spencer (Prof. W. Baldwin): on the Habits of Ceratodus, the Lung Fish of Queensland, 425; on the Fresh-water and Terrestrial Fauna of Tasmania, 425
- Spermatozoa, the Behaviour of, towards Electric Currents, Dr. Schweizer, 599
- Sphere, Prof. J. S. Slater's Improved Armillary, 134
- Spitta (Dr. E. J.), Law of Limiting Apertures, 186
- Sponge Trade of the Bahama Islands, 20
- Sponges, Fresh-water in the Buffalo Bay and Niagara Region, Dr. Kellicott, 305
- Sporting Sketches in South America, Admiral Kennedy, 390
- Spot, the Red, on Jupiter, W. F. Denning, 272
- Spring (Prof.), the Late Prof. Stas's "Silver" (the Results of further Stöchiometrical Investigations), 497
- Sprung (Dr.), Atmospheric Rings, 599
- Squirrels in Winter, C. Fitzgerald, 136
- Stage, Electricity on the, 259
- Standards of Measure and Weight immured in the Houses of Parliament, Examination of the, 543
- Stanton (T. W.), the Stratigraphic Position of the Bear River Formation, 450
- Starling (Dr. E. H.): an Introduction to Human Physiology, Augustus D. Waller, 340; a Text-book of Chemical Physiology and Pathology, W. D. Halliburton, 51
- Stars: Proper Motions of the Stars, W. H. S. Monck, 8; the Motion of Stars in the Line of Sight, Prof. J. Norman Lockyer, F.R.S., 117; Prof. H. C. Vogel, 280; Star Groups, J. Ellard Gore, 52; on the Observation of North Polar Stars in the Vertical of Polaris, Truman Saffard, 159; Stars having Peculiar Spectra, Prof. Pickering, 210; New Star in the Milky Way, Ralph Copeland, 325; Observations of Nebulæ and Star-Clusters, M. Bigourdan, 352; the New Star in Auriga, 344, 366; Thos. D. Anderson, 365; G. Rayet, 408; J. Norman Lockyer, F.R.S., 429, 473; Herren Eugen and Gothard, 473; S. W. Burnham, 473; H. C. Vogel, 498; Astronomer-Royal of Scotland, 454, 527; Photographic Magnitudes of Stars, 380; the Grouping of Stars in the Southern Part of the Milky Way, H. C. Russell, F.R.S., 423; Fuzziness of some Variable, Cuthbert G. Peek, 497; the Relative Motion of 61 Cygni, Prof. A. Hall, 547
- Stas (Prof.), Death of, 154
- Stas's (the late Prof.) "Silver" (the Results of further Stöchiometrical Investigations), Prof. Spring, 497
- Statesman's Year-book for the year 1892, J. Scott Keltie, 437
- Statistics of Population of the Five Continents, E. Levasseur, 552
- Statistics of the Production and Consumption of Milk in Great Britain, R. Henry Rew, 614
- Statistics of Surface and Population of European States, Émile Levasseur, 528
- Steam, Superheated, Lord Rayleigh, Sec. R.S., 375; J. Macfarlane Gray, 413, 486; Prof. James A. Cotterill, F.R.S., 414; G. H. Bailey, 414; John Gamgee, 438
- Steam-Engine, Thermodynamics of the, and other Heat-Engines, Cecil H. Peabody, Prof. A. G. Greenhill, F.R.S., 172
- Stearns (Robert E. C.), Conchology of the West Coast of South America, 89
- Steel, Microscopic Structure of Hard, Behrens, 48
- Steen (Herr), Influence of Total Solar Eclipse on Air-Pressure, 444
- Stejneger (L.), Enormous American Lizard, 40
- Stellar Aberration, Lord Rayleigh, Sec. R.S., 499
- Stellar Photography, a Shutter for use in, J. Joly, 167
- Stellar Spectra, Distribution of Energy in, Prof. Pickering, 159
- Stellar Spectra, the Draper Catalogue of, A. Fowler, 426
- Step (Edward), By Sea-shore, Wood, and Moorland, Peeps at Nature, 28
- Stirling (James), Hydrology of the Mitta Mitta, 40
- Stirling (Dr.), New Australian Animal (*Notoryctes typhlops*), J. D. Ogilby, 135
- Stockholm Natural History Museum, Prof. Svén Lovén's Resignation of his Position as Senior Keeper in the, 613
- Stokes (Sir G. G., F.R.S.): the Interactions occurring in Flames, 430; on an Optical Proof of the Existence of Suspended Matter in Flames, 133
- Stokvis (Prof.) on Mutual Antagonism, 72
- Stones for Building and Decoration, Geo. P. Merrill, 222
- Stones, Precious, and Gems, their History, Sources, and Characteristics, Edwin W. Streeter, 531
- Stoney (Dr. G. Johnstone, F.R.S.): Analysis of Sodium Spectrum, 166; proposed Standard Gauge, 598
- Stonyhurst Drawings of Sun-spots and Faculæ, Rev. Walter Sidgreaves, 261
- Storm, Magnetic, of February 13-14, 1892, 493
- Storms, Magnetic, Dr. M. A. Veeder, 557
- Storms, Winter, of Northern India, Henry F. Blanford, F.R.S., 490
- Story of the Hills, Rev. H. N. Hutchinson, 364
- Streeter (Edwin W.), Precious Stones and Gems, their History, Sources, and Characteristics, 531
- Strength, the Limpet's, J. Lawrence Hamilton, 487
- Striated Surface under the Cromer Drift, William Sherwood, 511
- Struthious Birds of Australasia, on the Origin of the, Prof. Hutton, 425
- Struts and Tie-rods laterally loaded, Prof. J. Perry, F.R.S., 192
- Struve (H.), Two New Laws of Celestial Mechanics, 70
- Stuart (Prof. T. P. Anderson): the Mechanism of the Closure of the Larynx, 357; Exchange of Professorial Duties, Prof. E. Ray Lankester, F.R.S., 557
- Stuart (Villiers), Adventures amidst the Equatorial Forests and Rivers of South America, 317
- Submarine Eruption North-west of Pantelleria, October 1891, on the Matter thrown up during the, General W. Butler, Geo. H. Perry, 251; Abstract of Mr. A. Ricco's Account of the, G. W. Butler, 584
- Suffling (E. R.), How to Organize a Cruise on the Broads, 52
- Sugar in Blood, Note on the Behaviour of, Dr. Vaughan Harley, 407
- Sulphur, Decomposition of, Tested Electrolytically, Dr. Gross, 599
- Sulphuric Acid, the Manufacture of, George Lunge, Ph.D., Prof. T. E. Thorpe, F.R.S., 121
- Sumatra, Java, &c., Fresh-water Fauna of, Prof. Max Weber, 408
- Sumpitan and Bow in Indonesia, Use of the, C. M. Pleyte, 235
- Sun: the Temperature of the, M. H. Le Chatelier, 547; Sun Pillar, Annie Ley, 484; Spectra of the Sun and Metals, F. McClean, 159; Sun-spots and Air Temperature, 271; Stonyhurst Drawings of Sun-spots and Faculæ, Rev. Walter Sidgreaves, 261; Sun-spots of February, 446; Red Light after Sunset, Dr. M. A. Veeder, 30
- Sunday Lecture Society, 116
- Sunflower Cultivation in Southern Russia, 568
- Sunflower, Biology of the, A. Gordyaghin, 597
- Superheated Steam, Lord Rayleigh, Sec. R.S., 375; J. Macfarlane Gray, 413, 486; Prof. James A. Cotterill, F.R.S., 414, G. H. Bailey, 414; John Gamgee, 438
- Supernumerary Rainbows observed in the Orkneys, Robt. H. Scott, F.R.S., 223; M. Spence, 223
- Surface Tension, a Lecture Experiment in, E. D. Fridlander, 463
- Surgery: on the implanting of Large Pieces of Decalcified Bone to fill up Losses of Substance of Skeleton, Le Dentu, 95
- Surrey Hills, on, by a "Son of the Marshes," 5
- Suspended Matter in Flames, on an Optical Proof of the Existence of, Sir G. G. Stokes, F.R.S., 133
- Swan's Secret, a, Mrs. Jessie Godwin-Austen, 416
- Swift (Dr. Lewis): some Apparently Variable Nebulæ, 261; Variability of Nebulæ, 522; a New Comet Discovered by, 446; Swift's Comet, March 6, 548; Comet Swift, 1892, 569
- Swinhoe (Colonor), Silk-producing Moths, 38
- Sydney: Discoloration of Water in Port Jackson by Minute Marine Organisms, 184
- Sydney: Ethnological Purchases for the Australian Museum, E. P. Ramsay, 325; Fruit-growers' Conference at, 420
- Sydney, Royal Society of New South Wales, 311

- Sydney University, the Demonstrator of Chemistry at, 19
 Syme (David), Topical Selection and Mimicry, 30
 Symons (G. A.), Phenomenal Barometrical Depression
 (November 11, 1891), 65
 Tacchini (Prof.), State of Solar Activity, 137; Solar Observations, 352
 Tait (Prof. P. G.): on the Virial Equation for Gases and Vapours, 199; the Isothermals of Mixtures of Gases, 431; the Relation between Kinetic Energy and Temperature in Liquids, 455
 Tannin, the Mangrove as a Source of, Dr. J. T. Thorrock, 546
 Tarr (R. S.), the Permian of Texas, 310
 Tasmania, on the Freshwater and Terrestrial Fauna of, Prof. W. Baldwin Spencer, 425
 Tate Gallery, the Science Museum and the, 385, 433
 Taurus, the Eastern, and the Anti-Taurus, D. G. Hogarth, 138
 Taylor (A. J.), the Ouse, 102
 Taylor (J. Traill), Optics of Photography and Photographic Lenses, 364
 Taylor (Sedley), a System of Sight-singing from the Established Musical Notation, based on the Principle of Tonic Relation, 437
 Tea-Culture in New South Wales, W. T. Robertson, 260
 Teaching, the Optical Lantern as an Aid in, C. H. Bothamley, 437
 Teall (J. J. H., F.R.S.), the Plutonic Rocks of Garabal Hill and Meall Breac, 360
 Technical Education: the Speaker of the House of Commons on, 19; Technical Education in Essex, 243, 613; in Scotland, 377; in London, 403; the New London County Council and, 566; Technical Education for Novelists, 487
 Technology, Photography as a Branch of, Prof. R. Meldola, F.R.S., 331
 Tegetmeier (W. B.), Utilization of Homing Pigeons, 320
 Telegraph, Heroes of the, J. Munro, 5
 Telegraphic Connection with the Bahama Islands, 114
 Telephone Installation at Adelphi Hotel, Liverpool, 184
 Telescopic Objectives, A. Fowler, 204
 Telluric Spectrum, Dr. Müller on the, 21
 Tempel-Swift's Periodic Comet, 21
 Tempel-Swift Comet, 159
 Temperature, Changefulness of, as an Element of Climate, 610
 Temperature in Europe, Research on Extremes of, Dr. Lachmann, 576
 Temperature, Metals at High, Prof. W. C. Roberts-Austen, F.R.S., 534
 Temperature of the Sun, the, M. H. Le Chatelier, 547
 Tenasserim River, Discovery of Coal on, 496
 Tension, a Lecture Experiment in Surface, E. D. Fridlander, 463
 Terne (Dr. B.), the Utilization of the By-products of the Coke Industry, 157
 Tertiary Silicified Woods of Eastern Arkansas, R. Ellsworth Call, 119
 Tesla (Nikola), Lectures on Alternate Currents of High Potential and Frequency, 345
 Theobald (F. V.), an Account of British Flies (Diptera), 173
 Theory of Solutions, Prof. W. Ostwald, 293, 415; J. W. Rodger, 342, 487
 Thermodynamics: Thermodynamics of the Steam Engine and other Heat Engines, Cecil H. Peabody, Prof. A. G. Greenhill, F.R.S., 172; a Simple Heat Engine, Fred. J. Smith, 294; Elementary Thermodynamics, J. Parker, 314; the Thermal Conductivities of Crystals and other Bad Conductors, C. H. Lees, 382; Poincaré's Thermodynamics, Prof. H. Poincaré, 245, 414, 439, 485, 532; Thermodynamical View of Action of Light on Silver Chloride, H. W. Elder, 524
 Thermometer, a Compensated Air-, H. L. Callendar, 212
 Thermometers, the Change of Zero of, C. T. Heycock, 526
 Thiselton-Dyer (W. T., F.R.S.): University of London, 329; Award by Royal Society of New South Wales of Clarke Memorial Medal to, 495
 Thomas (R. Haig), a Plague of Small Frogs, 8
 Thompson (Elizabeth), Science Fund, 9
 Thompson (E. O.), the Prairie Larks and Cranes of Manitoba, 135
 Thompson (J. O.), the Law of Elastic Lengthening, 311
 Thompson (Prof. S. P., F.R.S.): Electro-Magnetism, Prof. A. Gray, 73; Supplementary Colours, 412; Modes of Representing Electromotive Forces and Currents in Diagrams, 478
 Thomson (D.), the Prolongation of the Gooseberry Season, 157
 Thomson (Prof.), some Experiments on Electric Discharge, 526
 Thomson (Prof. J. J., F.R.S.), Collection de Mémoires Relatifs à la Physique, 361
 Thomson (Principal J. L.), Olive-culture in Australia, 135
 Thomson (J. P.), on Recent Explorations and Discoveries in British New Guinea, 425
 Thomson (Sir William, F.R.S.): Portrait of, 113; Peerage conferred on, 233
 Thorne (R. Thorne, F.R.S.), Diphtheria, its Natural History and Prevention, 123
 Thornycroft (J. I.), the Steadying of Vessels at Sea, 570
 Thorpe (Prof. T. E., F.R.S.): Dr. George Lunge on the Manufacture of Sulphuric Acid, 121; the Alkali Maker's Handbook, by Dr. George Lunge and Dr. F. Hurter, 121; Phosphorous Oxide, ii, 213; Frangulin, ii, 214; Obituary Notice of Hermann Kopp, 441; Lecture Experiment to illustrate Phenomena in Coal-Dust Explosion, 551
 Thraen (Herr Dr.), Wolf's Comet, 1891 II., 548
 Throwing-Sticks, Eskimo, Prof. O. T. Mason, 66; Agnes Crane, 103
 Thurston (Edward), on the Fall of Meteorites in Madras, 20
 Thibet, Across, Gabriel Bonvalot, 269
 Tibet Expedition, General Pevtsoff, 45
 Tides of St. Malo Bay, the, M. Heurtault, 143
 Tierra del Fuego, Mussel Poisoning in, M. Segers, 134
 Tilden (W. A.), Limettin, 453
 Tin Mining in Mergui, 496
 Titchener (E. B.): Comparative Palatability, 53; Peculiar Eyes, 177
 Tittmann (O. H.), C.G.S. System of Units, 581
 Tobacco, the Insect &c. Enemies of, Prof. Tozzetti, 325
 Tokyo Botanical Magazine, 46
 Tomb, Prehistoric, in Ohio, Discovery of Remarkable, 157
 Tombs, Ancient, and Burial Mounds of Japan, Prof. Hitchcock, 381
 Tomlinson (Herbert, F.R.S.), the Aneroid in Hypsometry, 440
 Tonganoxie Meteorite, E. H. S. Bailey, 119
 Topical Selection and Mimicry, David Syme, 30; Dr. Alfred R. Wallace, 30
 Topinard (Paul), the Transformation of the Animal Skull into a Human Skull, 260
 Topinard (Paul), L'Homme dans la Nature, 457
 Topy (W.), Obituary Notice of Dr. T. Sterry Hunt, 400
 Tornado in N.W. States of North America, 545
 Torpid Cuckoo, A. Holte Macpherson, 416
 Tortoise Enclosed in Ice, a, Frank Finn, 320
 Tower of Babel and the Confusion of Tongues, the, Thos. G. Pinches, 210
 Town Fogs and their Effects, 53; Dr. W. J. Russell, F.R.S., 10
 Tozzetti (Prof. A. T.), the Insects &c. that Injure Tobacco, 325
 Trajectories of Elongated Projectiles, Calculation of, Rev. F. Bashforth, 473
 Transcaucasie et la Péninsule d'Apchéron, la, Calouste S. Gulbenkian, 52
 Transit Circles, N.P.D.'s Observed with Greenwich and Washington, Prof. Newcomb, 548
 Transit Observations, Personal Equations in, 617
 Transvaal, Southern, Geology of the Gold-bearing Rocks of the, Walcot Gibson, 598
 Travaux de la Société des Naturalistes de St. Pétersbourg, 141
 Travels of a Painter of Flowers, 602
 Trees, Our, John Robinson, 603
 Trigonometry, Elementary, Rev. R. H. Whitcombe and J. M. Dyer, 174
 Trigonometry: Levels, J. A. C. Oudemans, 240
 Trigonometry, the Elements of Plane, R. Levett and C. Davison, 509
 Trinity College, Dublin, Tercentenary Celebration of, 378
 Tropical Sea-side Plants, W. Botting Hemsley, F.R.S., 3
 Trouton (Fred. T.), some Experiments made with the View of Ascertaining the Rate of Propagation of Induced Magnetism in Iron, 42
 Trow (A. H.), a Difficulty in Weismannism, 102, 175
 Trowbridge (John), a Phasemeter, 622
 True (F. W.), the Puma, 445
 Tuberculosis, the Vaccination of the Dog against, Héricourt and Richet, 576

- Tudor Specimen of Eozoon, J. W. Gregory, 486
 Turner (F.), the Acclimatization of the Avocado Pear in New South Wales, 66
 Turner (H. H.), Solar Disturbances of 1891, June 17, 404
 Turner (Sir W.), the Lesser Rorqual Whale, 454
 Tutton (A. E.): Iron Carbonyl from Water Gas, 36; Further Researches upon Azonimide, N_3H , 127; Phosphorous Oxide, ii., 214; Phosphorous Oxide, 446; the Properties of Amorphous Boron, 522
 Tylor (Dr. E. B.): the Limits of Savage Religion, 71; the Bow as Origin of Stringed Instruments, 184
 Tyndall (John, F.R.S.), New Fragments, 508
 Typological Museums, General Pitt-Rivers, 184
 Tyrell (J. B.), Geology of Lake Winnipeg, 115
- Ungulates of South America, Aberrant Fossil, 608
 Umney (J. C.), the Aconite Alkaloids, ii., 525
 United States: Weather Bureau of the, 86; Education in, 156; Production of Pig-Iron in, John Birkinbine, 208; the Paper-making Industry in the, J. F. Hobart, 279; U.S. Naval Observatory, Report of, 352; the Mountain Meteorological Stations of the United States, A. L. Rotch, 403; the Study of Psychology as a Science in the United States, E. W. Scripture, 568
 Units, C.G.S. System of, O. H. Tittmann, 581; Prof. J. D. Everett, F.R.S., 581
 Universal Atlas, the, 52
 Universities in Australia, Prof. Morris on, 426
 Universities, Functions of, Prof. Geo. Fras. Fitzgerald, F.R.S., 513
 University College, London, Proposed Extension of Physical and Engineering Departments, 348
 University Colleges in Great Britain, Report of Committee on Grants to, 544
 University Extension Movement, Lord Cranbrook and the, 155
 University, the Function of a, Prof. W. E. Ayrton, F.R.S., 430
 University Intelligence, 23, 45, 70, 92, 118, 139, 162, 286, 334, 356, 381, 428, 449, 549, 622.
 University of London, W. T. Thiselton Dyer, F.R.S., 392; Prof. E. Ray Lankester, F.R.S., 413; Prof. W. F. R. Weldon, F.R.S., 440
 University, the Proposed Gresham, 323, 443, 517
 University, Teaching, for London, Royal Commission to investigate the Question of a, 612
 Upham (Warren), Fossils recently Discovered near Boston, 622
 Uraninite, New Analyses of, W. F. Hillebrand, 119
 Uranium in Swedish Anthracitic Minerals, Discovery of, Baron Nordenskiöld, 209
 Urinary Secretion of Nitrogen, Dr. Gumlich on the, 599
 Urine in some Infectious Maladies, Ptomaines extracted from, A. B. Griffiths, 72
 Useless Studies, Value of, Prof. Geo. Fras. Fitzgerald, F.R.S., 392
 Utilization of Homing Pigeons, W. B. Tegetmeier, 320
- Vaccination of the Dog, the Tubercular, Héricourt and Richet, 576
 Vacher (M.), Workmen Killed and Wounded in Accidents in Germany, 350
 Vacuum Discharge Streamers, on the Action of, upon each other, Dr. M. I. Pupin, 622
 Vacuum Tubes and Electric Oscillations, Prof. Oliver J. Lodge, F.R.S., 366
 Valence of a Coloured Radiation, Hering, 115
 Value of Useless Studies, Prof. Geo. Fras. Fitzgerald, F.R.S., 392
 Value, an Introduction to the Theory of, William Smart, 268
 Varet (Raoul), Action of Metals on Salts Dissolved in Organic Liquids, 360
 Variability of Nebulæ, Dr. Lewis Swift, 522
 Variable Nebulæ, Some Apparently, Lewis Swift, 261
 Variable Stars, Fuzziness of Some, Cuthbert G. Peek, 497
 Variables, Two New, in Cepheus, Paul S. Yendall, 570
 Variation of Latitude, Dr. S. C. Chandler, 404, 589; Robert B. Hayward, F.R.S., 465; Dr. B. A. Gould, 521; on the, M. Faye, 570
 Vasey (Dr. George), Grasses of the South-West, 390
 Vaussenat (C. X.), Death and Obituary Notice of, 207
Vedalia cardinalis successfully Colonized at the Cape of Good Hope, 615
 Vedel (Lieut.), on the Polynesians, 615
 Veeder (Dr. M. A.): Auroras at Lyons, N.Y., 7; Red Light after Sunset, 30; Plan for Observations to Determine Local Distribution and Altitude of, 234; Magnetic Storms, 557
 Velocity, Molecular, Relation of Voltaic Electromotive Force to, Dr. G. Gore, F.R.S., 596
 Venus, Rotation of, Herr Loschardt, 210
 Verbeek (Dr. R. D. M.), Relics of the Hindu Period in Java, 88
 Vereker (Hon. J. G. P.), the Resolution of Podura, 239
 Verner (W.), Threatened Extinction of the Kentish Plover, 236
 Vesuvius, Eruption of, 259
 Vibrations, on Earth, Dr. Emil Oddone, 510
 Victoria: Victoria Agricultural Department, Results of the Travelling Dairy, A. Crawford, 39; Hand-book of the Destructive Insects of Victoria, C. French, 246; Experimental Perfume Farming in, 305; Viticulture for Victoria, F. de Castella, 324
 Vienna, Annales of the University Observatory in, 138
 Vienna, a New Epidemic in, 349
 Vilmorin (Philippe L. de), Les Fleurs à Paris; Culture et Commerce, 510
 Vincent (M.), Thermometer-Temperature and Skin-Temperature, 304
 Violle (J.), Radiation of Incandescent Bodies and Optical Measure of High Temperatures, 552
 Virial Equation for Gases and Vapours, on the, Prof. P. G. Tait, 199
 Virial of a System of Hard Colliding Bodies, on the, Lord Rayleigh, F.R.S., 80
 Vision, Peculiar Eyes, James Shaw, 104
 Viticulture: the Wines of the Medoc District, 279
 Viticulture for Victoria, F. de Castella, 324
 Vogel (Dr. E.), Praktisches Taschenbuch der Photographie, 51
 Vogel (Prof. H. C.): Motion of Stars in the Line of Sight, 280; the New Star in Auriga, 498
 Volcanoes: Projected Abandonment of Villages near Colima (Mexico), in Consequence of Activity of Neighbouring Volcano, 158; Volcanic Action in the British Isles, Sir Archibald Geikie, F.R.S., 398; Volcanic Action in Eastern Australia and Tasmania, T. W. E. David, 424; Eruption of Vesuvius, 259; Discovery of Saltpetre and Soda in Kilima-Njaro District, 379
 Voltaic Electromotive Force, Relation of, to Molecular Velocity, Dr. G. Gore, F.R.S., 596
 Vonberg (Prof. Ignace), 518
- “W = Mg,” Prof. Arthur G. Webster, 29
 Waals's (Van der) Generalizations regarding “Corresponding” Temperatures, Pressures and Volumes, Prof. Sydney Young, 93
 Waals's (Van der) Isothermal Equation, Prof. D. T. Korteweg on, 152, 277
 Wagner (Rudolf von), Manual of Chemical Technology, 386
 Walker (Alfred O.), Destruction of Immature Sea-fish, 176
 Walker (G. T.), Repulsion and Rotation produced by Alternating Electric Currents, 213
 Walker (J. J.), Ants' Nest Beetles, 351
 Wallace (Dr. Alfred R.): Topical Selection and Mimicry, 30; the Naturalist in La Plata, W. H. Hudson, 553
 Waller (Augustus D.), an Introduction to Human Physiology, Dr. E. H. Starling, 340
 Ward (Prof. H. Marshall, F.R.S.): the Ginger-beer Plant, 190; The Oak, a Popular Introduction to Forest Botany, 509
 Warner Observatory, 422
 Warning Colours, Frank E. Beddard, 78; Edward B. Poulton, F.R.S., 174; W. L. Distant, 174
 Washington Observations, 1886, 237
 Washington Observations, 1887, 548
 Washington Weather Bureau, Atlas issued by, 587
 Washington, Wind-rush at, Prof. H. A. Hazen, 597

- Water, an Elementary Hand-book on Potable, Floyd Davis, Prof. Percy F. Frankland, F.R.S., 25
 Water, Air and, Vivian B. Lewes, 531
 Water Gas, Iron Carbonyl from, A. E. Tutton, 36
 Water Jets, Sensitive, W. B. Croft, 606
 Water-supply of London, John Hopkinson, 88; Appointment of Commission on, 470
 Watson (Rev. H. W., F.R.S.), on the Boltzmann-Maxwell Law of Partition of Kinetic Energy, 512
 Watson (Serenio), Obituary Notice of, 494
 Watson (W.), Effect of Fog on Plants Grown in the Houses at Kew, 16
 Wave-motion Model, F. Cheshire, 347
 Waves, Remarkable Illustration of Height of Breaking, 305
 Weather-cock, Self-Registering, J. Lawrence-Hamilton, 559
 Weaving as practised by the Navajo Indians, Dr. Shufeldt, 260
 Weber (Prof. Max), Freshwater Fauna of Sumatra, Java, &c., 408
 Webster (Prof. Arthur G.), "W = Mg," 29
 Weight, Examination of the Standards of Measure and, imured in the Houses of Parliament, 543
 Weinschenk (E.), Meteoric Iron, 69
 Weismannism, a Difficulty in, Edward B. Poulton, F.R.S., 52; Prof. Marcus Hartog, 102; A. H. Trow, 102, 175
 Weiss (F. E.), Caoutchouc-containing Cells of *Eucommia ulmoides*, 335
 Weldon (W. F. R.), the Renal Organs of certain Decapod Crustacea, 140
 Weldon (Prof. W. F. R., F.R.S.), the University of London, 440
 Wells (H. L.), a Series of Cæsium Trihalides, 310
 Wells and Penfield (Messrs.), Remarkable Series of Compounds of Halogen Salts of Cæsium with Two or more Atoms of Chlorine, Bromine, or Iodine, 325
 Werigo's (Dr.) Experiments respecting Influence of Oxygen on Elimination of Carbon Dioxide of Lungs, Prof. Zuntz, 576
 Wernadsky (W.), the Sillimanite Group and the Part played by Aluminium in the Silicates, 141
 Wesendonck (Prof.), Gaseous Carbonic Acid not capable of Generating Electricity by Mechanical Friction on Metal, 306
 West India Islands, Zoology and Botany of the, 139
 West Indies, Dr. J. T. Rothrock on the Flora &c. of the Bahamas and Jamaica, 596
 Westgate-on-Sea, Aurora Visible from, 613
 Wethered (Edward), on the Microscopic Structure and Residues Insoluble in Hydrochloric Acid in the Devonian Limestone of South Devon, 597
 Weyl (Dr. Th.), Animals rendered Immune to Anthrax, 312
 Whale, a Steamer's Encounter with a, 88
 Whale, the Lesser Rorqual, Sir W. Turner, 454
 Wheat, Rust Fungus in, 615
 Wheat in Ohio, the Average Yield of, geologically considered, 420
 Whipple (G. M.), Magnetic Disturbance, 364
 Whitaker's Almanack for 1892, 156
 Whitcombe (Rev. R. H.), Elementary Trigonometry, 174
 White (W. H., F.R.S.), the Influence of Shallow Water upon the Trial Trip Speeds of Modern Vessels, 571
 White (William), Darwinian Theory, 53
 Whiteley (R. Lloyd), Chemical Calculations, 604
 Whitney (W. Dwight), the Century Dictionary, 316
 Whympster (Edward): how to Use the Aneroid Barometer, 339; Travels among the Great Andes of the Equator, Prof. T. G. Bonney, F.R.S., 561
 Wiborgh's (Prof.) Air-Pyrometer, John Crum, 304
 Wild (H.), the Magnetic Storms of February 13-14, 1892, 480
 Wilkins (A.), Intelligence in Birds, 151
 Wilks (W.), the Place of Horticulture in Technical Education, 38
 Willer (Arthur), a new Genus of Synascidians from Japan, 450
 Williams (Dr. C. Theodore), Value of Meteorological Instruments in Selection of Health Resorts, 551
 Williams (F. N.), the Genus *Dianthus*, 383
 Williams (Prof. G. H.): a Geological Excursion in Maryland, 235; the part played in Growth of Geological Opinion by Regions near great Universities, 519
 Williams (J. Francon) and William Hughes, the Advanced Class-Book of Modern Geography, 460
 Willis (J. C.), the Method of Fertilization in *Ixora*, 455
 Wilson (F. R. L.), Action of Dry Hydrochloric Acid Gas on Dry Carbonates, 503
 Wilson (Prof.), Experiment Illustrating Power of Palladium of Occluding Hydrogen, 380
 Winchester, Macro-Lepidoptera and Birds of, 115
 Wines of the Medoc District, the, 279
 Wing in Dinornis, Evidence of a, Henry O. Forbes, 257
 Wind Direction, 149
 Wind-rush at Washington, Prof. H. A. Hazen, 594
 Winnecke's Comet, Dr. G. F. Haerdil, 617
 Winnipeg, Lake, Geology of, J. B. Tyrell, 115
 Winter Storms of Northern India, Henry F. Blanford, F.R.S., 490
 Wislicenus (Herr Dr. Walter), on the Influence of Ring and Disk Blinds in Micrometric Measurements, 137
 Wissmann (Hermann von), My Second Journey through Equatorial Africa, 507
 Within an Hour of London Town, 557
 Woeikof (Dr. A.), Cold Waves, 357
 Wolf (Rodolf), Solar Activity in, 1891, 307
 Wolf's Periodic Comet, 42; Dr. Berberich, 237
 Wolf's Comet, 1891, 11; Herr Dr. Thraen, 548
 Wolf's Numbers for 1891, 307
 Wolstenholme (Prof. Joseph), Death of, 85
 Wood (Sir H. Trueman), Light, 269
 Woods, Furniture, D. Deeming, 459
 Woodward (Mr. A. S.), Appointed Assistant Keeper of Department of Geology at British Museum, 566
 Woodward (M. F.), the Milk Dentition of *Procyon (Hyax) capensis*, 287; Teeth Development in the Marsupialia, 333
 Worship, Dwarfs and Dwarf, Harold Crichton-Browne, 269
 Worthington (A. M.), the Mechanical Stretching of Liquids, 358
 Wray (Leonard, Jun.), the Ipoh Poison of the Malay Peninsula, 278
 Wright (C. R. Alder, F.R.S.), on Certain Ternary Alloys, v., 381
 Wright (Prof. G. Frederick): the Theory of an Interglacial Submergence in England, 310; Cirques, 317
 Wrightson (J.), Farm Crops, 247
 Yahgan, the, P. Hyades and J. Deniker, 577
 Yarrow (A. S.), on Balancing Marine Engines and the Vibration of Vessels, 571
 Year, the Origin of the, J. Norman Lockyer, F.R.S., 487
 Year-book of Science, 1891, Prof. T. G. Bonney, F.R.S., 604
 Yeast, Milk Ferment Identical with Kefyr, in use in Canada and United States, C. L. Mix, 471
 Yellow Butterflies, Pigment in, F. Gowland Hopkins, 197
 Yendall (Paul S.), Two New Variables in Cepheus, 570
 Yezo, the Fauna of, Dr. Adolf Fritz, 89
 Young (Prof. C. A.): Note on the Chromosphere Spectrum, 28; the Chromosphere Line λ 6676.9, 198
 Young (Prof. Sydney), Van der Waals's Generalizations regarding "Corresponding" Temperatures, Pressures, and Volumes, 93
 Younghusband (Capt.), Journeys in the Pamirs and Adjacent Countries, 353
 Zebra, on the Attitudes of the, during Sleep, and their Influence on the Protective Value of its Stripes, 248
 Zebra, Skin of Grevy's, brought from Somaliland, 598
 Zebras, Notes on, S. B. Carlill, 526
 Zeitschrift für Anorganische Chemie, 421
 Zeitschrift für Pflanzenkrankheiten, 20
 Zimbabwe Ruins, Finds at the Great, Theodore Bent, 551
 Zodiacal Light, O. T. Sherman, 381
 Zoology: Zoological Gardens, Additions to, 21, 41, 67, 89, 116, 137, 159, 186, 210, 236, 260, 280, 307, 325, 351, 380, 404, 422, 445, 472, 497, 521, 547, 569, 589, 616; the Death of the Giraffe, 518; Zoological Society, 70, 164, 287, 383, 430, 503, 526, 597; Enormous American Lizard, L. Stejneger, 40; Herr Lehmann on the Camel, 87; Prof. Cossar Ewart on Scottish Zoology, 87; Zoological Regions, G. A. Boulenger, 104; Dr. Stirling's New Australian Animal (*Notoryctes typhlops*), J. D. Ogilby, 135; Squirrels in Winter, C. Fitzgerald, 136; Zoology and Botany of the West India Islands, 139; Text-book of Comparative

Anatomy, Arnold Lang, 145; Lehrbuch der Vergleichenden Entwicklungsgeschichte der Wirbellosen Thiere, Dr. E. Korschelt und Dr. K. Heider, 145; the Migration of the Lemming, F. Howard Collins, 149; W. Duppa Crotch, 194, 294; Prof. George J. Romanes, F.R.S., 249; W. Mattieu-Williams, 294; Big Game in India, Harold Little-dale, 158; Discovery of New Species of Frog in New Jersey, Prof. E. D. Cope, 208; Animal Sketches, C. Lloyd Morgan, 291; Animals recently Extinct or Threatened with Extermination, F. A. Lucas, 305; Freshwater Springs in the Buffalo Bay and Niagara Region, Dr. Kellicott, 305; Zoology of the Sandwich Islands, Mr. R. C. L. Perkins Selected to Investigate the, 322; the Hydrocorallinae Collected by Prof.

Haddon in Torres Straits, S. J. Hickson, 407; Freshwater Fauna of Sumatra, Java, &c., Prof. Max Weber, 408; the Puma, P. W. True, 445; the Lesser Rorqual Whale, Sir W. Turner, 454; Zoological Record for 1890, 483; a Zoologist on Disease, Dr. Elie Metschnikoff, Prof. E. Ray Lankester, F.R.S., 505; Mr. Charles Hose's Collections, 517; Notes on Zebras, S. B. Carlill, 526; a New Oryx (*Oryx callotis*), 526; the New Imperial German Zoological Station at Heligoland, 544; Egg of the Extinct Gigantic Bird of Madagascar *Aepyornis maximus*, 586
 Zune (M.), the Composition of Hæmocyanin, 456
 Zuntz (Prof.), Dr. Werigo's Experiments respecting Influence of Oxygen on Elimination of Carbon Dioxide by Lungs, 576



A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

*"To the solid ground
Of Nature trusts the mind which builds for aye."*—WORDSWORTH.

THURSDAY, NOVEMBER 5, 1891.

ELECTRICITY AND MAGNETISM.

Electricity and Magnetism. Translated from the French of Amédée Guillemin. Revised and Edited by Silvanus P. Thompson, D.Sc., F.R.S. (London: Macmillan and Co., 1891.)

THIS work is an English translation of M. Amédée Guillemin's popular treatise of electricity. We are informed, in the preface, that the translation has been in great part executed by Mr. Colman C. Starling and Prof. Walmsley, under the editorship of Dr. Silvanus P. Thompson. It is a splendidly illustrated and beautifully got-up book, designed, so the editor says, rather for the table of the drawing-room than for the desk of the student.

We doubt whether, in fashionable drawing-rooms at any rate, scientific curiosity exists to any great extent; but now that large houses are very frequently lighted with electricity there may be a minority of people who are willing to spend any spare time left over from more absorbing drawing-room occupations in learning something of how the light is produced and of other applications of electricity. For such a public the present work seems exceedingly well adapted. It is popularly and attractively written, so far as a translation from a foreign tongue, supplemented, and to some extent corrected, by editorial paragraphs, can well be; it is profusely illustrated, and comprehensive to an extent which has made the book almost too bulky for convenient perusal.

Still, the remnant of people by whom popular scientific treatises such as this are welcomed, though numerous in itself, is, alas, only a very small minority of that great and influential section of the British public who are brought directly into contact every hour of their lives with the wonderful practical results of the progress of science. The great majority converse through telephones, consult their watches, and send telegrams, and know no more than a Hottentot does how a telephone acts, a watch goes, or a telegraph message is transmitted.

The book is divided into two parts, dealing respectively with phenomena and their laws, and practical applications; or, speaking briefly, theory and practice. In the theoretical part, magnetism is first treated, then electricity, in the order statical electricity, electro-chemistry, and electro-magnetism. In the practical part are comprised telegraphy and telephony, electric lighting and transmission of power, and a number of minor, but in themselves important, applications, such as clockwork-driving and regulation, electricity in warfare, and electroplating. Of the treatment of these subjects we can give here only the merest sketch, noting as we do so a few points in which the book seems to call for modification or improvement in a new edition.

The theoretical part begins with a brief account of the natural history of magnetism, then passes to a discussion of the polar theory of magnetism, starting with the notion of Thales that a magnet had a soul, and ending with the experiments of Coulomb and their results. An excellent description of Coulomb's torsion-balance experiments is given, and then follow the methods devised by Coulomb and Jamin for the determination of the distribution of magnetism in magnets. It is hardly correct to say, as is done on p. 33, that Coulomb's method "enabled him to study the distribution of magnetism in magnets; that is to say, how the magnetism at the surface varies along the magnet between one end and the other." Apart from the objection that the field at any point external to the surface of the bar depends really upon the whole distribution of magnetism, and not merely on that supposed to be near the point, and the further objection (which also does not seem to be stated here) that the vibrating needle itself affects the magnetization of the magnet, it is quite certain that this method, like others devised for the same purpose, cannot be made to give any definite information except as to the surface-distribution of magnetism, which, as Gauss showed, can be made to replace the magnet so far as the external field is concerned. By none of these methods can any information whatever be obtained as to the actual magnetization of a bar of finite cross-section.

It would have been well also if the editor had here appended a note as to the essential inaccuracy of Jamin's method "of placing on the point that we wish to study a

small contact-piece of soft iron, and of measuring by means of a graduated spring that gradually extended, the force requisite to detach the iron," and given a description of the much more satisfactory method adopted by Rowland and others.

After a chapter on methods of magnetization, in which all the ancient and now discarded methods of "touch" are described, we have an excellent popular discussion of terrestrial magnetism, ending with a splendidly illustrated account of auroræ. The introduction of the subject of auroræ at this point is justified on the ground that they are electrical phenomena connected with the magnetism of the earth, and a sketch is given of the various theories which have been proposed.

Passing now to the subject of electricity, we have the same wealth of illustration, though many of the smaller cuts, like some of those in the section on magnetism, are old familiar friends. Electrical machines are described, from Otto Guericke's down to Wimshurst's. Nothing impresses us as more indicative of the enormous advance of electrical science in recent times than a comparison of Plates V. and XIII. of this book. The former, a well-known picture, represents an electrical machine "according to the model in fashion about 1754"; the latter, a large Edison steam-dynamo. In the former a bevy of ladies and gentlemen in the costume of last century are grouped round a sulphur ball machine, which a gentleman in powdered wig and ruffles is vigorously turning by means of a crank attached to a large and much ornamented driving-wheel of wood. Evidently we have here "electricity in the drawing-room," as practised in the middle of last century. On the other plate we see a large modern steam-engine, in all its array of steam-pipes, balanced cranks, and connecting-rods, resting on a massive bed-plate of iron bolted to a base of masonry, and driving an enormous dynamo. The somewhat *dilettante* group of men and women have disappeared, and in their place stands a typical Yankee engineer, oil-can in hand, and coatless, intently regarding the bearings of the engine. Here there is no unnecessary ornamentation, no suggestion of elegant trifling, everything is sternly suggestive of work and nothing else. Nevertheless, in the contrast, the real dignity and beauty is with the present, not with the past; with modern science in the laboratory, the workshop, or the factory; with work carried on in the deepest earnest, with plain duty-doing, irrespective of sensation or applause.

Next comes an account of batteries, which (like several other parts of the book) we think might very well have been lightened by ignoring old and obsolete pieces of apparatus; after that, we have a discussion of the production of electric currents. In a book of this size, in which a considerable amount of space is devoted to things relatively unimportant, the subject of electrolysis might have been more fully treated; for example, there are matters connected with electrolytic theories to which, since such a theory as that of Clausius is introduced, a few pages might very well have been devoted. The absolute measurement of currents by means of electrolysis from the known electro-chemical equivalents of different substances is not referred to; indeed, an electro-chemical equivalent does not seem to be anywhere defined. But

what strikes one as strange indeed is that in the chapter on thermo-electricity Peltier's name is only mentioned in connection with an illustration showing what is called his "thermo-electric pince." Not a word is said on the subject of the Peltier effect, or the Thomson effect, not to speak of the bearing of these on thermo-electric theory! Again, no mention appears to be made of any form of secondary cell except that of Planté: surely some of the modern forms now so largely in use in practice for electric lighting, traction, &c., might have been figured and described.

The next section of theory, electro-magnetism, has three chapters devoted to it. The main phenomena are well described, and excellently illustrated by diagrams. Here the only forms of tangent and sine galvanometer figured are those of Pouillet (one of these (p. 337) has an enormous needle). Some of the splendid instruments which have been made for absolute measurements (for example, Fitzgerald's tangent galvanometer) ought surely to find a place in a work like the present, published as it is at a time when currents, &c., are no longer measured in arbitrary units, and their determinations are as far as possible divested of errors arising from instrumental peculiarities and accidents of place. A definition might also have been given here of the electro-magnetic unit of current, with some indication, where the constant of a galvanometer is referred to, of how it is possible to measure currents in absolute units, and the importance in this respect of electro-magnetic instruments, the constants of which can be determined from their dimensions and arrangement. At p. 333 a current of so many amperes is referred to as producing a certain force at the needle, but we have not anywhere, so far as we have been able to discover, a definition of an ampere.

The following passage (p. 369) apparently quoted from Faraday's "Researches," was at first sight rather startling: "In this state of circumstance(s) the force of the electro-magnet was developed by sending an electric current through its coils, and immediately the *image of the lamp-flame continued magnetic*." It is almost needless to say that a reference to the "Researches" showed that the copyist had dropped out a line from Faraday's account of the actual phenomenon, which was not exactly that asserted in the quotation. After "flame" supply the words "became visible, and continued so as long as the arrangement."

The second part of the book is most excellent. All applications of electricity of any importance are fully described, and magnificent cuts, without stint, illustrate in the clearest manner the marvellous and complex contrivances and arrangements now in use in the various systems of telegraphy and telephony, electric lighting, &c., &c. Full-page plates of the illumination of Tunis by the search-lights of the French fleet, the electric light in use in the erection of a great Parisian *magasin*, the head-light of a locomotive illuminating the track, the interior of one of the Paris forts during the siege, and other subjects, serve to show the great part now played by electricity in all branches of industry and the arts, even including warfare, slow as that is in some respects to profit by the latest results of scientific invention. No book could form a more attractive and useful present for a boy with a taste for mechanics and practical electrical

science, and it is sure to be no less popular among older people who appreciate a sound and easy guide to the mysteries of practical electricity.

In taking leave of this work, we have only to say, what has already been indicated above, that an extension of the editorial remarks, and their absorption into the general current of the text, with consequent re-writing of some of the chapters, would render it more homogeneous, and throughout more in accordance with the electrical spirit of the age. Still, the clearness of its arrangement and style more than compensate for the disadvantages necessarily attending an edited English edition of a foreign scientific treatise, however popular. As a whole, it reflects credit on all concerned—translators, editor, and publishers alike. Its publication may even do something towards arousing an interest in electricity in circles, even in this proverbially practical country, where the light of science can hardly be said to have yet penetrated.

A. GRAY.

BIOLOGY OF SEASIDE PLANTS.

Die indo-malayische Strandflora. Von A. F. W. Schimper. Mit 7 Textfiguren, einer Karte, und 7 Tafeln. (Jena: Gustav Fischer, 1891.)

Ueber die Mangrove-Vegetation im malayischen Archipel. Von G. Karsten. *Bibliotheca Botanica*, Heft 22. (Cassel: Theodor Fischer, 1891.)

THESE two essays are exceedingly interesting contributions to our knowledge of plant-life on tropical sea-shores. They partly cover the same ground, partly supplement each other, and to some extent review and summarize the work of previous observers. Schimper treats of the salt-loving plants of the sea-shore generally, whilst Karsten's investigations are limited to the purely mangrove vegetation. Karsten also enters more fully into the formation of seeds—that is to say, into the development of the embryo-sac, the endosperm, and the embryo; and he follows up their germination and subsequent growth.

But the object of this notice is to give some general idea of the subject rather than a critical exposition of the writings of the authors named, for they are the first attempts at a connected description of the vegetation of tropical sea-shores.

The mangrove¹ vegetation—that is, the vegetation of the tidal forests—exhibits comparatively little variety, though the components belong to several different natural orders. First come the Rhizophoræ—genera *Rhizophora* (both in the Old World and in America), *Bruguiera*, *Ceriops*, and *Kandelia*; *Combretaceæ*—*Lumnitzera* (*Laguncularia* in America); *Lythraceæ*—*Sonneratia*; *Meliaceæ*—*Carapa*

¹ The word mangrove looks quite English, but it appears to be a corruption or modification of *mangro* or *mungra*, the name commonly applied, according to Rumpf (1750), and Blume (*Museum Botanicum*, i. p. 132), in Dutch Guiana to *Rhizophora Mangle*. However, it was employed in its present form by Dampier, Sloane, and other writers of the seventeenth century, and it is now applied to a number of different trees and shrubs that constitute the outermost fringe of vegetation on tropical coasts. It is also used to designate these shrubs and trees collectively. *Mangi-mangi* is the generic term in the Malay Islands for these trees and shrubs, and the different kinds are distinguished by affixes. In Brazil, *Rhizophora Mangle* is called *mangle* and *mangue*; and in Panama, on the authority of Seemann ("Die Völkernamen der amerikanischen Pflanzen"), the former name is current, with various qualifying affixes. In Grisebach's list of colonial names of plants ("Flora of the British West Indian Islands," p. 785), we find mangroves (*Rhizophora mangle*); black mangrove (*Avicennia nitida*); white mangrove (*Laguncularia racemosa*); and Zaragoza mangrove (*Conocarpus erectus*).

(*Carapa guianensis*, a native of tropical America and west tropical Africa, does not appear to inhabit the tidal forests); *Myrsinæ*—*Ægiceras*; *Rubiaceæ*—*Scyphiphora*; *Verbenaceæ*—*Avicennia* (both in the Old World and in America); *Acanthaceæ*—*Acanthus ilicifolius*; *Palmæ*—*Nipa fruticans*.

The foregoing are the principal and widely-spread trees and shrubs of the mangrove girdle of muddy tropical shores; but this list might be largely augmented if we included those forming the tidal forests of the Bay of Bengal, and similar situations. Thus, in the Sunderbun, as Mr. C. B. Clarke informs me, the Sundra tree (*Heritiera Fomes*) abounds to such an extent that a railway is almost entirely devoted to carrying the wood to Calcutta, of which city it is the fire-wood. Among other common trees and shrubs are *Hibiscus tiliaceus*, *Sapindus Danura*, *Dalbergia monosperma*, *Derris uliginosa*, *Oxystelma esculentum*, *Dolichandrone Rheedii*, *Premna integrifolia*, *Clerodendron inerme*, *Pandani*, *Phoenix paludosa*, and *Cocos nucifera*. Mr. Clarke further informs me that the milk of the coco-nut in the Sunderbun is so salt as to be undrinkable. This is a very remarkable fact, and scarcely in harmony with the observations of Schimper, Karsten, and others, so far as mangrove plants are concerned generally.

In this connection it may be mentioned that mangrove plants have mostly very thick leaves, with few, very deeply seated stomata, so that transpiration is reduced to as low a minimum as in true xerophytes. As it is obvious that transpiration is not checked in halophytes because of a lack of water, it must be accounted for in some other way; and, as it has been found that the accumulation of salt in the tissues of the leaves beyond a certain quantity, varying in different plants, prevents the formation of starch and glucose, it is assumed that it is of a protective character; that, in short, smallness of transpiration means smallness of absorption, and thus no more salt is taken into the tissues of the plant than it is capable of assimilating. The correctness of this view is strongly supported by the fact that mangroves, grown in soil free, or practically free, from chloride of sodium, develop foliage of less substance, furnished with a larger number of stomata.

Turning to another phase in the life-history of mangroves—namely, reproduction—we find special provisions, suitable to the exceptional conditions, to insure the propagation of the species. Most of the members of the Rhizophoræ, for instance, are, in a sense, viviparous—that is to say, the seed germinates on the parent plant. Only one ovule is developed, the rest being aborted; and when the seed is ripe, the radicle, or primary root, grows through the apex of the fruit, assuming a slender club-shaped form, with the centre of gravity nearest the organic base, so that, when it eventually separates from the parent, it falls in such a manner that the radicle penetrates the mud, and usually sufficiently to withstand the ebb and flow of the water. The size and length of the viviparous radicle varies considerably in different genera, and even in different species, of the same genus, attaining its greatest development in *Rhizophora mucronata*, the foremost of the Asiatic mangroves, and perhaps the only one that sometimes grows where the soil is always submerged. In this the viviparous radicle is

usually from twenty to twenty-four inches long, and occasionally as much as forty; and it is capable of growing even should it fall where it is wholly under water in the early stage of its further development. When the young plantlet is ready to separate from the parent, the aperture made by the growing radicle is sufficiently large to allow the inclosed or apical end to slip out, leaving the empty fruit still attached to the branch. And when this happens, there is a fully-formed leaf-bud at the top, from which the stem is developed. The primary root does not grow much after falling, but stout secondary roots are thrown out from this axis, successively, one above the other; and as they assume an arched form, and are produced in all directions, the plant becomes very firmly fixed. The American *Rhizophora Mangle* is very closely allied to the Asiatic and African *R. mucronata*; but whereas there is only one genus and one species of the order in the New World, there are several in the Old.

Singular to say, the only herbaceous plant of the Asiatic mangroves, *Acanthus ilicifolius*, is supported by similar stilt-roots. Most of the other trees and shrubs of the mangrove vegetation have horizontal roots, often of enormous length and strength, and some of them produce the so-called knee-roots in great abundance. These roots grow out of the ground, at an angle of about 45°, to a height of a foot or two, or perhaps more, and return to the ground at about the same angle, forming an anchor-like attachment. But their function is not merely to hold the plant. They are abundantly furnished with lenticels, through which the interchange of gases takes place—at least, such is the opinion of several eminent physiologists. Indeed, Karsten designates them breathing roots. Schimper figures negative geotropic roots of *Avicennia tomentosa*, which grow quite erect, from a thicker horizontal root, to a height of about a foot, and are either undivided or forked, and taper to a point. They are thickly studded with lenticels, as are the stilt-roots of *Rhizophora*. Another modification of root-production is exhibited by some of the mangrove-trees. Like *Rhizophora*, they produce aerial roots; but, instead of their remaining free, they eventually grow to the stem and outwards, forming plate-like buttresses.

Many other interesting facts might be extracted from the papers cited; but enough has been said to give an idea of the nature and value of their contents.

W. BOTTING HEMSLEY.

RICARDO'S "POLITICAL ECONOMY."

Principles of Political Economy and Taxation. By David Ricardo. Edited, with Introductory Essay, Notes, and Appendices, by E. C. K. Gonner, M.A., Lecturer on Economic Science, University College, Liverpool. (London: George Bell and Sons, 1891.)

THIS edition of Ricardo's "Principles" will be found useful to students of political economy. In addition to a large number of footnotes, the editor contributes an introductory essay of forty pages, and two short appendices—(1) on Ricardo and his critics, (2) on the effect upon rent of improvements in the fertility of land. The introductory essay gives a general account and brief critical estimate of Ricardo's work. It is characterized

by judicial moderation and impartiality; and many ambiguities and obscurities, due to the defects of Ricardo's style, are cleared away. Naturally, the abstract theory of value is treated first; and here the editor acknowledges that Ricardo did not attach sufficient importance to the influence of demand in determining value. But, on the serious question of the relation of capital to labour, he hardly seems to make Ricardo's position clear. He says (p. xxxix.):—

"Of course, the mere fact that capital is subject to such replacements enables us to assert that, in the long run, there is a tendency to some equality of reward between indirect labour (*i.e.* labour embodied in capital) and direct labour. Thus in a somewhat abstract and general way we may renew our previous statement that commodities exchange in the ratio of their cost of production."

This passage, in which the editor concludes his general criticism of Ricardo's theory of cost of production, appears to involve the very fallacy that some Socialists have committed in their reasonings based on Ricardo. For it suggests their doctrine that capital is nothing but labour applied *indirectly* to production. Now Ricardo most explicitly avoided this fallacy. He wrote (p. 27):—

"On account of the time which must elapse before one set of commodities can be brought to market, they will be valuable, not exactly in proportion to the quantity of labour bestowed on them, . . . but something more to compensate for the greater length of time which must elapse before the most valuable can be brought to market."

In short, Ricardo distinctly points out that an additional value arises when the same quantum of labour is extended over a larger period of time.

On the question of the distribution of reward between capital and labour, the editor remarks (p. xxxviii.):—

"The two great agents in production—labour and capital—so divide total value between them that an increase in the value obtained by the one implies a diminution in the share of value falling to the other."

This apparently harmless truism is elaborated with painful prolixity. But the form in which Ricardo applied it was always "Profits depend on wages"—never "Wages depend on profits." With Ricardo, profits were the residue of production remaining over and above the value of the standard of comfort; and he did not enter too closely into the question of the forces determining variations in this standard. This crucial error shows itself throughout all Ricardo's reasonings—notably in his theory of taxation.

In Appendix B, the treatment of the effects upon rent of improvements in the fertility of land is very unsatisfactory. The editor says that Ricardo made two assumptions—one implicitly and the other explicitly. But if he had properly interpreted the assumption explicitly made, he would have seen that the other was unnecessary. Ricardo explains quite clearly that the contemplated improvement is assumed not to disturb "the *difference* between the productive powers of the successive portions of capital." The editor most gratuitously interprets *difference* to mean *ratio*, in the face of the fact that *all* Ricardo's illustrations assume constancy of difference, not constancy of ratio. Now Prof. Marshall has shown

that, with Ricardo's premiss, his conclusion is absolutely correct without any further assumption. If, on the other hand, we adopt constancy of *ratio* (instead of constancy of *difference*)—which was Mill's (not Ricardo's) supposition—then some further assumption must be made in order to demonstrate that improvement in fertility produces diminution of rent. In proving this point, the editor uses an unnecessarily complicated piece of mathematical reasoning.

Without further dwelling on these defects, it is only necessary to say that the explanatory footnotes are everywhere extremely helpful, and that the frequent references to Ricardo's "Letters to Malthus" will be found especially useful in further elucidating the great economist's doctrines.

W. E. J.

OUR BOOK SHELF.

Photographic Pastimes: a Hand-book for Amateurs. By Hermann Schnauss. Translated from the Second German Edition. (London: Iliffe and Son, 1891.)

MANY and varied are the effects that can be produced with the aid of the camera, and the present work gives a plain and popular account of the methods that have been adopted in producing them. The five chapters are headed, respectively—specialities, curiosities, photography by peculiar arrangements, photographic optical entertainments, and entertainments with photographic prints.

In carrying out the experiments contained under the first two headings, amateurs will find their time fully occupied, while the novel effects that can be obtained will afford both instruction and amusement. With reference to taking pictures by moonlight, we can quite agree with the author when he says that "if the moon is included in the picture, its track will make a straight band of light nearly half-way across the photograph, which, besides the peculiar illumination of the landscape, gives a *most characteristic effect*." The characteristic effect, we should think, would be very decided.

An excellent and easy method of producing ghosts, which may prove useful to amateurs, and which is not wholly described in this book, is as follows:—The ghost consists of a person completely covered over with a sheet, the latter being so adjusted as to give a dim outline of the head; when in position, a short exposure of about half an inch of magnesium is given: then, as soon afterwards as possible, without moving anything with the exception of the ghost (which now is no longer required), another exposure is made, by means of a magnesium flash light, of the other figures that are required for the picture. In this manner excellent results have been obtained, the pattern on the wall appearing through the ghost, giving it quite a realistic appearance.

In these and the remaining chapters, descriptions of many novelties too numerous to mention are given, of which the following may serve as types—caricature, composite, and pin-hole photographs, statuary portraits, kaleidoscopic and stroboscopic pictures, &c.

Altogether, amateurs will find in this hand-book much that will occupy them during the winter months, when out-door photography is more or less at a standstill.

On Surrey Hills. By a "Son of the Marshes." (Edinburgh and London: W. Blackwood and Sons, 1891.)

THE Surrey hills are so well known that an ordinary writer would find it hard to say anything fresh about them. The "Son of the Marshes," however, has an exceptionally good power of observation, and even familiar facts he is able to present in a way that seems to give them new

vitality. In all his books he is especially interesting in passages dealing with the habits of animals, and there are many such passages in the present volume. No secondhand information is offered; the author tells us only of things which he himself has had opportunities of noting. Most of the chapters have already appeared in *Blackwood's Magazine*, but many who read them there will be glad to possess them in their present form. The manuscripts of the "Son of the Marshes" have, as usual, been edited by Mr. J. A. Owen, who does not say precisely how much his editorial work includes.

Heroes of the Telegraph By J. Munro. (London: Religious Tract Society, 1891.)

THE author of this book desires that it shall be regarded as in some respects a sequel to his volume on "Pioneers of Electricity." He begins with a short account of the origin of the telegraph, and then sketches the lives and principal achievements of those discoverers and inventors to whom we owe the electric telegraph and the telephone—Charles Wheatstone, Samuel Morse, Sir William Thomson, Sir William Siemens, Fleeming Jenkin, J. P. Reis, Graham Bell, Thomas Alva Edison, and D. E. Hughes. In an appendix, Mr. Munro gives brief accounts of various other investigators whose names are intimately connected with his subject. He has a plain, straightforward style, and the book will give much pleasure to young readers who take interest in the practical applications of science.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Koh-i-Nur.

DR. BALL, in his reply (*NATURE*, vol. xlv. p. 592) to my criticisms on his "true history" of the Koh-i-Nur, feels aggrieved that I "smite him in season and out of season," and considers me in the light of a partisan for doing so. I can assure him that my criticisms were absolutely impersonal, as I have never, to my knowledge, seen him in my life, and bear no kind of ill-natured feeling towards him; indeed, I said whatever I was able honestly to do in favour of his work. But of course, where I considered his arguments to be groundless or illogical, I met them. If he has read into my remarks an asperity I did not desire to impart to them, surely he should blame himself somewhat for the style of his attacks on those who went before him, and of whom I have shown that they knew not less, but more, of the subject than he did himself.

I have pleasure in withdrawing my expression of an accusation that Prof. H. H. Wilson was one of those against whom Dr. Ball threw out a sneer in relation to the earlier history and traditions attaching to the Koh-i-Nur. I supposed that, as he has laboured to make his knowledge of the authorities on the subject complete, he would certainly have known what was of common knowledge at the time as to the authorship of by far the most interesting notice ever penned on the Koh-i-Nur. But that was long ago. It was that notice, however, that brought me into such contact as I have had with the subject. As a young Professor at Oxford, I had the honour of knowing the great master of Sanskrit and of Indian lore: and as I had been interested in Indian history I ventured to approach him now some thirty-five or thirty-six years ago on the subject of the values assigned by him to certain weights referred to in his article. I drew his attention to Babar's valuation of the mishkal in ratis, and I further pointed out the probability of the retention by Shah Jahan of the Mogul diamond in his captivity. He received my suggestions in the kindest spirit, and offered me every help in further inquiry; and at the East India Company's Library he placed all the documents before me.

I shall not weary your readers with thrashing out and again winnowing the various statements involved in this controversy.

I could say more about the Garcias-De Boot matter, but I am satisfied with having shown that it was not Dr. Ball, but Mr. King, who, twenty-five years ago, explained the misprints in De Boot, and declared the very great improbability of the 140 mangelin diamond of Garcias, estimated by De Boot at a weight of 187½ carats, not being the Koh-i-Nur. Dr. Ball alludes to inaccurate figures in Mr. King's treatise. That Mr. King was inaccurate, was hasty, no one knows better than I. Nor did any of his many warm friends lament more than I did the unhappy infliction of advancing blindness which explains so much of the former demerit, as no one admired more than I the boy-like enthusiasm which often gilded in his imagination what seemed to others metal of a less precious order than gold. He had a splendid memory, and he trusted too much to it in drawing out from it, rather than throwing on his impaired eyesight, the verifying the records of his enormous reading and varied knowledge. I had controversies with him over a thousand subjects, but while he kept singularly isolated, and let no one come between him and his printer, he never resented a friend's criticism or difference from him.

As regards the scene before the throne of Aurungzebe, it can never, perhaps, be determined whether the view first put forward by Prof. H. H. Wilson, that Tavernier weighed the diamond, but with weights and scales supplied by Akil Khan its custodian, is the correct one; or the view I have held—namely, that Tavernier's account of the transaction given in his tenth chapter was barely compatible with his having weighed the stone, as he asserts he did in the twenty-second chapter of his book, which was avowedly a retrospective one written long afterwards, and near the end of his life. That I have reason for adhering by preference to the latter view is confirmed by what Dr. Ball himself says of another passage referring to the Great Mogul diamond. Dr. Ball condemns the passage as "in part spurious if not altogether so, . . . as the statements are in contradiction with others made elsewhere in the 'Travels'; and there is the strongest reason for attributing them to an erroneous editorial interpretation, and not to Tavernier himself." The delinquent he supposes to have been a M. Samuel Chappuzeau, the reputed editor of Tavernier's works.

As a fact, the travelled Frenchman seems to have been a person somewhat illiterate, as he had to call in extraneous aid in putting his memoirs into shape. He must be supposed to have picked up some colloquial Persian, but otherwise seems to have been dependent on interpreters throughout his travels. The treatment Chappuzeau received during a year of editorial service at the hands of Tavernier and his wife is recounted by Dr. Ball as a sort of "mortification, if not martyrdom." Chappuzeau appears to have described the notes of the traveller, on which he had to depend, as a chaos, and to have attributed the only written part of them to the permanship of one Father Gabriel. I think I am justified, then, in asking whether the account of the weighing in the later chapter may not have been an editorial afterthought; but whether it were so or was historical, in the sense assigned to it by Prof. Wilson, really very little affects the question.

The logical issue of this discussion is involved in the acceptance of one of two alternatives, the one a series of astounding coincidences and improbabilities, the other one of simple probabilities. Garcias saw a diamond weighing 140 mangelins; Le Cluze estimated its weight at 700 apothecary grains (= 573·8 grains troy, or 180 carats). De Boot assigned to it a weight of 187½ carats. The Koh-i-Nur weighed 589½ grains, or 186 carats. Misinterpreting a note of Le Cluze, Dr. Ball throws scorn on this having anything to do with the Koh-i-Nur.

Tavernier sees a diamond to which a weight is assigned of 319·5 ratis. Babar's diamond (the Koh-i-Nur) weighed 8 mishkals, or 320 ratis, equivalent to about 186 carats. Dr. Ball says this diamond was that known as the Great Mogul, that it is the Queen's Koh-i-Nur, but that it was whittled down by necessitous princes—to find them, in fact, in pocket-money—from 280 carats to 589½ grains, or 186 carats, the identical weight of Babar's diamond and of the Koh-i-Nur. Dr. Ball finally declares the Darya-i-Nur to have this same weight of 186 carats.

In opposition to this impossible recurrence of coincidences I have endeavoured to show that the stone Garcias saw may have been the Koh-i-Nur, that the one Tavernier handled was in all probability—I believe was certainly—the Koh-i-Nur. I say there is no evidence whatever of the Koh-i-Nur having been whittled down by cleavage, accidental or intentional; that its form in 1851

was more probably its original form rudely faceted (and I think, perhaps, I may not be without a mineralogist's experience when I say this); I further say that the Darya-i-Nur is undoubtedly the "Golconda table" diamond.

Finally, I assert the probability that the Great Mogul, unwhittled down and entire, is in the jewel chamber of the Shah of Persia to this day.

Of the great diamond which I would identify with this stone I append a tracing, in which it is seen in its carcanet of ruby-enamel. In the original drawing it is accompanied to right and left by two large diamonds, similarly girdled; while, above and below, is a row of three enormous rubies encircled by emerald-enamel. Ten pearls above and ten below, some of them ¾ of an inch in diameter, form a fringe to this gorgeous ornament. It

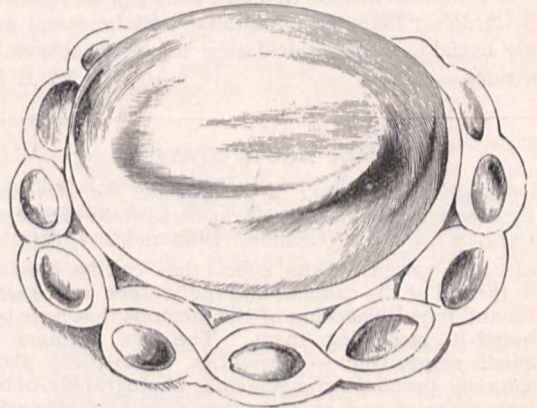


FIG. 1.—Great Mogul.

is, however, only one half of a cylindrical cap the corresponding half of which is its counterpart in splendour and wealth of stones, only the Darya-i-Nur is in, that other half, the central ornament.

I leave the great stone to speak for itself in the tracing, and I furthermore for comparison give a tracing from a drawing of the Koh-i-Nur, taken from a somewhat similar point of view—that is to say, looking down on it.

That the Koh-i-Nur was valued beyond these greater stones I believe to have been in consequence of its being the reputed talisman of Indian empire. It was probably that last relic of his treasure surrendered by the miserable Muhammad Shah when he exchanged caps with Nadir, and the conqueror saluted this most historic of his spoils by the name it has since borne—

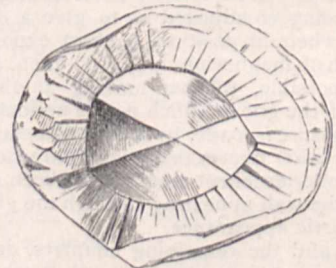


FIG. 2.—Koh-i-Nur.

the Koh-i-Nur. It was certainly the diamond that Shah Rukh, after yielding up all his wealth of jewellery, held to through every torture till he gave it to Ahmad Shah. Shah Zaman carried it to his prison, and secreted it in a crevice; whence Shah Shuja recovered it on information from his blinded brother.

Shah Shuja again clung to the old talisman not less fiercely than those who had preceded him, till he surrendered it to Runjit Singh under pressure which amounted to compulsion; and memorable was the answer of Shah Shuja to Fokeer Nur-ud-din, who had been sent by Runjit to ask in what its value consisted. It is "good luck," said Shah Shuja, "for he who has possessed it has done so by overpowering his enemies."

I have put, I hope clearly, to my readers, the alternative and

conflicting interpretations of the portion of the accounts of the Koh-i-nur from Babar's time onward. There are still some interesting questions of a difficult kind regarding its history antecedent to the days of the Mogul Empire. But I believe I have said now my last word regarding the later history, and leave to my readers the decision as to the side in this little controversy on which the truth is more likely to lie.

N. STORY MASKELYNE.

Basset Down House, October 26.

A Rare Phenomenon.

AURORAS were visible at Lyons, New York, on September 9, 10, and 11. That on September 9 was very fine, flickering streamers and arches forming at intervals from 8 o'clock to 10 o'clock p.m. A peculiar feature of this aurora was an arch similar to that described in NATURE of September 17 (vol. xlv. p. 475), as having been seen by Mr. Tuckwell at Loughrigg, Ambleside, on September 11. The arch seen at Lyons on September 9 was visible shortly after sunset, and remained in the same position throughout the evening. It consisted of a narrow band of light, which arose vertically from a point on the horizon nearly due west, and passed through the constellations of the Northern Crown and the Lyre, and just south of the zenith down to the eastern horizon. When it was brightest, at about 10 p.m., a few small streamers formed in connection with it nearly in the zenith; otherwise it consisted simply of a narrow band of white light separated by a wide interval from the auroral coruscations and streamers in the northern heavens. This seems to have been very similar to the band seen by Mr. Tuckwell. Other instances have been noted by the writer in which some peculiarity of form or colour characteristic of an outbreak of the aurora has attended its appearance in localities remote from each other.

M. A. VEEDER.

Lyons, N.Y., October 17.

Two instances of the occurrence of the rare phenomenon referred to in your issue of September 24 (vol. xlv. p. 494), by Prof. R. Copeland and Mr. W. E. Wilson, will be found recorded in the Transactions of the Nova Scotian Institute of Natural Science, vol. vi. p. 100. The dates of these occurrences were July 31 and September 5, 1883. The general appearance and position of the luminous arch were the same in both cases as in those described by Prof. Copeland and Mr. Wilson. Two additional points were noted, however, which are worthy of mention, viz. (1) that the arch of September 5 had a slightly marked rayed structure, which, when first observed, was in the direction of its length, but which gradually changed to a direction inclined about 45° to the longitudinal, and (2) that the spectrum of this arch, as determined by one of Hilger's pocket spectroscopes, consisted of two lines in the green, one quite bright and the other faint.

On Tuesday, September 1 of this year, I again observed the same phenomenon at Halifax, N.S. I was unable to make accurate observations, but noted the following facts:—The luminous arch was quite bright when first observed, at 11.30 p.m., and extended from horizon to horizon. Fifteen minutes later it had completely faded away. It was about 4° or 5° in width throughout its whole length. It met the horizon at points about 10° or 15° to the north of the east and west points, and passed through a point a few degrees south of the zenith. When first observed, it was approximately uniformly bright throughout, except at the edges, where its brightness diminished rapidly outwards. To the eye its light seemed to be white, and stars were visible through it. In fading away, the east and west ends disappeared first, and the main body of the arch became gradually fainter, wider, and more variable in width. The night was bright and clear, and the temperature lower than it usually is in the beginning of September, and there was no appearance of aurora in other parts of the sky.

Except on this occasion I have neither observed this phenomenon nor heard of its occurrence since 1883. But as it might readily occur without my either seeing it or hearing of it, I cannot say that I know it to be rare.

J. G. MACGREGOR.

Dalhousie College, Halifax, N.S., October 14.

It has twice been my good fortune to observe phenomena similar to that described in NATURE of September 24 (vol. xlv. p. 494). My recollections of the first occasion are some-

what indistinct, but at all events the luminous band extended east and west almost through the zenith, and was preceded by an auroral display. It occurred in August or September of 1883 or 1884.

My attention was again directed to a similar appearance on the evening of September 9 of the present year, while near Toronto. The narrow band of light, as before, extended from the eastern almost to the western horizon, passing through the zenith, and was accompanied by an aurora.

It is worthy of note that I saw the phenomenon at Toronto on the evening of September 9, not September 11.

R. N. HUDSPETH.

Bishop's College, Lennoxville, P.Q.

Apparent Size of Objects near the Horizon.

SOME years ago there appeared an account of an investigation into the cause of the sun and moon looking larger when low down than when high up in the sky. The theory advanced as the result of the investigation attributed the effect to a physiological cause. One could not expect an explanation of this kind to be applicable to all individuals, but rather that with different persons there would be different results; so I have made observations—81 in number—to find out what law applies to my own case. These observations were made by taking notice of two stars near the horizon, and then looking up near the zenith to see what stars in that situation appeared to be the same distance apart as those near the horizon. I took a great variety of different cases, the length of the compared arcs varying from 1° 4' to 100°. I observed them also in various angles of position, from horizontal to vertical; and sometimes had the two arcs at the same angle of position upon the retina, and at other times at different angles.

The result of this investigation is an unexpected one, showing that the length of the observed arc greatly affects the result of the estimation—short arcs appearing longer when near the horizon than when high up, and long ones appearing shorter.

The comparisons were made in either of two ways; according to one method, after I had carefully taken note of the apparent length of the arc near the horizon, and had fixed an idea of it in my mind, I then took a single glance at the stars near the zenith and fixed in a moment upon an arc that appeared to be of the same length; whereas in the other plan I made as deliberate and careful an estimation of the arc near the zenith as of that near the horizon with which it was compared, looking to and fro from one to the other till I was satisfied as to their apparent equality.

One would naturally expect that the instantaneous estimations would be less accurate than the careful ones, and this is found to be the case. Taking all the observations, I find the average deviation from the truth of a single estimation is 7.7 per cent. in the case of careful comparisons, and 10.3 per cent. in the case of the instantaneous ones. The following formula is based upon the careful comparisons—

$$L = l \left\{ 1 + \frac{A^\circ - a^\circ}{74} (.085 - .0032l) \right\},$$

where l and L are the lengths (in degrees) of apparently equal arcs at a° , the lower altitude, and at A° , the higher altitude, respectively. According to this formula, an arc 26° 48' long appears the same length at whatever altitude it is situated, but an arc shorter than 26° 48' appears longer at the horizon than at the zenith, and an arc in excess of 26° 48' would actually appear longer near the zenith than near the horizon: an arc 1° 4' long (the shortest in my observations), when at the horizon, would appear equal to an arc in the zenith 109.85 per cent. of its length; while an arc 100° (about the longest in my observations) at the horizon would appear equal to an arc of 71° 30' only in the zenith (*i.e.* with its middle point in the zenith). When the above formula is applied to all the observations, the average deviation (of the observed lengths from the computed) is reduced to 4.2 per cent. in the case of the careful comparisons, and 7.0 per cent. in the case of the instantaneous ones. If this formula can rightly be applied to objects of such small dimensions as the sun and moon, it (as will be seen) allows only a small increase for their apparent size near the horizon upon that when they are seen at a considerable altitude.

It would be easy to find a more complex formula which would satisfy the observations still better, but these are not sufficiently numerous to warrant the doing so.

It might be supposed that the estimations would agree better when the angles of position are the same for both arcs compared together, than when they are different. But this supposition is not borne out by my observations; for after correcting them by the above formula, the average deviation from the truth in the case of the careful comparisons is 4.4 per cent. when the angle of position of both arcs on the retina is the same, or within 10° of the same; and 4.1 per cent. when it differs more than 10° ; while in the case of the instantaneous comparisons these numbers are 7.9 and 6.3 respectively.

When the lower arc is horizontal, or nearly so, it is (on the average) estimated as being shorter than when in a vertical position, but the difference is so slight that it is doubtful whether it would not disappear with a larger number of observations. The best correction formula I have obtained for this is to apply the factor

$$(1.04 - .048 \cos d)$$

to the result already obtained: d being the deviation of the lower arc from the horizontal. But the application of this factor only reduces the sum of the squares of the differences between calculation and observation in the case of the careful comparisons from 1163 to 1111.

The angle of position of the upper arc seems to make no difference in the results.

T. W. BACKHOUSE.

West Hendon House, Sunderland, October 24.

Proper Motions of the Stars.

MISS CLERKE, in her very interesting article (NATURE, vol. xliv, p. 572) on the motion of the sun in space, seems to think that we have only the two alternatives of supposing that the brightness of a star is independent of its distance, or that the motions of the stars increase with their distance. I suspect that, when the proper motions of all stars down to the 9th magnitude have been tabulated, the necessity of adopting either alternative will disappear. My object in writing this letter, however, is to call the attention of spectroscopists to the question thus raised. The spectroscope, when used in connection with a powerful telescope, ought to be able to show whether the fainter stars as a rule move more rapidly in the line of sight than the brighter ones; for if the average motion in the line of sight is the same in both cases, astronomers will be slow to accept an explanation of phenomena which supposes a different average velocity on the whole. But even instruments incapable of deciding this question may throw light on the subject. It now appears certain that if a Sirian and a solar star of the same mass were placed at the same distance from us, the Sirian star would appear more than one magnitude brighter. Hence, before we can use magnitudes as in any sense a test of distance, we must ascertain the relative proportion of Sirian and solar stars in the groups which we are comparing. It would also be very desirable that the magnitudes of the stars employed by Profs. Eastman, Boss, and Stumpe, should be photometrically determined. The photometer has at all events the advantage over the eye that its results are in all cases (allowing for errors of observation) comparable.

W. H. S. MONCK.

Dublin, October 17.

California Foxes.

IN NATURE of September 10 (p. 452), there is a paragraph in praise of the intelligence of the (English) fox, with examples in proof. Permit me to say that his California cousin is next door to a fool. My young son has amused himself for the past three summers in trapping (in large box-traps) the small California foxes which infest these mountains, and which live on a mixed diet of Manzanita berries and astronomer's chickens. I pass over the fact that each trap has painted over its door "Danger to all who enter here!", and I proceed to show that our California foxes are barely one remove from idiots. When they are caught, my boy is in the habit of fastening a small leather collar about their necks, and of chaining them with light chains to stakes near the Observatory buildings. Many of them have escaped by parting the chains (by dint of strength, not of intelligence), and have been again caught within two or three days in the same traps! One of them was caught three times in quick succession! I presume an English fox, once caught, would emigrate to North Britain, or at least to the next county. My own ideas of the intelligence of the fox, until I came here, were derived from Goldsmith's "Animated Nature," and, generally, from English writings.

I have now become satisfied that the California fox is *arriéré*. Either the struggle for existence is not sharp here, or he has made up his mind that existence is not worth struggling for.

Lick Observatory, October 8.

EDWARD S. HOLDEN.

A Plague of Small Frogs.

MY wine-cellar has been visited during the recent rains with a curious plague of small frogs (*Rana temporaria*) all the same size, about one inch long. There would be nothing surprising in this visitation were it not for the apparent absence of any means of communication from outside, the level of which is six feet above that of the cellar; there is no drain near that part of the house. There is a step up before you go down into the wine-cellar from the adjacent cellar, against which the door closes, leaving no crack any animal so large could squeeze through. The cellar has solid stone walls and a bricked floor. During the recent floods the water stood some three or four inches deep there, apparently oozing through a tiny hole level with the floor on the outside wall, into which the point of a pencil could only penetrate for an inch. Even had it been possible for these little creatures to come in that way they must have burrowed down six feet from the outside level. Only one or two were found in the cellar adjacent, which is lighted by a grating into the garden, whereas in the wine-cellar two or three dozen were caught, many of them drowned by the flood.

Is it not unusual for bats to fly in the day-time? Here one has been doing so for two afternoons, coming out about 2.30, and flying backwards and forwards after insects in most brilliant sunshine. The gardener tells me he has never observed them do so before; and having sometimes caught them in the day-time, always noticed that when thrown into the air they would drop at once, and run instead of flying.

R. HAIG THOMAS.

BOTANY OF THE EMIN RELIEF EXPEDITION.

THE botanical exploration of Tropical Africa leaves so much to desire that it was somewhat disappointing to find that Mr. Stanley brought nothing back which would give any idea of the nature of the dense forests which he traversed. The conditions under which such an expedition is necessarily executed make natural-history-collecting extremely difficult. Travellers, however, often suppose that because they cannot make extensive collections they can do nothing to add to our knowledge. Yet to fill a small portfolio with well-selected and significant specimens is not a very difficult matter. And these may often furnish the basis of useful and important conclusions as to the general nature of the flora. Sir Joseph Hooker was able to give the first account of the vegetation of Kilimanjaro from a small parcel of plants collected by a missionary, the Rev. Mr. New, who was supplied for the purpose by Sir John Kirk, with "a bundle of old *Guardians*." An officer of the Ashanti Expedition brought from Comassi the fruit of what proved to be a new species of *Duboscia*. And quite lately Lord Lamington sent to Kew a small parcel of plants collected by himself in an expedition through the Shan States, which contained good specimens of an interesting plant only known previously from imperfect material collected by Griffith. It has now been worked out and figured in the Kew "*Icones Plantarum*."

Nor is it so difficult as it might be supposed to do even more than this. And I am not sure that a little careful and intelligent plant-collecting would not be a healthy and useful distraction to the tedium and strain of an arduous journey. Nothing could probably exceed the difficulties under which Joseph Thomson travelled in Masailand; yet he managed, notwithstanding, to get together a tolerably extensive and most valuable botanical collection. Upon this Sir Joseph Hooker was able to base the first attempt at a rational theory of the geographical relations of the high-level flora of Eastern

Equatorial Africa. Nothing, again, could be more admirable than the collections made by Brigade-Surgeon Aitchison when attached to the Kuram Field Force under Sir Frederick Roberts in Afghanistan. And the Government of India has now arranged—and it is an indication of the sympathy for science which animates its members—that, as part of the organization of the Botanical Survey of India, a botanist shall for the future be attached to all frontier expeditions.

Major Jephson, who accompanied Mr. Stanley, seems, however, to have had his eyes about him. A correspondent has sent me a copy of the October number of the *Mayflower*, a small monthly horticultural periodical published in New York, which contains (pp. 155, 156) a short paper by him on the "Plants of the Dark African Wilderness." This seems to me worth putting on record in the pages of NATURE, where it will be at least more accessible for future reference. At my request, Mr. Baker, the Keeper of the Kew Herbarium, has had the paper annotated with such critical comments as were possible.

To Major Jephson's paper Mr. Stanley has prefixed a brief introduction, which adds nothing of importance. He remarks:—

"In this branch of science I fancy we were all but amateurs, and considering what very little time any of us could devote from the engrossing business of marching, and seeking for food to sustain life, Mr. Jephson shows what might have been done by him had circumstances been more favourable."

This is, however, erring a little on the side of modesty. As I have already shown, amateurs can do very useful work without much difficulty, if they are content to do only a little, but to do that little carefully. Some further observations are open to more serious criticism:—

"Africa is yet too young and too crude for the scientific botanist. We have only been pioneers to stake the highway to make ready for those who shall come after us. When the rails have been laid in pairs of iron lines across the swamp and desert, and the engined boat cleaves the red bosoms of the great rivers, and furrows the dead green face of the fresh-water seas, then the tender-nurtured botanist, conveyed from point to point without danger to his valuable life, may be trusted, with his enthusiasm and devotion, to bring to us results worthy of science and the age. Of those who have given us an insight into the botanic treasures of the African world, Schimper (sic) is by far the best, but he has also laboured under such disadvantages and discomforts that he was not able to do for Equatorial Africa a tenth part of what Bates did for the Amazon."

One cannot but wonder a little at the ignorance of the literature of African travel which this paragraph displays. Men like Grant, Speke, Kirk, Welwitsch, Mann, Vogel, Barter, and Thomson, to mention only a few of those to whom we owe our knowledge of the African flora, would have thought it comical to be described as "tender-nurtured" botanists. The work of Schweinfurth was admirable; yet no one would, I think, be more surprised than that distinguished naturalist, Mr. Bates, to learn that the botanical collections which he never even professed to make, were ten times better.

W. T. THISELTON-DYER.

Royal Gardens, Kew.

"It is difficult to give an accurate idea of the flowers we saw in our march through Africa in a short magazine article, but I here give a short sketch, mentioning a few things which I think may be interesting to my readers.

"The great forest of Central Africa through which we passed is not so rich in variety of flowers and orchids as the forests of Mexico and Brazil, or even the jungles of India and Ceylon. It is chiefly rich in flowering vines,

trees, lilies,¹ and Begonias. There is, however, a great wealth of different kinds of ferns, such as I have often seen cultivated in hot-houses in England. In many places the damp ground was covered by a thick growth of filmy ferns and Lycopodium of the most beautiful description.

"Here is a short extract from my journal, which will give some idea of the every-day sights we saw on the banks of the Lower Congo, 1700 feet above the sea, and 250 miles distant from it:—

"At the bottom of a piece of swampy ground I came to a small stream, on the banks of which were growing *Osmunda regalis*,² or Royal fern. It was slightly stunted in growth, being not more than 2 feet in height. It is the first I ever have yet seen in the tropics. Close by the stream was growing a group of beautiful ground orchids,³ in form like a *Hyacinthus candicans*. There were clusters of great pink flowers with yellow centres; the whole had a very gorgeous effect. Here, also, was a profusion of Lycopodium.⁴ It is of a kind I have not yet seen; it creeps up and over everything in great blue-green masses; its long tendrils creep up the tree trunks like ivy, to a height, in some cases, of 4 feet. There were quantities, also, of the ribbon fern, exactly like the *Davallia pentaphylla*,⁵ which has been introduced into English hot-houses from the Malayan Archipelago. What would not florists at home have given for an acre of this ground?"

"In the forest there were two kinds of lilies which were common. One, which grew in swampy ground, was in form like an *Amaryllis*.⁶ It was white, with a deep crimson centre, and had a delicious but heavy scent. The other was a lily,⁷ which grew everywhere through the whole length of the forest. It was of a brilliant scarlet colour, and was formed of several hundreds of small flowers, forming a round ball like a huge Guelder rose, four inches in diameter. It was of such a brilliant scarlet that it looked almost metallic, growing in the darkest recesses of the forest. One of the commonest and most striking of all the ferns we saw was the *Platycerium alcinorne*.⁸ It is an extremely interesting fern, one of a singular genus of epiphytal plants, growing on the branches of trees. Our Zanzibaris called it 'elephant ear,' from its curious shape. There was another of the same family, *Platycerium Stemmaria*, which we found growing upon rocks in the open country. Both these ferns grew at altitudes from 1000 to 5000 feet. Tree-ferns⁹ of the ordinary kind we found growing in all the gullies and streams on the slopes of the mountains above the Albert Nyanza. The altitude was from 5000 to 6000 feet above the level of the sea, and I noticed especially that the flora here was remarkably like that in the Central Province of Ceylon, which is an altitude of 2500 to 4000 feet above the sea.

"By far the most common plant which we saw in the jungle was the Amomum, or wild cardamom.¹⁰ It was almost precisely the same in form as the cardamom which is cultivated in Ceylon. It grew almost throughout the whole of Central Africa. It has a large purple flower, which grows in clusters on the ground at the root of the plant, and from it a bright scarlet fruit forms, of a pear shape, and about the size of a small fig. It is divided into four quarters, and contains some white, fleshy pulp, very juicy and acid. This pulp is full of

¹ Crinum.

² *Osmunda regalis* is cosmopolitan, but in tropical zone is high up only.

³ Mr. Rolfe cannot suggest anything better than *Lissochilus*.

⁴ *Selaginella scandens*, no doubt.

⁵ "Ribbon fern" would suggest *Ophioglossum pendulum* or *Vittaria*, but they are not like *Davallia pentaphylla*.

⁶ *Crinum zeylanicum*. ⁷ *Brunsvigia toxicaria*.

⁸ *Platycerium alcinorne* is not African, but *P. Stemmaria* is widely spread.

⁹ No doubt *Cyathea Thomsoni*, Baker, which is very near *C. Dregei* of the Cape.

¹⁰ There are a large number of *Amomums* in West Tropical Africa. The fruits are 3- not 4-celled. See *A. Daniellii*, &c., in Oliver and Hanbury's paper in Journ. Linn. Soc., vii. 109.

small black aromatic tasting seeds like those of the cultivated cardamom. If ever planters go into Africa, the cardamom will be an important product of the soil for commerce, for there are vast tracts of forest with the climate, soil, and checkered shade which are necessary for the cultivation of the cardamom. Orchilla weed should also become a valuable article of commerce; it grows in many parts of the forest. I consider, however, that when the great forest of Central Africa is opened up to civilization, by far the most valuable article of commerce will be india-rubber, the want of which is increasingly felt in the civilized world. Now that electricity is so much used for various purposes, the demand for india-rubber grows larger and larger: the supply which is shut up in the African forest is practically unlimited. There are various trees of the fig tribe which yield this product, but by far the greatest amount is contained in the india-rubber vines¹ which abound in the forest and hang from almost every tree. In cutting our way through the forest in some places, we got covered with the milky glutinous sap, which dropped upon us from the vines we cut through.

"The natives know its value, and use it largely for smearing the inside of their buckets in order to make them hold water. They use it largely also for covering the ends of their drum-sticks. The india-rubber obtained is of a clear, yellowish colour, like glue, and is of the most elastic description.

"In the forest region I saw no water-lilies, but in Emin Pasha's Province, in the Bari country, I saw two kinds.² They were both about the size of an ordinary white water-lily, and the leaves and flowers floated on the surface of the water, but the stalks and formation of the leaves and flowers was finer and more slender. One was of a pink coral-like colour, not white like the Zanzibar lily, and the other of a pale bluish lavender. They were growing in small clear pools only a few miles apart in the valley of the Nile, at an altitude of about 3000 feet above the sea.

"One of the most interesting botanical discoveries I made in the forest was the discovery of a wild orange-tree. During our march through the forest I had continually come upon trees varying from 8 to 15 feet high. They had double leaves of a peculiar shape, which had a delicious smell like orange leaves; the branches were covered with long sharp thorns, and I at once pronounced them to be orange-trees. My fellow officers smiled incredulously, and exclaimed: 'Orange-trees³ in the middle of the forest!' But I held to my opinion, and just before reaching the open country, I came upon a tree with both flowers and fruit upon it. The flowers were exactly the same as the flowers of a cultivated orange-tree. The fruit, which was green, was about the size of a marble. On cutting through it with a knife I found it had the same divisions as an ordinary orange, but each division was full of small seeds, which were very bitter and aromatic. On reaching Emin's Province I told him about it, and he regretted very much that I had not brought a specimen with me, for he was a good botanist, and wished to add it to his collection of dried plants. He told me my discovery was doubly interesting, as many years before a German had penetrated the forest on the west coast of Africa, and reported that he had found wild orange-trees. His story was discredited, and now our discovering the orange-tree in the forest pointed that his report was after all true.

"I have not space to speak much about the flowers we saw in the open country, but will say a few words about those flowers which we found at a high altitude on the slopes of Ruwenzori, or the Mountains of the Moon.

¹ Landolphia.

² *Nymphaea stellata* and *N. Lotus* are both plentiful in Upper Nile-land.

³ This reads like a tree *Citrus*, and if so is an interesting discovery, as no species is hitherto known there.

Lieutenant Stairs who made the ascent of the mountains, gives the following facts in his report:—

"The barometer stood at 21°10, thermometer 70° F. Ahead of us and rising in one even slope stood a peak, in altitude 1200 feet higher than we were. This we now started to climb, and after going up a short distance came upon three heaths. Some of these must have been 20 feet high, and as we had to cut our way foot by foot through them our progress was necessarily slow. Here and there were patches of inferior bamboos, almost every stem having holes in it made by some boring insect, and quite destroying its usefulness. Under foot was a thick spongy carpet of wet moss, and the heaths on all sides of us we noticed were covered with "Old Man's Beard" (*Usnea*). We found great numbers of blue violets which had no smell, and from this spot I brought away some specimens of plants for Emin Pasha to classify. The altitude was 8500 feet. We found blueberries and blackberries¹ at an altitude of 10,000 feet. The following² are the generic names of the plants collected as named by Emin Pasha:—

Clematis.
Viola.
Hibi-cus.
Impatiens.
Tephrosia.
Glycine.
Rubus.
Vaccinium.
Begonia.
Peucedanum.
Gnaphalium.
Helichrysum.
Senecio.
Sonchus.
Erica arborea.
Landolphia.
Heliotropium.
Lantana.

Moschosma.
Lissochilus.
Luzula.
Carex.
Anthistiria.
Adiantum.
Pellæa.
Pteris aquilina.
Asplenium.
Aspidium.
Polypodium.
Lycopodium.
Selaginella.
Marchantia.
Parmelia.
Dracæna.
Usnea.
'Tree Fern.'

"These were just a few specimens Lieutenant Stairs brought down with him. But the slopes of Ruwenzori will, when properly explored, yield numbers of unknown treasures to be added to the Botanical Encyclopædia.

"For many weeks we drank coffee which we made from the berries of the wild coffee-trees which abound on the highlands round the great lakes of Central Africa. The Arabian coffee was originally supposed to have come from Kaffa, in Abyssinia. That which we found in Karagwe, Ankori, and Uganda is equal in flavour to the finest Arabian coffee, and will, when Central Africa is opened up, be another of the chief articles of commerce.

"I. A. M. JEPHSON."

TOWN FOGS AND THEIR EFFECTS.³

UNTIL 1880 the formation of fog was looked upon as arising simply from the separation of liquid water, probably in the form of hollow vesicles, from an atmosphere saturated with aqueous vapour; but in that year Aitken showed that really the determining cause of the separating out of liquid water, and consequent formation of fog, was dust present in the air. He pointed out that a change of state, a gas passing to a liquid, or a liquid to a solid, really always occurred at what he terms a "free

¹ It would be very interesting to have these identified. The two highest-known species of *Rubus* are *pinatus* and *rigidus*, at 5000–6000 feet.

² This list is in Stanley's book. The *Viola* is no doubt *abyssinica*, common to the mountains of Madagascar, Abyssinia, the Cameroons, and Fernando Po. There are three heaths known on the high mountains of Central Africa, viz. *Erica arborea*, *Ericinella Mannii*, and *Blaeria spicata*. There is no *Vaccinium* known before in Tropical Africa; though three or four are plentiful in Madagascar, and there is one on the Drakensberg, so that its occurrence is most probable. The ferns of Tropical Africa are nearly all species widely spread in other continents.

³ The paper by Dr. W. J. Russell, F.R.S., introducing the discussion on Town Fogs at the Hygienic Congress.

surface"; that as long as a molecule of liquid water is surrounded by like molecules, and the same with gaseous water, we do not know at what temperature, or whether at any temperature, they would change their state; but if in contact with a solid then at the surface, where they meet, the change will occur; if the solid be ice it may become liquid or the liquid may become solid, and the same kind of action occurs when the liquid is in contact with its own vapour; in fact, that what we call the freezing and boiling-points of a body are the temperatures at which these changes take place at such free surfaces. The dust always present in the atmosphere offers this free surface to the gaseous water, and thus induces its condensation. This specific action of dust varies very considerably, first with regard to its composition, and second with regard to the size and abundance of the particles present. Sulphur burnt in the air is a most active fog-producer, so is salt. Many hygroscopic bodies form nuclei having so great an affinity for water that they can cause its condensation from an unsaturated atmosphere. At the same time non-hygroscopic bodies, such as magnesia and many others, are powerful fog-producers; no doubt their activity may in part be attributed to their being good radiators of heat, and thus becoming cooled, induce condensation. Mr. Aitken also shows that the products of combustion, even when the combustion is perfect, are powerful fog-producers, a fact which has important bearing on the production of town fogs. One other point in these experiments I cannot omit mentioning, it is the exceedingly minute amount of matter capable of inducing fog. In his first series of experiments Mr. Aitken showed that $\frac{1}{100}$ of a grain of iron wire, however often it was heated, evolved on each heating sufficient dust to cause a visible fog, and afterwards, with still more delicate apparatus, that $\frac{1}{1000}$ of a grain of either iron or copper, when treated in the same way, gave a similar result, and from these last experiments he infers that even $\frac{1}{100000}$ grain of either wire, if only slightly heated, would yield sufficient nuclei to cause a visible amount of fog. It is of much importance and interest, seeing how small a quantity of dust is required to produce fog, to know that even this small amount may be filtered out of the air by passing it through cotton wool, and thus an air be obtained in which a fog cannot be produced. Mr. Aitken's description of such an atmosphere is at first most alluring, for he says, if there was no dust in the air there would be no fogs, no mists, and probably no rain; but he goes on to state that when the atmosphere became burdened with supersaturated vapour, it would convert everything on the surface of the earth into a condenser; every blade of grass and every branch of a tree would drip with moisture deposited by the passing air; our dresses would become wet and dripping, and umbrellas useless; but our miseries would not end here, for the inside of our houses would become wet, the walls and every object in the room would run down with moisture. I think, if we picture to ourselves this state of things, we may be thankful that there is dust and fog. Dust in its finer forms is invisible to us; but as its delicate particles become loaded with moisture, it becomes a fine mist, dense if the number of particles are many; if, however, the dust-particles are fewer, and the amount of aqueous vapour the same, each particle will have a larger amount of condensed moisture to carry, and it will give rise to a more coarse-grained fog; the moisture, or some of it, will be more feebly attached to its nuclei, producing then what is known as a wet fog, whereas at least a most important fact in the production of a dry fog is the strong affinity between the nuclei and the condensed vapour. As most of you are no doubt aware, Mr. Aitken has invented a most ingenious method for counting the number of dust-particles in air, and has obtained most interesting and valuable results. I can only mention here that some of

these results deal with the clearness of air in relation to the number of dust-particles present, and other results show how little effect rain has in diminishing the amount of the finer dust in air. Evidently towns will supply dust of all kinds, and therefore offer every inducement for fogs to form there, and that at least some of the particles will be capable of causing the condensation of moisture even from an atmosphere which is not saturated with aqueous vapour. This condensation of moisture is a very complete process for removing all kinds of impurities from the air. Floating particles are free surfaces, and become weighted by the moisture they condense and tend to sink, and even the gaseous impurities in the air will be dissolved and carried down by the moisture present.

Experiment confirms this, for it has been proved how correctly the impurities of an air can be ascertained by determining the composition of dew, even if it be artificially and locally formed. It is of importance to note that even the purely gaseous emanations from our towns cannot pass away when a fog exists, as is shown by the accumulation of carbonic acid which takes place during a fog. Taking 4 volumes in 10,000 volumes as the normal amount of carbonic acid in London air, some years ago I found that it increased in the case of a dense fog to as much as 14.1 volumes, and often to double the normal amount, which must represent a very serious accumulation of the general impurities in the air.

A fog in this way becomes a useful indicator of the relative purity of the atmosphere in which it forms. If pure aqueous vapour be condensed it gives a white mist—a country fog, a sea fog—and a white light seen through it is not converted into a red light; but in town fogs the whiteness of pure mist disappears and becomes dark, in some cases almost black in colour, the change being produced by the foreign matters floating in the air, and by far the most abundant colouring matters of our town fogs are the products generated by the imperfect combustion of coal; but in addition to these bodies, many others must obviously find their way into the air over a town. Especially will there be dust from the universal grinding and pounding going on in street traffic and many mechanical operations, from the general disintegration of substances and the decomposition of perishable materials—all will add something to the air, and it will become an integral part of the fog. However, although it is often said that a town fog is so dense that it may be cut with a knife, still it is difficult to condense so much of it that it can be subjected to a searching chemical analysis. In 1885, by washing foggy air, I was able to determine the amount of sulphates and chlorides present, and as indicators of organic matter the quantity of carbon and nitrogen in the fog. The results showed strikingly how largely the amounts of organic matter and ammonia salts in the air varied with the weather; no case of dense fog occurred when the experiments were being made; but the mean of several experiments clearly showed that in foggy weather the amount of organic matter was double as much as existed in the air in merely dull weather, and that the amount of sulphates and chlorides increased under like conditions, but not to the same extent. Fog may, however, be made to give its own account of its constituents, for we have only to collect and analyze the deposit which it leaves to learn what its more stable constituents are, and we have to thank the air-analysis committee of the Manchester Field Naturalists' Society for the most complete analysis of such a deposit which has yet been made. The deposit analysed occurred during the last fortnight in February of this year (1891), and was obtained from the previously-washed glass roofs of the plant-houses at Kew, and Messrs. Veitch's orchid-houses at Chelsea. At Kew 20 square yards of roof yielded 30 grammes of deposit. At Chelsea the same area gave 40 grammes, which represents 22 lbs. to the acre or 6 tons

to the square mile, and the composition of these deposits is as follows:—

	Chelsea. Per cent.	Kew. Per cent.
Carbon	39'0	42'5
Hydrocarbons	12'3	4'8
Organic bases (pyridines, &c.)	2'0	
Sulphuric acid (SO ₃)... ..	4'3	4'0
Hydrochloric acid (HCl)	1'4	0'8
Ammonia	1'4	1'1
Metallic iron and magnetic oxide of iron... ..	2'6	
Mineral matter (chiefly silica and ferric oxide)	31'2	41'5
Water, not determined (say difference)	5'8	5'3
	100'0	100'0

These analyses give, I believe, for the first time, a definite account of the composition of fog-deposit. Soot and dust are by far its principal constituents, rendered sticky and coherent by hydrocarbons, but I should like to give you the striking description which Prof. Thiselton Dyer has sent me of this deposit, collected at Kew. He says: "It was like a brown paint, it would not wash off with water, and could only be scraped off with a knife. It thickly coated all the leaves of the evergreens, and upon what have not yet been shed it still remains." In the above analysis it is curious to note the large amount of metallic iron and magnetic oxide of iron.

The details with regard to these very interesting analyses we shall hear from a member of the Manchester Committee, and I will only ask you to note how large a proportion of these deposits arises from the imperfect combustion of coal. We also learn from the Manchester Committee some interesting facts with regard to fog-deposits which occurred last winter in their city. This deposit which was collected from Aucuba leaves contained as much as 6 to 9 per cent. of sulphuric acid, and 5 to 7 per cent. of hydrochloric acid, mostly, of course, in a state of combination, but the deposit was, they say, "actually acid to the taste." Also, that three days' fog deposited per square mile of surface, in by no means the worst part of Manchester, 1½ cwt. of sulphuric acid, and even as far out of the city as the Owens College, on the same area, over 1 cwt. of acid and 13 cwt. of blacks.

There is still one other point characteristic of town fogs to be noted: it is their persistency in an atmosphere considerably above the dew point. A country fog under such circumstances directly passes away; a town fog apparently does not do so. There seem to me to be two reasons for this: one is that the moisture is protected, and its evaporation to a large extent hindered, by the presence of oily matter; and secondly, when the moisture has really gone, the soot and dust remain, and produce a haze.

The great distance to which fogs will travel is also remarkable, for they have on many occasions been traced to a distance of at least 25 to 35 miles from London, and I believe I might say to 50 miles.

I have so far discussed the production and composition of town fogs, and before considering their effects, would say a word on the question of whether in London they are increasing in frequency and density. A complete and accurate record of fogs in London is not kept; several stations are required, and a correct method of registering the density and distinguishing the difference between haze and fog is necessary; but fortunately there is a fair approximation to this complete registration of London fogs published by the Meteorological Office in their daily reports. The observations are made every morning at Brixton, and every afternoon at Victoria Street, and from a paper by Mr. Brodie, on "Some Remarkable Features in the Winter of 1890-91," published in the Journal of the Royal Meteorological Society, I learn that the number of fogs thus registered which have occurred each winter since 1870 is as follows, winter being represented by the months December, January, and February. I have divided these 20 years into four groups of 5 years each:—

logical Society, I learn that the number of fogs thus registered which have occurred each winter since 1870 is as follows, winter being represented by the months December, January, and February. I have divided these 20 years into four groups of 5 years each:—

Between 1870 and 1875,	93 fogs occurred.
" 1875 and 1880,	119 " "
" 1880 and 1885,	131 " "
" 1885 and 1890,	156 " "

It appears, then, that during the last twenty years there has been a steady increase in the number of winter fogs. I am not aware of any data to prove whether the density of these fogs has increased, but it is probable that the increase of number of fogs largely depends upon an increase of atmospheric impurity, and the conversion of haze and mist into obvious fog; and as the great colouring matter of fogs arises from the combustion of coal, I have drawn up the following table from information which has been kindly furnished to me by Mr. G. Livesey and Mr. J. B. Scott, of the Coal Exchange. It gives the amount of coal really consumed annually in London; it does not include the coal used by the different gas companies. For the first five years, the amount given in the table is rather too high, as the quantity used by the suburban gas companies could not be ascertained and deducted. The quantities apply to what is known as the London district—an area, on an average, of 15 miles round London. The table shows an absolute increase, during the last fifteen years, of 2,000,000 tons of coal—that is, half as much again is now burnt as was burnt in 1875.

Coal consumed in London (that used by Gas Companies deducted).

Year.	Tons.	Year.	Tons.
1875 ...	4,882,233	1883 ...	5,872,310
1876 ...	4,988,280	1884 ...	5,669,281
1877 ...	4,143,909	1885 ...	6,026,063
1878 ...	4,973,147	1886 ...	6,096,732
1879 ...	5,833,891	1887 ...	6,231,956
1880 ...	5,334,823	1888 ...	6,463,498
1881 ...	5,598,281	1889 ...	6,390,850
1882 ...	5,343,974		

Supposing only 1 per cent. of sulphur in this last yearly amount is converted into sulphuric acid (H₂SO₄) and passes into the air; this would give 195,720 tons of this acid.

The five years' averages of winter fogs, we have seen, give a steady increase, but obviously the number each winter will vary much with the atmospheric conditions: for instance, last winter was remarkably favourable for the development of fog; for, again taking the last twenty years, the average number of days of fog during the winter is 25, but last winter the actual number was 50.

The general atmospheric conditions which induce fogs are a still and moist air and a high barometer—a state of the air most usual under anticyclonic conditions. The immediate determining cause, however, of a fog is usually a sudden and considerable fall of temperature. Mr. Brodie also points out that last winter was a time of calms; the percentage of such days on the average for the last twenty years is 9'7, but last winter the number was 22. Emphatically, he says, it was an anticyclonic winter.

A form of fog, well termed a "high fog," now frequently occurs in London. The lights in a street during this form of fog are often as visible as on clear nights, but above hangs a fog so dense that the darkness of night may prevail during the day. This particular form of fog appears

to have become much more frequent of late years, and, in fact, it is doubtful whether in former times it ever occurred. The immediate cause of this new form of fog is difficult to explain.

London has always been the head-quarters of town fogs, but now all the large towns appear to be emulating it in this respect, and this is what we must expect; an increase of population means an increase of combustion of coal, and that implies a pouring into the atmosphere of more and more carbon, hydrocarbons, and sulphuric acid. In dry and windy weather all these bodies may be scattered so as not to produce appreciable effects; but let the air be still, and even approach a state of aqueous saturation—then, we have seen, every particle of dust and dirt becomes a centre for moisture to deposit on, and we shall have a fog imprisoning all impurities and offering them to us for inhalation. To burn coal so that only

ascertain how far such views were correct, I studied the Registrar-General's reports for the times of fogs; but, as I found it difficult to interpret the figures, I have expressed them by the curves upon these somewhat lengthy diagrams (Figs. 1, 2, and 3). I have selected times of fog, viz. the winters of 1879-80, 1889-90, and 1890-91, and have represented graphically the temperature, the amount of fog, and the death-rate for each day.

The results are, I think, worthy of careful study. The first thing we learn from these diagrams is that by far the greater number of fogs occur when there is a great fall of temperature; and clearly this is closely followed after a few days by a great increase in the death-rate; but how much of this increase is to be attributed to the fog and how much to the fall in temperature may be difficult to determine; but we have evidence that when fogs occur without fall of temperature they do not appear to be followed

Explanation of Diagrams.—The amount of fog is represented by the small dark patches, the denser the fog the deeper the patch; thus the Registrar-General reports that it is either haze, foggy, fog, thick fog, or dense fog. These different degrees of fog are represented by the vertical thickness: thus dense fog is 5 times as deep as haze, and so with the other designations. The horizontal line represents the average temperature for each day for the previous 20 years, and also the average weekly death-rate from diseases of the respiratory organs for the previous 20 years. The curved line represents the divergence of temperature from the daily average, and the shaded part the divergence of the death-rate from the average.

Scale: $\frac{1}{2}$ inch represents 1 day, 1° F., and 10 deaths.

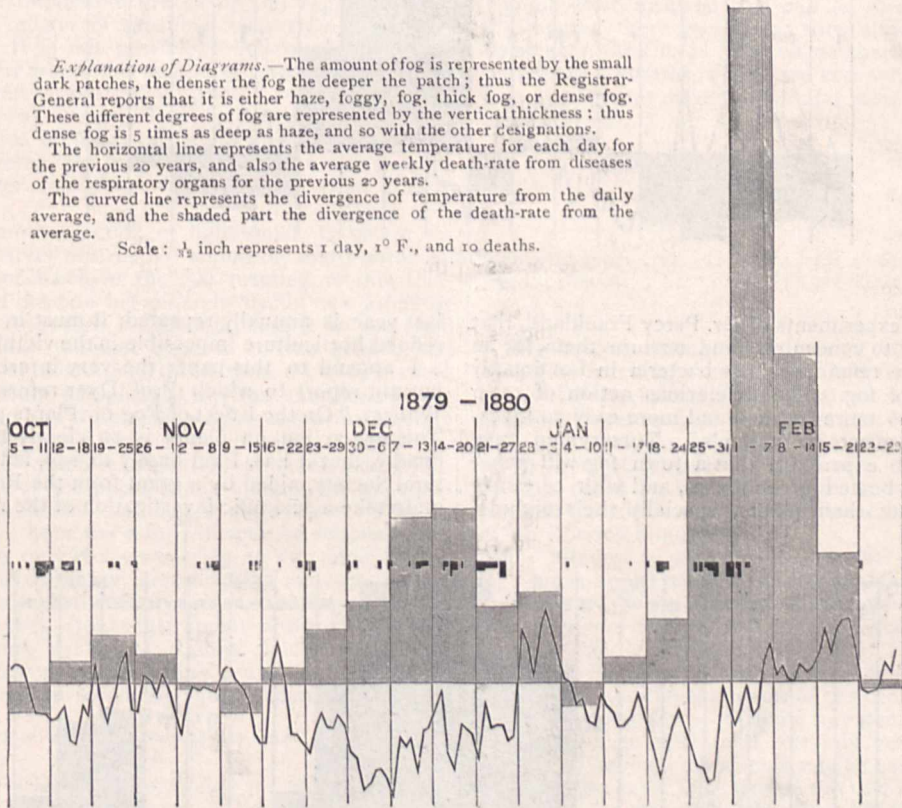


FIG. 1.

products of complete combustion shall escape is a problem of much difficulty, and is comparatively rarely done. Certainly the domestic fireplace does not do it, but, on the contrary, is the principal cause of the dark colour of our fogs. Many manufacturers, however, liberally contribute to produce the same effect.

I turn now from the constitution and production of fog to note some of the effects it produces. First, with regard to health, details on this point I leave to those who are more able to describe them than I am, but I have a few words to say with regard to the effect of London fogs on the death-rate in general. There are many people who feel so strongly the unpleasantness of fog that it induces them to magnify its results, and make extraordinary statements with regard to the mortality it produces. It has even by some been likened in deadliness to the Great Plague of London, and to other great epidemics. To

by any remarkable increase of death-rate; for, on December 15, 1889, there was a dense fog, and the temperature was even above the average: under these conditions the death-rate remained far below the average. On December 13 and 14 in the same year, again, there is a dense fog, an average temperature, and only an average death-rate; and the same thing happens on February 4 in 1890, when, notwithstanding a dense fog, the death-rate remained remarkably low; and last winter, on November 13 and 14, there was again a dense fog, a high temperature, and an average death-rate. With these four exceptions depression of temperature goes with fog. There is no case of depression of temperature not followed by increase of death-rate.

That many people suffer much, both physically and mentally, from the effects of fog, there can be no doubt; but, as far as I can interpret these returns of the Registrar-

General, they do not confirm the popular impression that fog is a deadly scourge; at the same time, it is beyond doubt that an atmosphere charged with soot, dust, and empyreumatic products is an unwholesome atmosphere to breathe; but I think that the principal cause of the great increase of death when fogs occur is attributable rather to the sudden fall of temperature which usually accompanies fog, than to the fog itself.

So many toxic effects are now traced to the action, direct or indirect, of bacteria, that it is satisfactory to

bare, and it is impossible ever again to recover them into slightly specimens. (2) The toxic influence of the fog. This is most striking. It is illustrated in the most forcible way by the inclosed memorandum. I attribute it in the main to sulphurous acid, though I cannot help suspecting that some hydrocarbon may also have something to do with it. The toxic effect varies from one plant to another, some are scarcely injured, others are practically killed." He adds:—"I hope you will be able to arouse some interest in this horrible plague. If the visitation of

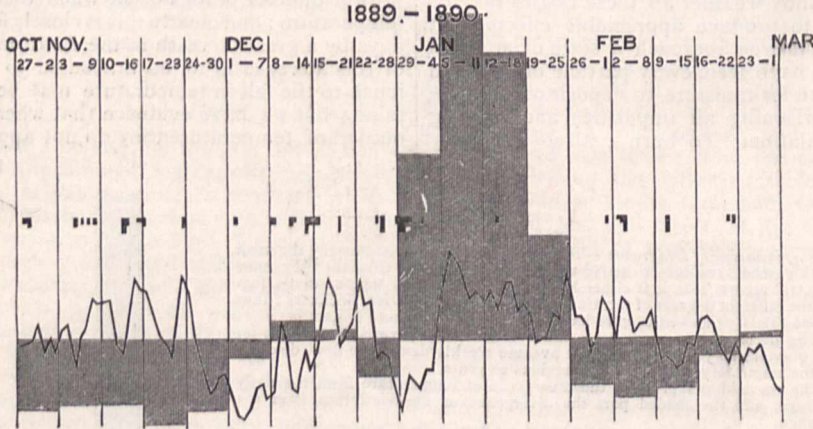


FIG. 2.

learn, from the experiments of Dr. Percy Frankland, that fogs do not tend to concentrate and nurture them, for he found there were remarkably few bacteria in London air during a time of fog. The deleterious action of town fogs on plants is more marked and more easy to investigate than its effect on animals. Nurserymen have long known from experience that a town fog will penetrate even their heated greenhouses, and with certainty will kill many of their plants, specially their orchids,

last year is annually repeated, it must in time make all refined horticulture impossible in the vicinity of London."

I append to this paper the very interesting and important report to which Prof. Dyer refers, from Mr. W. Watson, "On the Effect of Fog on Plants grown at Kew." This fog action on plants is so clearly marked, and so deadly, that it has, I am happy to say, led the Horticultural Society, aided by a grant from the Royal Society, to undertake a scientific investigation of the matter. Plants

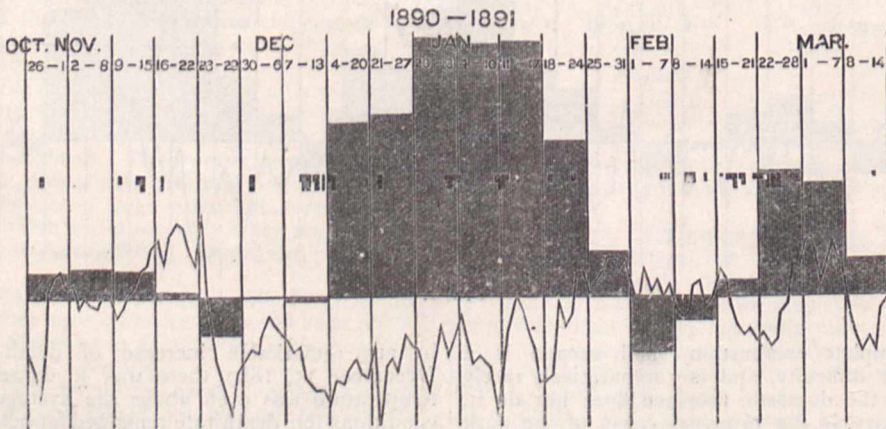


FIG. 3.

tomatoes, and, in fact, most tender and soft-wooded plants; but on this point, I cannot do better than read to you what the Director of Kew Gardens, Prof. Thiselton Dyer, says in a letter to me:—"With regard to plants under glass, the effect of fog is of two kinds—(1) By diminishing light. This checks transpiration. The plants are therefore in the condition of being over-watered. A well-known consequence of this is to make them shed their leaves wholesale. Many valuable plants which ought to be well furnished with foliage become perfectly

are so much more easily dealt with than people, all the circumstances of their attack by the fog and its immediate results so much more easily noted and traced, that the investigation has already yielded important results, and we shall, I hope, hear from Prof. Oliver—who is devoting himself specially to the investigation—some account of his latest results. A marked and admitted difference between town and country fog is, that while a country fog is harmless in a greenhouse, a town fog will produce most destructive results.

There is still another action of town fogs, and one which I believe is of great importance. I mean its power of absorbing light. This power of abstracting light depends principally on the amount of coal products which the fog contains. The slower-vibrating red rays can struggle through a fog which is absolutely impervious to the more refrangible ones. Even a mist but slightly tinged with smoke is opaque to the blue rays, and thus screens us from their action but as Aitken has lately shown, the heat rays can pass readily through. This opacity of town fog to light is, I believe, one of its most serious and detrimental characters. Animals can no more thrive in semi-darkness than can plants; and, important as the red rays may be, still it is undoubtedly the blue rays which are most active in producing the principal chemical changes going on around us. Experiments lately made have strongly impressed me with the wonderful activity which light confers on a mixture of air and moisture, oxidations which in dullness and darkness are impossible are easily and rapidly effected by aid of a gleam of sunshine, or even a bright diffused light. It is not possible, I believe, for people to remain healthy where this source of chemical activity is cut off, or even seriously diminished. In addition to the loss of physical energy, mental depression is induced by the absence of light, the whole tone of the system becomes lowered, and may be a prey to actions which, under brighter conditions, it would have been able to resist.

There is another action of light which is potent for good. I mean its destructive action on many forms of bacteria. Prof. Koch, at the last meeting of this Congress, pointed out how his tubercle bacilli are killed by even a short exposure to sunlight, and it is now well established how inimical light is to the growth and development of most kinds of bacteria. I wish I could show you in some perspicuous way the enormous power which town fog has of absorbing light, and bring forcibly before you the great difference which exists between the amount of light which reaches the inhabitants and buildings of a town, as compared to the amount on an equal area free from smoke. A simple actinometer is much required, and I hope the want will soon be supplied; but at present the only records bearing on this point are the observations of direct sunshine made at various stations, by the Meteorological Society and Meteorological Office, with the Campbell-Stokes instrument, and some interesting observations, by Mr. H. Raffles, on the distance at which objects were visible during a London winter.

First, with regard to the sunshine experiments. One

Hours of Sunshine during the Year 1890.

	Bunhill Row.	Greenwich.	Kew.	Apsley Guise.	Eastbourne.
January ...	29.9	44.0	56.0	57.3	56.9
February ...	42.4	62.8	57.8	70.5	106.5
March ...	71.3	90.8	109.3	110.4	133.5
April ...	127.4	141.5	144.8	137.3	170.1
May ...	215.7	223.9	223.9	214.3	267.9
June ...	128.0	125.2	141.4	119.1	165.3
July ...	134.1	120.6	139.9	141.3	185.6
August ...	164.0	153.1	182.5	189.5	200.2
September ...	131.6	153.2	169.5	166.1	207.4
October ...	89.6	96.9	121.6	135.6	125.3
November ...	23.4	40.8	57.6	64.7	66.9
December ...	0.1	2.4	0.3	13.4	38.0
Total ...	1157.5	1255.2	1404.6	1419.5	1723.6

station is situated in the heart of the City, in Bunhill Row, and it is of much interest to compare the amount of

sunshine there with, first, the amount in the immediate neighbourhood of London, where we are not beyond the effect of town fogs, viz. at Greenwich on one side, and Kew on the other, and also with a place not far from London, which is beyond the influence of its smoke, viz. Apsley Guise, near Woburn. I have also noted the results obtained at Eastbourne, which is about as far distant from London as Apsley Guise, but in the opposite direction, and is one of the sunniest places in England.

Taking the totals of last year, the table shows that the hours of sunshine registered at Bunhill Row were 1158, at Greenwich 1255, at Kew 1405, at Apsley Guise 1420, and at Eastbourne 1724; but for our present purpose we must compare the amounts of sunshine at these places during the winter months—November, December, January, and February—and we find that at Bunhill Row there were 95.8, Greenwich 150, Kew 171.7, Apsley Guise 205.9, and at Eastbourne 268.3 hours of sunshine; that is, if Apsley Guise be taken as giving the normal amount, Bunhill Row received only half its due amount, and at Eastbourne there was nearly three times as much sunshine as in the City. Now, on comparing the two other periods of 4 months, which are comparatively free from fogs, the amount of sunshine is far more nearly the same at all stations.

	Bunhill Row.	Greenwich.	Kew.	Apsley Guise.	Eastbourne.
March till June ...	542.4	581.4	619.4	581.1	736.8
July till October ...	519.3	523.8	613.5	632.5	718.5

Mr. Raffles, during the winter of 1887-88, which it should be noted was remarkably free from fogs, made a series of observations of the distances to which he could see from Primrose Hill, and found that looking south on the 152 consecutive days from November to March, only on 78 days could he see a quarter of a mile, and only on 83 days could he see to the same distance in a south-westerly direction: this conveys a good idea of the opacity of our London atmosphere.

We attempt to compensate for the darkness which fogs cause by the use of artificial light, and I have again to thank my friend Mr. Livesey for the information he has given me with regard to the extra quantity of gas burnt in London during a day of fog. He tells me that if a dense fog covered the whole of London, and lasted all day, the additional amount of gas consumed would be 30 million cubic feet; but since so extensive a fog as this probably never exists, and certainly never lasts all day, the actual amount consumed may be correctly reckoned at 25 million cubic feet; and if the cost of this be calculated at 2s. 6d. per 1000 cubic feet, which is rather below than above the actual cost, it amounts to £3125; but after all, it is not the single days of dense fog that measure the extra amount and cost of artificial light used on account of fog—it is rather the continually occurring dull days and local transitory fogs which demand an extra supply of gas, and this is often 5 to 15 million cubic feet in a day, and gives a total by the end of the winter which is very considerable. As a standard of comparison, I should state that the total consumption of gas in the London district in a day of 24 hours, during the depth of winter, is 140 million cubic feet.

Such, then, is an imperfect outline of the chief features and effects of town fogs; and now what is to be said with regard to the possibility of getting rid of such fogs? This question, it seems to me, resolves itself into this: fogs cannot be prevented from forming over towns; there are, and probably ever will be, special inducements, in the way of dust particles and products of combustion, for fogs to form there; but whether they must always be dark in

colour, and loaded with soot and tarry matter, is another question. The answer involves not only chemical but also social considerations. With regard to the first, my answer is that as long as coal is burnt you will have dense fogs; grates, kitcheners, furnaces, may be, and probably will be, much improved, and fires may be stoked in a better way, but that the improvements will be so great that all imperfect combustion will cease I think is improbable; if this be so, there is only one other alternative, as long as coal is our source of heat: it is to alter our form of fuel and adopt gas and coke; the soot and tarry matters will be then done away with; the question of sulphuric acid in the air would remain, but our fogs would at least be white. There is still the social part of the question, which is not without serious difficulty—namely, how to induce or compel people to give up the use of coal. At the present day it would not be possible to do as it is recorded was done in the reign of Edward I., try, condemn, and execute a man for burning coal in the City of London. W. J. RUSSELL.

Effects of Fog on Plants Grown in the Houses at Kew.

The heavy fogs experienced in the last two or three winters injured many plants in the houses at Kew. When thick fog occurred almost daily, the injury it did to many plants amounted practically to destruction. The leaves fell off, the growing point withered, and in some cases, such as Begonias and Acanthads, the stems also were affected. Flowers, as a rule, fell off as soon as they opened, or whilst in bud. Almost all flowers which expanded were less in size than when there was no fog. The flower-buds of *Phalænopsis*, *Angræcum*, some Begonias, Camellias, &c., changed colour and fell off as if they had been dipped in hot water.

In the Palm-house bushels of healthy-looking leaves, which had fallen from the plants, were gathered almost every morning. Plants which appeared to be perfectly healthy, when shaken would drop almost every leaf. Herbaceous plants suffered most, *i.e.* Begonias, Poinsettias, Bouvardias, Acanthads, &c. Some herbaceous plants, however, did not suffer at all, nor were their flowers injured, as, for instance, Cyclamen, Primula, Hyacinth, &c. Many hard-wooded plants lost their leaves and were otherwise damaged, *viz.* Boronias, some Heaths, Grevilleas, Acacias, &c. *Protea cynaroides*, a Cape plant with large laurel-like leaves, was much injured in the temperate house (minimum temperature 40°), the leaves turning black as though scalded. The same species, however, in another house where the atmosphere is drier and the temperature a few degrees higher, was scarcely affected by the fog.

As a rule, the plants that were in active growth suffered most. Monocotyledonous plants and ferns for the most part were not appreciably affected by the fogs, the injury they suffered, especially last winter, being clearly due to low temperature. The effect of fog on flowers is remarkable. Generally, white flowers are destroyed, but there are some notable exceptions—*viz.* *Masdevallia tovarensis*, *Odontoglossum crispum*, and *Angræcum* amongst Orchids, and Crinum, white Cyclamen, white Hyacinths, white Chrysanthemums, &c.

The green leaves of *Poinsettia pulcherrima* all fell off, whilst the red ones (bracts) remained, as also did the flowers. All Calanthes, of whatever colour, lost their flowers. The buds of the white-flowered *Angræcum sesquipedale* turned black as if boiled, whilst those of *A. eburneum*, also white-flowered, were not injured, and developed properly. These two plants are grown in the same house under identical conditions, and they come into bloom about the same time.

The conditions most conducive to rest from growth—*viz.* a low temperature and moderately dry atmosphere,

together with diminished light, unavoidable during the prevalence of fog—were proved at Kew to be the safest for all plants during the prevalence of heavy fogs.

July 25.

W. WATSON.

THE ANATOMY OF THE DOG.¹

THE dog has played by far the most important part in the elucidation of the difficult problems of physiology and pathology presented by the higher animal organism. It is by a firm reliance on the results of experimental researches, conducted largely upon this animal, that the modern physician is enabled to form some idea as to the causation of the symptoms of disease in man, and the mode of action of the remedies which he employs; while the modern surgeon, after a preliminary testing of an operation upon the dog, fearlessly proceeds to attack the most deeply-seated tumour, and to explore the most hidden recesses of the human organization. What, after all, are the services of friendship and companionship, or the more menial duties which are often laid upon the dog, compared with the alleviation of human suffering and the advancement of human knowledge for which he has served as the passive instrument, and this (*pace* the mendacious asseverations of fanatical essayists) at the expense of the least possible amount of suffering to himself?

For these reasons, to the physiologist, the pathologist, the pharmacologist, and the scientific surgeon, a book which, like the one before us, endeavours to deal with the anatomy of the dog in the same detailed and systematic manner in which the structure of man is dealt with in text-books of human anatomy cannot fail to be of the utmost value. To the comparative anatomist it will prove an important addition to the limited existing series of monographs dealing in detail with vertebrate types, while to the veterinarian it will be an indispensable *vade mecum*, both in study and in practice.

For the work is done excellently well, a result which might be anticipated from the manner in which it has been set about. Not only has it been carried on under the auspices of a scientific anatomist so well known as Prof. Ellenberger and in a veterinary school where an unlimited supply of subjects was available for dissection, but with a far-sighted liberality, for which the Saxon Government is much to be congratulated, all the expenses for material and instruments have been defrayed by the State, and one of the collaborators has been enabled to devote his whole time during a period of two years entirely to the labour incident upon the preparation of this work.

The book is a large octavo of 650 pages, containing 208 woodcuts, a few examples of which are here reproduced. There is, in addition, an appendix of 37 lithographed plates, representing in outline frozen sections through the trunk and limbs. A study of these is in itself sufficient to make out the relations of the organs to one another, and the authors have accordingly burdened the text as little as possible with topographical details. Histological and developmental references are entirely avoided, partly for the reason that the facts are not materially different from those which are found in other mammals, partly because they have been dealt with, especially for the dog, in other works, and largely because it was obviously desirable not to increase the bulk of the work. References to literature are also for the most part omitted, for although other works have been consulted, it is claimed by the authors that the present account is

¹ "Systematische u. topographische Anatomie des Hundes." Bearbeitet von Dr. W. Ellenberger, Professor an der tierärztlichen Hochschule in Dresden, und Dr. H. Baum, Prosektor an der tierärztlichen Hochschule in Dresden. (Berlin: Paul Parey, 1891)

based almost exclusively upon original dissections and preparations.

It might be supposed that the striking differences, both in size and in shape, which are presented by dogs

ties which result therefrom, are, as might be supposed, not ignored by the authors of this book. But they remark hereon that apart from differences in size, rendering absolute measurements of little value, the racial

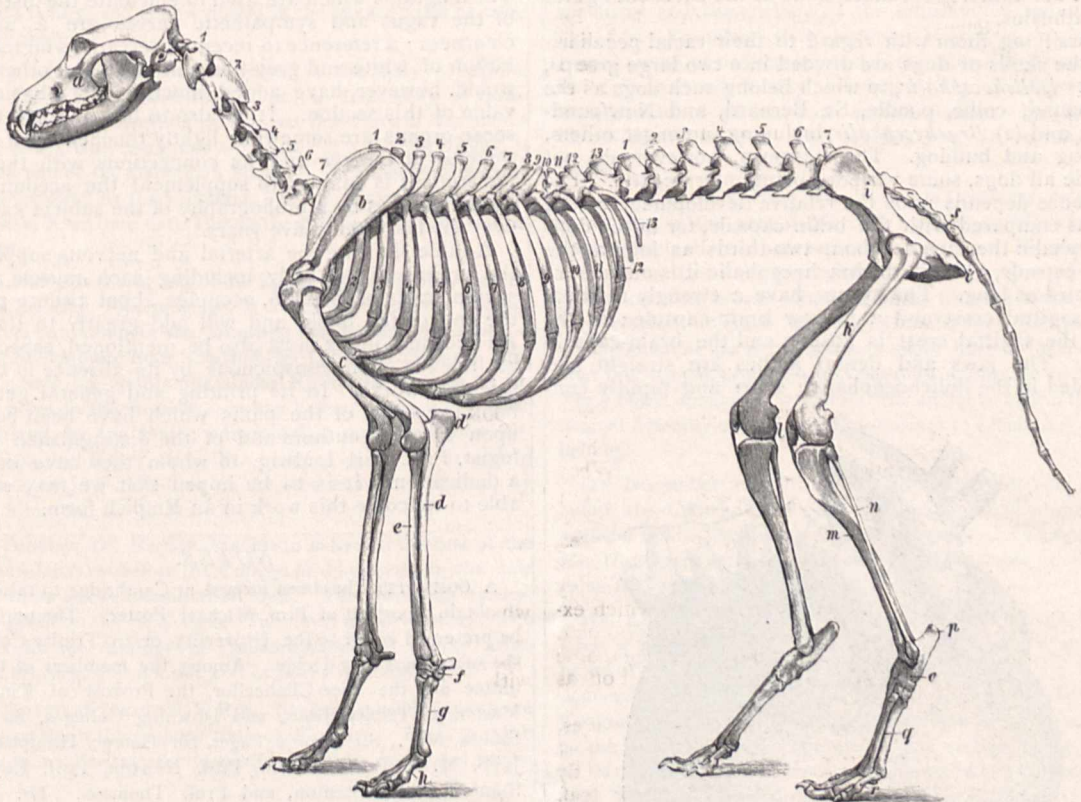


FIG. 1.—Skeleton of the dog. *a*, skull; *b*, scapula; *c*, humerus; *d*, ulna; *d'*, olecranon; *e*, radius; *f*, carpus; *g*, metacarpus; *h*, phalanges of fore-foot; *i*, pelvis; *j*, tuber ischii; *k*, femur; *m*, tibia; *n*, fibula; *o*, tarsus; *p*, tuber calcanei; *q*, metatarsus; *r*, phalanges of hind-foot; *s*, coccygeal vertebrae. The cervical, thoracic, and lumbar vertebrae and the ribs are respectively numbered consecutively.

of races so different from one another as, to take extreme cases, the greyhound and the pug, would be accompanied by such structural peculiarities as to render a general

differences are almost entirely confined to the skeleton and to certain parts of the muscular system, no important differences being manifest in the position of the muscles,



FIG. 2.—Fore-foot of the dog. *a*, carpal ball; *b*, ball of the sole; *c*₁ to *c*₄, balls of the toes.

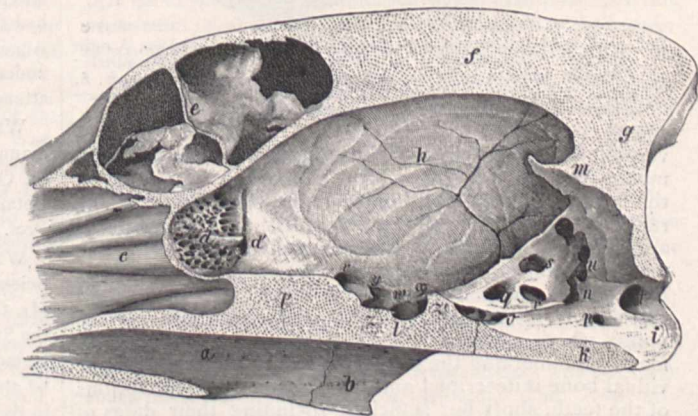


FIG. 3.—Section of skull, displaying the interior of the cranial cavity, and the frontal sinuses. The foramina of exit of the cranial nerves, and the impressions of the cerebral convolutions on the inner surface of the cranium are well shown.

anatomical account of the dog of less value than that of animals in which racial characteristics are less exaggerated. The differences which are found, and the difficul-

vessels, nerves, and viscera; and even in crook-legged dogs, such as the dachshund, in spite of the twisting of the extremities, the topographical relations of the muscles

to one another, as well as to the vessels, nerves, and bones, remain completely unaltered. The only racial characteristics, therefore, which are dwelt upon are those of the skeleton, and especially of the skull, in illustration of which the authors reproduce some of the excellent figures of Nathusius.

Classifying them with regard to their racial peculiarities, the skulls of dogs are divided into two large groups, viz. (1) *Dolichocephalic*, to which belong such dogs as the greyhound, collie, poodle, St. Bernard, and Newfoundland; and (2) *Brachycephalic*, including, amongst others, the pug and bulldog. These groups, however, do not include all dogs, some varieties being intermediate. The difference depends upon the relative development of the face as compared with the brain-capsule, for in the dolichocephalic the face is about two-thirds as long as the brain-capsule, while in the brachycephalic it is only about one-third as long. The former have a strongly marked, bony sagittal crest and a narrow brain-capsule; in the latter the sagittal crest is absent, and the brain-capsule wide. The jaws and dental arches are straight and extended in the dolichocephalic; short and rapidly con-

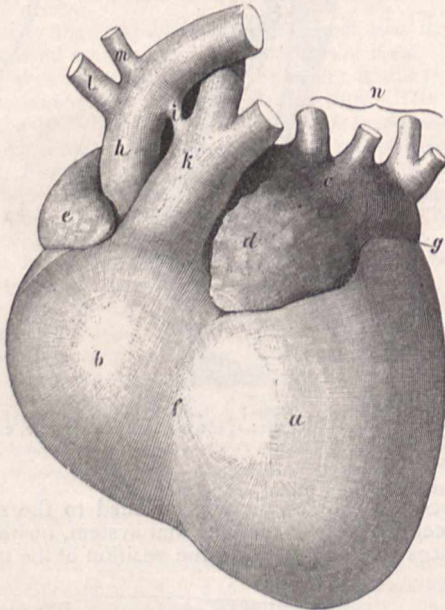


FIG. 4.—Dog's heart, viewed from the left side. *a*, left ventricle; *b*, right ventricle; *c*, left auricle; *d*, its auricular appendage; *e*, right auricle; *f*, groove between right and left ventricles; *g*, coronary groove; *h*, aorta; *i*, ligamentum Botalli; *k*, pulmonary artery; *l*, innominate artery; *m*, left subclavian; *n*, pulmonary veins.

verging in the brachycephalic; in the former the premolars are set straight, with well-marked intervals; in the latter they are closely packed, and set obliquely. The racial peculiarities of all the several bones of the skeleton are referred to, and a comprehensive table of pelvic measurements of the different races is given.

It would carry us too far to draw attention to all the details of a work like this, but there are certain points which deserve special mention. Amongst these may be enumerated the exact manner in which each individual bone is described and illustrated; the descriptions of the teeth, short but sufficient, including their dates of eruption; the account of the individual muscles and groups of muscles, with their action; the descriptions of the viscera and of the vascular and nervous systems; and last, but not least, the general excellence of the illustrations, in which the muscles, the blood-vessels, and the nerves are shown up by the aid of colours and differences of shading in a manner which gives a diagrammatic clearness to what appear to be drawings made from actual

dissections. Special mention may also be made of the section devoted to the cerebral hemispheres, the convolutions and fissures of which are minutely described and illustrated both by diagrams and artistic representations. The diagrams which are used to elucidate the distribution of the vagus and sympathetic nerves are a model of clearness; a reference to recent observations on the distribution of white and grey fibres in these and other nerves would, however, have added much to the physiological value of this section. It is also to be remarked that the sense-organs are somewhat lightly touched upon; but in the case of the eye and its connections with the brain, the student is enabled to supplement the account given by the authors by a bibliography of the subject extending over the last twenty-five years.

A table showing the arterial and nervous supply of all the organs of the body, including each muscle and the several parts of the skin, occupies about twenty pages at the end of the book, and will add greatly to its value. An excellent index must also be mentioned, especially as an index is often conspicuous by its absence in German scientific works. In its printing and general get up the book is worthy of the pains which have been bestowed upon it by its authors and of the distinguished physiologist, Prof. Carl Ludwig, to whom they have inscribed a dedication. It is to be hoped that we may soon be able to welcome this work in an English form.

NOTES.

A COMMITTEE has been formed at Cambridge to raise a fund to obtain a portrait of Prof. Michael Foster. The portrait will be presented either to the University or to Trinity College, as the subscribers may decide. Among the members of the committee are the Vice-Chancellor, the Provost of King's, the Masters of Trinity, Jesus, and Downing Colleges, Sir George Stokes, M.P., Sir George Paget, Sir George Humphry, Prof. Jebb, M.P., Prof. Darwin, Prof. Newton, Prof. Roy, Prof. Stanford, Prof. Stanton, and Prof. Thomson. Dr. Lea, of Gonville and Caius College, is the treasurer of the fund.

THE celebration of Prof. von Helmholtz's seventieth birthday, deferred from August 31, was held on Monday last at Berlin. He was congratulated in the warmest terms by the Minister of Education, and by representatives of many scientific Societies. Prof. du Bois Reymond, acting on behalf of the Helmholtz Medal Committee, handed to Dr. von Helmholtz the first medal, and said that numerous contributions to the Helmholtz Fund had flowed in from all parts of the world, and that the Berlin Academy of Science, with the Emperor's permission, had undertaken the trusteeship. In the evening over 500 guests attended a banquet at the Kaiserhof Hotel.

WE regret to have to record the death of Dr. H. K. H. Hoffmann, one of the most distinguished German botanists. He died on October 27. He had been for many years Professor of Botany at Giessen and Director of the Botanic Institution there. Prof. Hoffmann was in his seventy-third year.

WITH reference to the article on "Existing Schools of Science and Art" in NATURE of October 8 (vol. xlv. p. 547), Mr. O. S. Dawson writes:—"It was stated at the meeting that the St. Martin's School of Art 'had closed its doors.' I find this to be incorrect. Certain changes have been made, but I am glad to be able to state that this school (one of the oldest and best known in the country) is flourishing under the new head-master, Mr. Allen."

THE interest excited by the question of the compulsory study of Greek brought to Cambridge on Thursday, last week, the largest number of members of the Senate ever gathered in the Senate House. The proposal that the question should be made a subject of official inquiry was rejected by 525 votes against 185.

THE Museums and Lecture Rooms Syndicate, Cambridge, have accepted on behalf of the University a cast of the model executed by the late Sir J. E. Boehm, R.A., for his statue of Mr. Charles Darwin. The cast has been presented by Mr. Darwin's family, and is now placed in the lecture-room of comparative anatomy.

A SOCIETY for the encouragement of the study of natural science has recently been formed at the University of Edinburgh. In commemoration of the fact that Darwin was once a student of the University and a member of a similar society, it has been named the Darwinian Society. The inaugural address is to be delivered by the President, Prof. J. Cossar Ewart. Mr. J. Graham Kerr (late naturalist to the Pilcomayo Expedition) is chairman.

THE anniversary meeting of the Mineralogical Society will be held on Tuesday, November 10, at 8 o'clock. After the election of officers and Council, the following papers will be read:—analysis of aragonite from Scotland, by J. Stuart Thomson; on minerals from the apatite mines near Risør, Norway, by R. H. Solly; notes on the minerals from the hematite depo its of West Cumberland, by the same; mineralogical notes from Torreón, Chihuahua, by Henry F. Collins; on the pinites of Breage in Cornwall, by J. H. Collins; on the occurrence of danalite, by H. A. Miers and G. T. Prior.

ON Tuesday, Dr. Burdon Sanderson delivered the first of the Croonian Lectures before the College of Physicians in the new lecture-room at the Examination Hall. The remaining lectures will be given on the next three Tuesdays of November. The subjects are the etiology of inflammation and of the acute specific diseases, and natural and acquired immunity.

SIR DOUGLAS GALTON, F.R.S., has been asked to investigate and report upon the sanitary state of Florence. He is to make any recommendations and suggestions that he may deem necessary.

AT a meeting of the Senate of the University of Sydney on September 21, it was resolved that Prof. Thorpe and Prof. Ramsay should be asked to select and appoint a Demonstrator of Chemistry to take office at the Sydney University on March 1 next, the salary to be at the rate of £350 per annum, and £60 to be allowed for passage money, such sum to be refunded if the Demonstrator should resign his office before the expiration of two years from his appointment. The appointment of a new Demonstrator has been rendered necessary by the resignation of Mr. F. B. Guthrie, who has been made Analyst to the Department of Agriculture.

THE Society of Arts has completed its arrangements for the approaching session. The first meeting will be held on Wednesday, November 18, when the opening address will be delivered by the Attorney-General, Chairman of the Council. At subsequent ordinary meetings (four of which, in addition to the opening meeting, will be held before Christmas) the following lectures will be delivered:—Measurement of lenses, by Prof. Silvanus P. Thompson, F.R.S.; secondary batteries, by G. H. Robertson; the World's Fair at Chicago, 1893, by James Dredge; spontaneous ignition of coal, and its prevention, by Prof. Vivian B. Lewes; burning oils for lighthouses and lightships, by E. Price Edwards; dust, and how to shut it out, by T. Pridgin Teale; typological museums, by General Pitt Rivers; Iceland, by T. Anderson; artistic treatment of jewellery and personal ornament, by J. W. Tonks; agricultural banks for India, by Sir William Wedderburn. The following Cantor Lectures will be given on Monday evenings:—The pigments and vehicles of the old masters, by A. F. Laurie (three lectures, November 30, December 7, 14); developments of electrical distribution, by Prof. George Forbes, F.R.S. (four lectures,

January 25, February 1, 8, 15); the uses of petroleum in prime movers, by Prof. William Robinson (four lectures, February 29, March 7, 14, 21); mine surveying, by Bennett H. Brough (three lectures, March 28, April 4, 11); recent contributions to the chemistry and bacteriology of the fermentation industries, by Dr. Percy Frankland (four lectures, May 2, 9, 16, 23). A special course of six lectures, under the Howard Bequest, will be delivered on Friday evenings:—The development and transmission of power from central stations, by Prof. W. Cawthorne Unwin, F.R.S. (February 5, 12, 19, 26, March 4, 11).

LAST week the Speaker of the House of Commons, responding to a toast at the annual Mayoral banquet at Warwick, gave some sensible advice about technical education. He was afraid, he said, that there was great danger of the sums granted for the promotion of technical education being frittered away. What they wanted to teach was not a trade, not the particular manipulation of the article students might have to deal with in after life, but the principles of science as applicable to the art. Their object should be to elevate the students above the mere manual dexterity of the special professions to which they were to belong.

ON November 12, Mr. E. J. Humphery will read a paper before the Camera Club on a new method of photography by artificial light. According to the Journal of the Camera Club, Mr. Humphery promises a process of considerable novelty and value in practical work.

DR. ELISHA GRAY lately read before the Chicago Electric Club a paper in which he urged the importance of the International Congress of Electricians which is to be held in connection with the World's Fair at Chicago in 1893. The Congress, he thinks, should be divided into sections according to the various interests represented, one section being devoted to the purely scientific aspects of the subject. "Success," he said, "will be assured from the beginning if all our interested friends act harmoniously, and are actuated by one common desire that the best thing shall be done, without regard to geographical boundaries or local prejudices." Commenting on the paper, Mr. Parker pointed out that, owing to the supremacy which America enjoys in the practical development of industrial electricity, the electrical department would be the most interesting and attractive feature of the Exhibition. He held, therefore, that the directors of the Exhibition should give priority to this department in all arrangements, and should do all in their power to render the Electrical Congress a successful gathering.

PROF. WARD, the mineralogist, of Rochester, New York, has offered to send his collection of geological specimens to the Chicago Exhibition. It is said to be one of the most valuable collections in the United States.

ON Wednesday, October 28, a terrible earthquake visited Nipon, the island which forms the larger part of the Japanese Empire. The area over which the shocks were felt was wider than was at first supposed. It extended inland to the region of the lakes. The principal shock lasted less than two minutes, but was of extreme violence. The subsequent shocks were not strong enough to have done damage in ordinary circumstances, but they sufficed to shake down walls already cracked, and added immensely to the terrors of the night. The *Times* correspondent, telegraphing from Hiogo on November 2, says that great fissures had appeared in the ground at many points, rendering roads impassable and travelling dangerous; and that there had been a remarkable subsidence of the land to some depth over large tracts of country. The volcanic mountain Nakusan belched forth enormous masses of stones and continuous streams of sand and mud, and the contour of the mountain has been completely changed by the eruption. The greatest havoc

seems to have been caused at Ogaki, where at least 1000 persons were killed, chiefly by falling buildings. Both there and at Gifu the earthquake was followed by fires, in which many perished. At Kitagata, Ichinomiya, Tiraguna, Kiyonsu, Kamatsu, and other places, chiefly along the coast, great damage was done. The city of Nagoya suffered to a less extent, although seriously. Much distress prevails in the ruined towns, and the Government is embarrassed in its efforts by the prevailing panic, and the absence of means of communication, telegraph lines and many miles of railway having been destroyed. Exact details as to the extent of the calamity will probably not be obtained for some time. On November 2 the following was the official estimate: killed, 4000 persons; injured, fully 5000; houses destroyed, 50,000.

A GREAT rush of migratory birds seems to have passed over Dublin during the night of May 4 last, evidently on the way to their northern breeding-haunts. An account of the matter is given by Mr. Allan Ellison in the new number of the *Zoologist*. "While sitting in our rooms in Trinity College, about 11 p.m.," he says, "we were attracted by the loud call-notes of birds passing overhead. The night was calm and cloudy, not very dark. We listened at the open window until about 1 a.m., when they seemed to be still passing over in undiminished numbers. They were mostly golden plovers and dunlins, easily recognized by their notes, but we frequently heard the cry of the whimbrel, or the shrill call of the common sandpiper. It was most curious to hear these notes, at first far away towards the south-west, gradually becoming louder as the flocks drew nearer and passed overhead, and then rapidly passing away to the northward. Sometimes the whole air seemed full of their clear whistling notes: in one direction the loud, short pipe of the golden plover, in another the shrill wheezing cry of the dunlin, reminding one of the sound made by a whistle with a pea in it. Sometimes a bird or two would fly quite close over the house-tops, uttering its loud whistle close to the open window, but they seemed for the most part to fly at a great height."

ONE large meteorite and two fragments were lately received by the Government Central Museum, Madras, through the Board of Revenue. Mr. Edward Thurston, the Superintendent of the Museum, quotes in his report for 1890-91 the following statement, by the Tahsildar of Tirupatūr, in the Salem district, as to the conditions under which these stones fell:—"On June 4, 1890, about 8 a.m., there was a sudden clap of thunder, accompanied by an unusual rumbling noise. At this time two stones are said to have fallen in the village of Kakangarai. The fall of both the stones occurred at the same time in adjacent fields, and was witnessed by rayats, who were ploughing close by at the time. One stone appears to have been broken up and divided among the rayats, while the other was taken charge of by the village munsif. The large specimen weighs 11½ ounces, and the fragments weigh about 1 ounce and ½ ounce respectively."

THE sponge trade of the Bahama Islands forms the subject of an excellent report by the U.S. Consul at Nassau. The number of persons engaged in this industry in the Bahamas is from 5000 to 6000, all of whom, except the shipowners, brokers, and skippers are coloured people. The sponges are gathered by means of iron hooks attached to long poles. By using a water-glass the fisherman can readily discover the sponges at the bottom, and then with his pole and hook he will bring up those he may select as fit for his purpose, leaving the smaller ones untouched. Some sponges adhere firmly to the bed of the sea, while others—known as "rollers"—are not attached at all. About ten years ago an attempt was made to introduce dredges, but it seemed likely that they would ruin the beds, and a law was passed forbidding their use. The vessels are provided and

fitted out, as a rule, for a voyage of about six weeks, and generally from six to eight voyages are made in the year. It is difficult to estimate the average catch per trip, as the cargoes vary greatly in size and value. Of the larger sponges a catch of 5000, or of the smaller ones 7500, would be considered a fair lot. Occasionally a cargo of from 12,000 to 15,000 large sponges has been brought in, but this success is exceptional. Contradictory statements are made as to the time taken by sponges to grow to the size at which they are wanted. It seems probable, however, that under ordinary conditions a healthy sponge will reach a marketable size in from twelve to eighteen months.

EXTENSIVE excavations of the prehistoric mounds in Ohio and Indiana have lately been carried on under the supervision of Prof. Putnam. In one mound, near Anderson Station, Indiana, 7232 flint spear-heads and knives have been discovered. They were found in a layer one foot thick, extending over a space of twenty by thirty feet. They are made of grey flint found only in Indiana. The largest find of flint implements previously made in America did not include more than 1800 specimens.

STATISTICS published by the French Ministry of Public Instruction show that there are in France 525 learned Societies, of which 135 have been officially recognized as of national importance. Of these 525 Societies, 95 are historical and social; 95 agricultural and horticultural; 57 medical and pharmaceutical; 45 scientific; 41 artistic; 37 geographical; and the rest miscellaneous, including photographic, statistical, and ballooning associations.

PROF. KIKUCHI, of Tokyo, whose Japanese treatise on geometry we noticed briefly a year or two since, has now published a translation of his work into English. In the first Japanese Parliament Prof. Kikuchi had the honour to be made a life member of the House of Peers by the Emperor ("this does not constitute peerage as in England"), and at the request of the Department of Agriculture and Commerce he was one of the original framers of the Weights and Measures Bill.

THE Cambridge University Press has published a second edition of Mr. S. L. Loney's "Treatise on Elementary Dynamics." The book is intended for beginners, the author having dealt only with those parts of dynamics which can be treated without the use of the infinitesimal calculus. In the present edition the work has been carefully revised and somewhat enlarged.

THE first part has now been issued of the *Zeitschrift für Pflanzenkrankheiten*, edited by Dr. Paul Sorauer, with the assistance of an "International Phytopathological Committee." The journal is intended to be published bi-monthly, at a subscription of 15 marks per annum; and will contain original articles, reviews, and news, extending over the whole subject of the diseases of plants and the remedies for these diseases.

MESSRS. CASSELL AND CO. have issued Part 37 of their "New Popular Educator." Besides many illustrations in the text, there is a coloured plate representing sea-jellies and sea-stars.

FREE hydroxylamine, NH_2OH , has been isolated by M. Lobry de Bruyn, and a preliminary account of its mode of preparation and properties is published by him in the current number of the *Recueil des travaux chimiques des Pays-Bas* (1891, 10, 101). The manner in which the free base was obtained was briefly as follows. About a hundred grams of hydroxylamine hydrochloride, $\text{NH}_2\text{OH} \cdot \text{HCl}$, were dissolved in six hundred cubic centimetres of warm methyl alcohol. To this solution a quantity of sodium dissolved in methyl alcohol was added, in such proportion that the hydrochloride of hydroxylamine was present in slight excess over and above that required to convert it to sodium chloride. After deposition of the separated sodium

chloride the solution was decanted and filtered. The greater portion of the methyl alcohol was next removed by distillation under the reduced pressure of 160-200 mm. The remainder was then treated with anhydrous ether, in order to completely precipitate the last traces of dissolved sodium chloride. The liquid eventually separated into two layers, an upper ethereal layer containing about 5 per cent. of hydroxylamine, and a lower layer containing over 50 per cent. of hydroxylamine, the remainder of the methyl alcohol, and a little dissolved salt. By subjecting this lower layer to fractional distillation under 60 mm. pressure, it was separated into three fractions, of which the first contained 27 per cent. of hydroxylamine, the second 60 per cent., and the third crystallized in the ice-cooled receiver in long needles. This third fraction consisted of free solid NH_2OH . Hydroxylamine as thus isolated in the free state is a very hygroscopic substance, which rapidly liquefies when exposed to air, owing to the absorption of water. The crystals melt at 33° , and the fused substance appears to possess the capability of readily dissolving metallic salts. Sodium chloride is very largely soluble in the liquid; powdered nitre melts at once in contact with it, and the two liquids then mix. Free hydroxylamine is without odour. It is heavier than water. When rapidly heated upon platinum foil it suddenly decomposes in a most violent manner, with production of a large sheet of bright-yellow flame. It is only very slightly soluble in liquid carbon compounds such as chloroform, benzene, ether, acetic ether, and carbon bisulphide. The vapour attacks corks, so that the solid requires to be preserved in glass-stoppered bottles. The free base appears also to act upon cellulose, for, upon placing a few drops of the melted substance upon filter paper, a considerable amount of heat is evolved. The pure crystals are very stable, the base in the free state appearing to possess much greater stability than when dissolved in water. The instability of the solution appears, however, to be influenced to a considerable extent by the alkalinity of the glass of the containing vessel, for concentrated solutions free from dissolved alkali are found to be perfectly stable. Bromine and iodine react in a remarkable manner with free hydroxylamine. Crystals of iodine dissolve instantly in contact with it, with evolution of a gas and considerable rise of temperature. Bromine reacts with violence, a gas again being explosively evolved and hydrobromic acid formed. The nature of the gas evolved is now undergoing investigation. A letter from M. Lobry de Bruyn appears in the number of the *Chemiker Zeitung* for October 31, warning those who may attempt to prepare free hydroxylamine by the above method that it is a dangerously explosive substance when warmed to a temperature of 80° - 100° . Upon warming a flask containing the free solid base upon a water-bath a most violent explosion occurs. A spontaneous decomposition appears to set in about 80° , and even in open vessels the explosion is very violent. Care must also be taken during the fractional distillation of the concentrated solution in methyl alcohol to cool the apparatus before changing the receiver, as if air is admitted while the retort is heated the experiment ends with an explosion.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀), two Macaque Monkeys (*Macacus cynomolgus* ♂ ♀), a Bonnet Monkey (*Macacus sinicus* ♀) from India, two Roseate Cockatoos (*Cacatua roseicapilla*), a Greater Sulphur-crested Cockatoo (*Cacatua galerita*), two Cockateels (*Calopsitta nova-hollandiae*) from Australia, presented by the Rev. Sidney Vatcher; two Rhesus Monkeys (*Macacus rhesus* ♂ ♂) from India, presented by Mr. John H. Taylor; a Macaque Monkey *Macacus cynomolgus* ♂ from India, presented by Mr. K. A. Williams; a Yak (*Porphagus grunniens* ♂) from Tibet, presented by Mr. M. E. C. Ingram; a Corn Crake (*Crex pratensis*), British, presented by Mr. E. Hart, F.Z.S.; two Woodcocks (*Scolopax rusticola*),

British, presented respectively by Mr. Hamon Le Strange, F.Z.S., and Mr. William Bellamy; two Water Vipers (*Cenchriscus piscivorus*), a Water Rattlesnake (*Crotalus adamanteus*) from Florida, presented by the Natural History Society of Toronto; a Small-scaled Mastigure (*Uromastix microlepis*) from Persia, presented by Mrs. Howell; an Alligator (*Alligator mississippiensis*) from the Mississippi, presented by Mr. W. Chattaway; two Bearded Vultures (*Gypaetus barbatus*), European, deposited; a Molucca Deer (*Cervus moluccensis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE TELLURIC SPECTRUM.—Dr. Müller has made some observations of the telluric spectrum on the summit of the Säntis, and his results are given in a recent publication of Potsdam Observatory (vol. viii., No. 27). The observing station was situated at a height of 2500 metres above sea-level. It was found that when the sun had a mean altitude, about 40 per cent. of the lines due to the water vapour in the atmosphere were quite invisible, and the remainder were very weak. Whilst the zenith distance of the sun was less than 60° , the appearance of the spectrum remained unchanged. At greater zenith distances the weak lines increased in intensity and the missing ones gradually appeared. Measurements of the intensities of single lines observed on different days and at different zenith distances indicate a variation roughly proportional to the thickness of atmosphere traversed. The aspect of the portion of spectrum observed was on the whole strikingly similar to that seen when observations were made near sea-level on dry and cold days. This is in agreement with the fact that the vapour pressure on mountains in summer is approximately equal to that on the plains in winter. Careful estimations of the intensities of the atmospheric lines at C and D might therefore be utilized to determine the decrease of the amount of vapour present in the air at different elevations. With regard to other atmospheric lines, Dr. Müller observed changes in the α -group. The whole of the lines of this group, however, were easily seen at the mountain station when the sun had a high altitude, and the difference of intensity there and in the plains was considerably less than in the groups C and D. Two maps are given illustrating the appearance of the lines in the neighbourhood of C and D for different zenith distances of the sun.

TEMPEL-SWIFT'S PERIODIC COMET.—The following ephemeris is given by M. Bossert in *Astronomische Nachrichten*, No. 3063:—

Ephemeris for Paris Midnight.

1891.	Right Ascension.	Declination.	Brightness.
	h. m. s.	° ' "	
Nov. 3 ...	21 31 22 ...	+ 7 49'6 ...	10'1
" 5 ...	21 37 6 ...	8 37'5	
" 7 ...	21 43 17 ...	9 27'7	
" 9 ...	21 49 59 ...	10 19'3	
" 11 ...	21 57 13 ...	11 15'1 ...	11'9
" 13 ...	22 4 59 ...	12 12'1	
" 15 ...	22 13 19 ...	13 11'2	
" 17 ...	22 22 14 ...	14 12'0	
" 19 ...	22 31 45 ...	15 14'4 ...	13'5
" 21 ...	22 41 54 ...	16 18'0	
" 23 ...	22 52 41 ...	17 22'2	
" 25 ...	23 4 6 ...	18 26'6	
" 27 ...	23 16 9 ...	19 30'5 ...	14'4
" 29 ...	23 28 48 ...	20 33'2	
Dec. 1 ...	23 42 1 ...	21 33'9	
" 3 ...	23 55 46 ...	22 31'8	
" 5 ...	0 9 57 ...	23 26'2 ...	14'0
" 7 ...	0 24 30 ...	24 16'3	
" 9 ...	0 39 18 ...	25 1'4	
" 11 ...	0 54 15 ...	25 41'0	
" 13 ...	1 9 13 ...	26 14'9 ...	12'0

The comet is moving north at the rate of 1° per day. It will be in Pegasus all this month, and will pass about 4° north of α Pegasus (Marcab) near the 23rd inst. The maximum brightness is reached at the end of the month.

CATALOGUE OF RUTHERFURD'S PHOTOGRAPHS.—A year ago Dr. Lewis Rutherford presented to the Observatory of Columbia College all his photographic negatives taken between

the years 1858 and 1878, and thirty quarto volumes containing the measures of many of them. The *Annals of the New York Academy of Sciences*, vol. vi., June 1891, contains a catalogue of these negatives. There are 139 negatives of the sun taken between 1860 and 1874, each of which has the time of exposure marked upon it. Several negatives were taken of the eclipses of 1860, 1865, and 1869. The solar spectrum is the subject of 160 negatives and 14 positives. The list of lunar negatives numbers 408, 40 of which are covered for protection. Mars was photographed in 1877, and the transit of Mercury in the following year. It is hoped soon to issue reductions of the measures of the numerous negatives of stars and clusters.

THE INSTITUTION OF MECHANICAL ENGINEERS.

A GENERAL meeting of the Institution of Mechanical Engineers was held on Wednesday and Thursday evenings of last week, the 28th and 29th ultimo. The meeting took place at the Institution of Civil Engineers, Great George Street, the theatre having been lent by the Council of the latter Society for the purpose. The President, Mr. Joseph Tomlinson, occupied the chair, and there were two papers on the agenda. The first of these, taken at the Wednesday's sitting, was "On some Details in the Construction of Modern Lancashire Boilers," by Mr. Samuel Boswell, of Manchester. The evening of Thursday was occupied with the reading of "The Report to the Alloys Research Committee," made by Prof. W. C. Roberts-Austen, C.B., F.R.S.

The first paper does not call for much attention at our hands. It dealt exclusively with boiler-making practice, and can hardly be of much interest outside the boiler-shop and draughting office. Within these limits the paper is one of great value, and therefore will occupy a most fitting place in the Proceedings of the Institution. The contribution of Prof. Roberts-Austen was of a very different description; and although it may not appeal so directly to the majority of mechanical engineers, it can hardly fail to improve the practice of engine construction, and advance the science of the production of mechanical energy many steps nearer that ideal of efficiency which is the goal all good engineers should keep in view. We have on previous occasions dwelt upon the excellent work done by the various Research Committees appointed by the Council of this Institution, and we can think of no better way in which the surplus funds of the Institution could be spent. Of all these Research Committees, it may be said that that appointed to consider the question of alloys is the most comprehensive and important, for we appear to be fast coming to a period when engines will consist almost wholly of two alloys—namely, brass and steel. Cast-iron will naturally continue to be used for massive parts where comparatively great weight is of small importance, but wrought-iron is every day giving place to steel, and steel castings have already almost entirely superseded those of iron in positions where it is desirable to combine lightness and strength.

Prof. Roberts-Austen's report is a long document occupying twenty-four pages of the Proceedings, and illustrated by several diagrams. We shall therefore, with the space at our command, be able to do little more than give an outline of its scope, or at any rate we can do no more than dwell on a few of the more salient features. In dealing with the question of iron and its alloys, the author assumed the reader to have an acquaintance with the work of the talented French physicist Osmond, of whom, as is well known, Roberts-Austen is a great admirer. Osmond holds that the results of his experiments show that there are two distinct varieties of pure iron—namely, the α or soft form, and the β or hard form. M. Osmond, it will be remembered, set forth his views in a paper read at the meeting of the Iron and Steel Institute, held in 1890.¹ Mr. Roberts-Austen had previously commenced an investigation upon the application of the "periodic law" of Newlands and Mendeleeff to the mechanical properties of metals, and the Research Committee requested him to carry his work in this direction still further. This law, as originally expressed, states that "the properties of the elements are a periodic function of their atomic weights." It has been shown that the effect of impurities added to gold is nearly proportional to their atomic volume, the larger the volume of the atom the greater being its effect.² It became

interesting to determine, therefore, whether this holds good for other metals. Osmond had determined that the action of impurities on iron does appear to be in accordance with the periodic law; and he had arranged the elements in the following order in accordance with their atomic volumes, found by dividing their atomic weight by their specific gravity:—

I.		II.	
Carbon	3.6	Chromium	7.7
Boron	4.1	Tungsten	9.6
Nickel	6.7	Silicon	11.2
Manganese	6.9	Arsenic	13.2
Copper	7.1	Phosphorus	13.5
		Sulphur	13.7

Osmond pointed out that the elements in column I., whose atomic volumes are smaller than that of iron (7.2), delay during cooling, *ceteris paribus*, the change of hard iron into soft iron, as well as that of "hardening carbon" into "carbide carbon." For these two reasons they tend to increase, with equal rates of cooling, the proportion of hard iron that is present in the cooled iron or steel, and consequently the hardness of the metal. The elements in column II. tend to raise, or maintain at its normal position during cooling, the temperature at which the change of hard to soft iron takes place. Further, they render the inverse change during heating more or less incomplete, and usually hasten the change of dissolved or hardening carbon to carbide carbon. Thus they maintain iron in the soft state at high temperatures, and must therefore have the same effect in the cooled metal. In this way they would act on iron as annealing does, rendering it soft and malleable, did not their individual properties, or those of their compounds, mask this natural consequence of their presence. The essential part played by foreign elements alloyed with iron is therefore either to hasten or to delay the passage of iron during cooling to an allotropic state; and to render the change more or less incomplete in one direction or the other, according to whether the atomic volume of the added impurity is greater or less than that of iron. In other words, foreign elements of low atomic volume tend to make iron itself assume or retain the particular molecular form which possesses the lowest atomic volume; whilst elements with large atomic volume produce a reverse effect. The report goes on to point out that the effect of impurities on iron is far more complicated than in the case of gold; the latter being probably more simple in its molecular structure. Also if iron, by itself, can exist in two widely different states, the mechanical properties will be affected by the proportion of each. Lead also, which was one of the metals the Committee selected for investigation, probably exists in more than one modification. The author had made many experiments on the mechanical properties of lead as affected by a small quantity of impurity, but had not brought the results to any concordant or definite conclusion, and the inquiry was laid aside for a time. The fundamental necessity in carrying out the work of the Committee was a trustworthy pyrometer which would measure higher temperatures, and fortunately an instrument which appears to fulfil these conditions is now to be procured. This, we need hardly say, is the Le Chatelier pyrometer. This instrument consists of a thermo-couple of platinum and platinum-rhodium wire, the record being obtained by the measurement of the electric current produced. An autographic record is obtained by means of a spot of light thrown from a mirror attached to the galvanometer which measures the current. This spot of light is thrown on to a sensitized plate (Eastman's film) which is caused to travel by suitable means so as to give the time factor. The amplitude of the deflection naturally gives the temperature of the substance which is supplying the heat to the thermo-couple. The calibration has been carefully effected by observations at known temperatures; and the instrument has been tested by observations in connection with the liquation of silver-copper alloys, about which a good deal is known.

The report next proceeds to deal with the effect of small quantities of impurity on the freezing point of gold—a metal which offers special advantages for investigations of this nature, as it may be prepared in a very high degree of purity, and is not liable to contamination by oxidation. Moreover, much is already known of its mechanical and thermal properties as influenced by small quantities of impurity. The effects of certain alloys upon gold are given in the report, and are well worth study on the part of those inquirers who wish to prepare them-

¹ See also *Comptes rendus*, vol. cx., 1890, p. 346.

² Philosophical Transactions of the Royal Society, vol. clxxix., 1888, p. 339.

selves for a better understanding of the alloys of metals which come within the scope of every-day experience.

From the engineer's point of view, as the report states, the most interesting information which the pyrometer has yet afforded is connected with the measurement of the internal stresses in iron and steel. The molecular change which takes place in steel must be of vital importance when the metal is subjected at high temperature to mechanical operations such as rolling or forging. "Do the molecular changes in the iron take place at one moment throughout the mass of metal? that is, is the rate of cooling approximate throughout the mass, or does the external portion of the ingot cool so much more rapidly than the centre as to allow the molecular changes in the iron, and the relation between the carbon and the iron, to become completed near the surface long before they take place in the interior of the mass?" The pyrometer used allows some insight to be gained into this hitherto unassailable problem. A small ingot of mild steel had two holes drilled into it, one near the circumference, and the other at the centre. The ingot was heated, and a thermo-junction was inserted in each hole. In this way curves of temperature were obtained simultaneously. With the mild steel the evidence as to molecular change was but slight. Another ingot of steel, containing 0.799 per cent. of carbon, 0.084 per cent. of silicon, and 0.412 per cent. of manganese, was tried in the same way. The initial temperature at the centre was 1160° C. The curve showed the molecular change at 880° C., and the carbon change at 696° C. At the circumference the carbon change took place no less than four minutes earlier than at the centre, and at the lower temperature of 665° C. This is a most important point, as the rate of cooling, as Osmond has pointed out, has a measurable effect upon the temperatures at which molecular change occurs. The great internal strain which must be set up is evident when it is borne in mind that the carbon change is accompanied by a considerable alteration of volume. It is pointed out in the report that "there can be but little question that such experiments well deserve careful attention, and, in the hands of competent observers, should be fruitful of results."

On the conclusion of the reading of the paper, the President called for a discussion, when Dr. Anderson was the first to rise. He spoke in terms of warm praise as to the value of the work done by Prof. Roberts-Austen. As an instance, he mentioned that the method described in the report, by which the temperatures of an ingot could be obtained simultaneously at the centre and the circumference, would be of the greatest use in dealing with the large pieces of steel used for gun-hoops; and he expected great help from this in the work at the Royal Arsenal.

Mr. R. Hadfield, of Sheffield, followed. He gave a summary of the effect of the most prominent alloys of iron. This table will form a useful appendix to the report when published in the Transactions of the Institution.

Prof. Howe, of Boston, gave an instance in which the Le Chatelier pyrometer had been turned to good practical account. This was in the Rodman system of gun-casting. In that process it was most desirable to know the varying temperatures of different parts of the cast, but naturally this had been hitherto impossible. By inserting a thermo-couple in the mould it was possible to get this information at all times. He thought the Le Chatelier pyrometer the greatest boon that metallurgists had received for very many years.

The next speaker was Prof. Arnold, of Sheffield, who made a certainly vigorous speech. We think, however, that he was rather carried away by his enthusiasm. To say that the work done by the author of the report was "not worth a rush," is rather straining the prerogative of rhetoric; and we failed to see, when Prof. Arnold descended to facts, that he justified the florid language of his exordium. Prof. Roberts-Austen, in his reply, gave an example of forbearance and good temper which it would be well if men of science could often follow. It was satisfactory to notice that the feeling of the meeting was by no means in accordance with Prof. Arnold.

Mr. Stromeyer added to the work done a useful table in which were collated the opinions of various authorities on the effect of alloys upon iron. The table was not read, but will be published in the Proceedings. Such work as this is very acceptable. It involves a great deal of labour and brings but small return in the way of praise and glory, which of course are two things to which a true follower of science is profoundly indifferent.

Mr. Stead, of Middlesborough, protested against Prof. Arnold's remarks, and spoke of the value of the author's work. The testimony of Mr. Stead is valuable, as he combines the position of a practical investigator, working for commercial ends, and a man of science.

The meeting broke up after passing the usual votes of thanks.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Junior Scientific Club held their first meeting this term in the Physiological Laboratory at the Museum, under the presidency of Mr. R. S. Gunther, of Magdalen.

Mr. W. Pullinger, of Balliol, read a paper on volatile platinum compounds, and exhibited prepared specimens.

Mr. A. F. S. Kent, of Magdalen, indicated improvements in the manipulation of photo-micrography whereby the effect of tremors was excluded, and passed through the lantern some very excellent slides which he had taken from negatives obtained by his new method.

Mr. G. E. C. Pritchard, of Hertford, exhibited specimens of Bacteria, and described the method whereby they had been obtained and prepared for microscopic exhibition.

Dr. Collier read a paper of a very interesting character on the physiology of muscular exercise with special reference to training, in the course of which he traversed some statements recently made by Sir Morell Mackenzie, to the effect that fatigue was due to the cessation of blood flowing to the muscles. Dr. Collier would rather attribute fatigue to the development of waste-products in the muscle, formed too rapidly for the blood to remove them, and quoted experiments carried out on frogs which seemed to support this view.

CAMBRIDGE.—The Agricultural Education Syndicate, in view of a grant of £400 a year from the Cambridgeshire County Council, recommend that a lecturer in agricultural science, who shall also be director of agricultural studies, should be appointed at a stipend of £500. They also propose that a second lecturer be appointed at a stipend of £300. These two lecturers would take between them the subjects of agricultural botany and agricultural chemistry.

The degree of M.A. *honoris causa* has been conferred on the distinguished entomologist Mr. D. Sharp, F.R.S., Curator in Zoology at the University Museums.

Dr. Sir A. Geikie and Dr. T. G. Bonney have been appointed adjudicators of the Sedgwick Prize of 1895.

At St. John's College, on November 2, the following were elected to the vacant Fellowships: William McFadden Orr, B.A., Senior Wrangler, 1888; Edward Ernest Sikes, B.A., First Class (Division 1), Classical Tripos, 1889, Newton Student in Archaeology; Percival Horton-Smith, B.A., First Class Natural Sciences Tripos, 1889-90 (distinguished in physiology), late Hutchinson Student in Physiology.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 26.—M. Duchartre in the chair.—On the theory of Hertz-oscillations, by M. H. Poincaré.—On a new mineral—boleite, by MM. Mallard and E. Cumenge.—The new mineral occurs with copper in volcanic tuff and conglomerate found near Santa Rosalia, Lower California. It crystallizes in the cubic system, and its composition is represented by the expression $PbCl_2 + CuO.H_2O + \frac{1}{2}AgCl$. Its density is a little greater than that of calcite; cleavage easy parallel to the faces of cube, much less easy parallel to faces of octahedrons. Approximate index of refraction, 2.07.—Vasomotor action of bacteria, by M. Ch. Bouchard.—Contribution to the botanical history of the truffle (fourth note): *Kama* of Bagdad (*Terfezia Hafizi* and *Terfezia metaxasi*) and of Smyrna (*Terfezia Leonis*), by M. Ad. Chatin.—On a storm observed at the Canary Islands. This is an extract from a memoir by M. de la Monneraye.—On the original causes of cyclones, and on their precursory signs: extract from a memoir by M. Le Goarant de Tromelin.—On the theory of the voltaic pile, by M. P. Duhem.—Experimental researches on a category of capillary phenomena, with an application to the analysis of alcoholic liquids and others, by M. Emile Gossart.—On bromo-

stannates, by M. Leteur. The author has prepared the following bromostannates, the general method consisting in mixing concentrated solutions of the two bromides, and evaporating the mixture in a vacuum or dry air: $\text{SnBr}_4\text{NH}_4\text{Br}$, $\text{SnBr}_4\text{NaBr} + 6\text{H}_2\text{O}$, $\text{MgBr}_2 \cdot \text{SnBr}_4 + 10\text{H}_2\text{O}$.—On a new crystalline ferric oxychloride, by M. G. Rousseau. Concentrated solutions containing more than 80 per cent. of Fe_2Cl_6 , if kept for some time at a temperature between 160° and 220°C ., give rise to crystalline ferric oxychloride, $2\text{Fe}_2\text{O}_3 \cdot \text{Fe}_2\text{Cl}_6 \cdot 3\text{H}_2\text{O}$. The author has studied the decomposition of solutions of ferric chloride at temperatures higher than 220° . Between 225° and 280° anhydrous oxychloride ($2\text{Fe}_2\text{O}_3 \cdot \text{Fe}_2\text{Cl}_6$) was obtained. At temperatures between 300° and 340° a new oxychloride was formed, having the composition $3\text{Fe}_2\text{O}_3 \cdot \text{Fe}_2\text{Cl}_6$.—On the estimation of thallium, by M. H. Baubigny.—On the solution of bismuth chloride in saturated solutions of sodium chloride, and on the basic salicylate of bismuth, by M. H. Causse.—On a characteristic difference between the alcoholic radicles substituted in place of carbon and nitrogen, by M. C. Matignon. From a thermo-chemical investigation the author finds that the substitution of an alcoholic radicle for nitrogen increases the heat of combustion more than the substitution of the same radicle for carbon.—Action of benzoic acid on essence of turpentine, by MM. G. Bouchardat and J. Lafont.—On the formation of quaternary iodides of ammonium by the action of trimethylamine, in concentrated aqueous solutions, or the hydriodic ethers of several primary and one secondary alcohol, by MM. H. and A. Malbot.—On a new albuminoid substance in the blood serum of man, by M. C. Chabrié.—The soluble substances of the pyocyanic bacillus producing fever, by M. A. Charrin.—Experimental progressive muscular atrophy, by M. Roger.—Some anatomical characteristics of *Hyperoodon rostratus*, by M. E. L. Bouvier.—*Apropos* the chromatophores of Cephalopods, by M. Raphael Blanchard.—Physiology of the nerve which enables us to localize sounds, by M. Pierre Bonnier.—On a method for destroying insects injurious to the beetroot and cereals, by M. Decaux.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, NOVEMBER 5.

LINNEAN SOCIETY, at 8.—A Theory of Heredity based on Force instead of Matter: Rev. Prof. Henslow.
 CHEMICAL SOCIETY, at 8.—The Disociation of Liquid Nitrogen Peroxide: J. Tudor Cundall.—The Magnetic Rotation of the Ammonium and Sodium Salts of Fatty Acids: Dr. Perkin, F.R.S.—The Vapour Pressures and Molecular Volumes of Acetic Acid and of Carbon and Tin Tetrachlorides: Prof. S. Young.—The Ortho- and Para-nitro Derivatives of Orthotoluidine: A. G. Green and T. A. Lawson.—Researches on the Gums of Arabin Group, Part II.: C. O'Sullivan, F.R.S.
 CAMERA CLUB, at 8.30.—The Action of Light and Heat upon the Haloid Silver Salts: Dr. J. J. Acworth.

FRIDAY, NOVEMBER 6.

PHYSICAL SOCIETY, at 5.—On Corresponding Temperatures, Pressures, and Volumes: Prof. Sydney Young.
 GEOLOGISTS' ASSOCIATION, at 8.—*Conversazione*.

SATURDAY, NOVEMBER 7.

ESSEX FIELD CLUB, at 7.—Notes concerning the Distribution of Mollusca in the Thames Estuary: A. J. Jenkins.—Some Remarks upon the Aquatic Plants and Algae of the Thames Marshes: A. J. Jenkins.—On the Occurrence of Westleton Beds in part of North-Western Essex: J. French.

SUNDAY, NOVEMBER 8

SUNDAY LECTURE SOCIETY, at 4.—The Personal Life of Shakespeare: W. E. Church.

MONDAY, NOVEMBER 9.

CAMERA CLUB, at 8.30.—Lenses, II.: Lyonel Clark.

TUESDAY, NOVEMBER 10.

MINERALOGICAL SOCIETY, at 8.—Anniversary Meeting.
 INSTITUTION OF CIVIL ENGINEERS, at 8.—President's Address: George Berkley.—Presentation of Medals, Premiums, and Prizes.
 PHOTOGRAPHIC SOCIETY, at 8.

WEDNESDAY, NOVEMBER 11.

GEOLOGICAL SOCIETY, at 8.—On Dacrytherium ovium from the Isle of Wight and Quercy: R. Lydekker.—Supplementary Remarks on Glen Roy: Thos. F. Jamieson.

THURSDAY, NOVEMBER 12.

MATHEMATICAL SOCIETY, at 8.—On the Classification of Binodal Quartic Curves: H. M. Jeffery, F.R.S.—On Selective and Metallic Reflection: A. B. Basset, F.R.S.—On a Class of Automorphic Functions: Prof. W. Burnside.—The Contacts of Systems of Circles: A. Larmor.—Note on the

Identity $4(x^2 - 1)/(x - 1) = Y^2 \pm \#Z^2$: Prof. G. B. Mathews.—Note on Finding the G Points of a given Circle with respect to a given Triangle of Reference: J. Griffiths.
 INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Description of the Standard Volt and Ampere Meter used at the Ferry Works, Thames Ditton: Captain H. R. Sankey (late R.E.) and F. V. Andersen.
 CAMERA CLUB, at 8.30.—A New Method of Photography by Artificial Light: E. J. Humphrey.

FRIDAY, NOVEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 8.
 INSTITUTION OF CIVIL ENGINEERS, at 7.30.—Description of the Works on the Barking and Pitsea Extension Railway: Henry E. Stilgoe.—Rail Pile Bridges in Ceylon: Harry Bucknall.
 CAMERA CLUB, at 8.—Retouching: Redmond Barrett.

SATURDAY, NOVEMBER 14.

ROYAL BOTANIC SOCIETY, at 3.45.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Natural Theology: Sir G. G. Stokes (Black).—Elementary Trigonometry: J. M. Dyer and Rev. R. H. Whitcombe (Bell).—Fundamental Problems: Dr. P. Carus, 2nd edition (Chicago).—L'Amateur d'Oiseaux de Volière: H. Moreau (Paris, Baillière).—Les Coquilles Marines: A. Locard (Paris, Baillière).—Colour-Blindness and Colour-Perception: Dr. F. W. Edridge-Green (Paul).—Handleiding tot de Kennis der Flora van Nederlandsch Indië: Dr. J. G. Boerlage, Tweede Deel, Eerste Stuk (Leiden, Brill).—Star Groups: J. E. Gore (Lockwood).—Elementary Thermodynamics: J. Parker (Cambridge University Press).—Report on the Meteorology of India in 1889: J. Eliot (Calcutta).—Copernic et la Découverte du Système du Monde: C. Flammarion (Paris, Marpon and Flammarion).—Moral Teachings of Science: A. B. Buckley (Stanford).—Further Reliques of Constance Naden: edited by G. M. McGrie (Bickers).—The Wire and the Wave: J. Munro (R.T.S.).—Ytterligare om Gadolinij-Jordens Molekylarvigt: A. E. Nordenskiöld (Stockholm).—Notes on the Recent Geometry of the Triangle: J. Griffiths (Simpkin).—Journal of the Royal Microscopical Society, October (Williams and Norgate).—Illustrations of the Flora of Japan, vol. 1. Nos. 7, 8, 9 (Tokyo).

CONTENTS.

PAGE

Electricity and Magnetism. By Prof. A. Gray . . .	1
Biology of Seaside Plants. By W. Botting Hemsley, F.R.S.	3
Ricardo's "Political Economy." By W. E. J.	4
Our Book Shelf:—	
Schnauss: "Photographic Pastimes: a Hand-book for Amateurs"	5
"On Surrey Hills"	5
Munro: "Heroes of the Telegraph"	5
Letters to the Editor:—	
The Koh-i-Nur. (<i>Illustrated.</i>)—Prof. N. Story Maskelyne, F.R.S.	5
A Rare Phenomenon.—Dr. M. A. Veeder; Prof. J. G. MacGregor; R. N. Hudspeth	7
Apparent Size of Objects near the Horizon.—T. W. Backhouse	7
Proper Motions of the Stars.—W. H. S. Monck	8
California Foxes.—Prof. Edward S. Holden	8
A Plague of Small Frogs.—R. Haig Thomas	8
Botany of the Emin Relief Expedition. By W. T. Thiselton Dyer, C.M.G., F.R.S.; Major I. A. M. Jephson	8
Town Fogs and their Effects. (<i>Illustrated.</i>) By Dr. W. J. Russell, F.R.S.; W. Watson	10
The Anatomy of the Dog. (<i>Illustrated.</i>)	16
Notes	18
Our Astronomical Column:—	
The Telluric Spectrum	21
Tempel-Swift's Periodic Comet	21
Catalogue of Rutherford's Photographs	21
The Institution of Mechanical Engineers	22
University and Educational Intelligence	23
Societies and Academies	23
Diary of Societies	24
Books, Pamphlets, and Serials Received	24