

Biblioteka Główna i OINT
Politechniki Wrocławskiej



100100234204

A 610 II

AAA



op. 21/5/13
J.M.

Supplement to Nature,
December 8, 1898

Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE





Nature



ILLUSTRATED JOURNAL OF SCIENCE

Supplement to Nature,
December 8, 1898.]

Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

VOLUME LVIII

MAY 1898 to OCTOBER 1898



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

1912. 1942.

London

MACMILLAN AND CO., LIMITED

NEW YORK: THE MACMILLAN COMPANY

Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE



RICHARD CLAY AND SONS, LIMITED,
LONDON AND BUNGAY.



Faint, illegible text at the bottom of the page, possibly bleed-through from the reverse side.

INDEX

- ABBE (Prof. C.), Barisal Guns, 353; the Altitude of the Aurora Borealis, 603
Abbott (W. J. L.), some Particulars of Henry Lewis's Career, 16
Aberration, Constant of, and Stellar Magnitudes, Prof. Doberck, 258
Aberson (J. H.), a New Isomeride of Malic Acid, 232
Ackworth Birds, being a List of Birds in the District of Ackworth, Yorkshire, Major Walter B. Arundel, 292
Acland (H. D.), Volcanic Series in Malvern Hills, 142
Acland (Sir Henry W., K.C.B., F.R.S.), Medical Missions in their Relation to Oxford, 222
Acoustics: Study of Speaking Voice by Phonograph, M. Marage, 23; the Spirate Fricatives, Dr. Lloyd, 46; Max Meyer's Theory of Audition, Dr. S. P. Thompson, 166; Thermophones, F. Braun, 335
Actinometer, an Absolute, A. Crova, 95
Adenoid Growth, Dr. H. W. Meyer, 625
Adschidarja Gulf, the, 525
Aeronautics: Fifth International Balloon Ascent of June 8, 1898, 278; a Propeller Kite, Laurence Hargrave, 312; the Use of Kites in Meteorology, 382; Captive Kite Balloon Trials, 382; Experiments in Aerial Research, Percival Spencer, 327; the International Aeronautical Conference, 380; the Instrumental Equipment of Balloons, 381; Ascent of Balloon Sonde "Langenburg," 382; Proposed Balloon-Exploration of Africa, M.M. Dex and Dibos, 399; Remarkable Balloon Ascent, Stanley Spencer and Dr. Berson, 513; attempted Balloon Passage of Alps, Capt Spelterini, 549
Aethurus girinus, a New Rodent, W. E. de Winton, 95
Africa: Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, W. W. A. Fitzgerald, 6; a Plague Centre in German East Africa, Prof. Koch, 254; Report of Cape of Good Hope Bacteriological Institute, 278; Proposed Balloon Exploration of Africa, M.M. Dex and Dibos, 399; the Marine Fauna in Lake Tanganyika, and the Ad-visibility of Further Exploration in the Great African Lakes, J. E. S. Moore, 404; South African Coleoptera, L. Péringuey, 423; the Tsetse Disease in Mammals, Prof. Kanthack and Mr. Durham, 426; Trout Acclimatisation in Cape Colony, J. D. F. Gilchrist, 628
Agamennone (Dr.), Mean Surface-Velocity of Pulsations from Calcutta Earthquake of June 12, 1897, 109; Attempt to Calculate Velocity of Aidin Earthquake of August 9, 1895, 421
Agassiz, the Glacial Lake, Warren Upham, 81
Agriculture: Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, W. W. A. Fitzgerald, 6; Death of M. Demontzey, 16; Nitrogenous Nutrition of Phanerogamous Plants, L. Lutz, 24; Method of Reducing Losses of Ammonia in Manufacture of Farm Manure, P. P. Déherain, 71; a Text-Book of Entomology, including the Anatomy, Embryology, and Metamorphoses of Insects, for Use in Agricultural and Technical Schools and Colleges, Prof. Alpheus S. Packard, 244; Study of Phosphoric Acid Dissolved by the Water of the Soil, 384; Tea, Coffee, and Cinchona Cultivation in India, 423; Toxicity of Copper Salts for Wheat, H. Coupin, 492; Action of Lime and Chalk on Humic Materials, G. André, 564
Air, on a New Constituent of Atmospheric, Prof. William Ramsay, F.R.S., and Morris W. Travers, 127
Air, Liquid, at One Operation, Lord Rayleigh, F.R.S., 199
Air Waves, Formed by Projectiles, Studied by Means of Interference Bands, Herr Mach, 422
Aitchison (Surgeon-Major J. E. T., M.D., F.R.S.), Death of, 550; Obituary Notice of, W. Botting Hemsley, F.R.S., 578
Akerman (R.), the Swedish Iron Industry, 430
Albahary (J. M.), Ovalbuminic Acid, 288
Albert-Levy (M.), the Carbonic Acid of the Air, 168
Albrecht (Prof.), the Movement of the Earth's Polar Axis, 1890'0-1897'5, 42
Albumens, Prof. A. Kossel on, 481
Albuminous Substances, Synthesis of, Dr. Leo Lilienfeld, 351
Alcock (A. W.), Report on the Natural History Results of the Pamir Boundary Commission, 493
Alge: Reproduction of *Dictyota dichotoma*, Lloyd Williams, 632; Form of Protoplasmic Body in Floridæ, Prof. Philips, 633
Algebra: Connection of Algebraic with Automorphic Functions, E. T. Whittaker, 93; Introduction to Algebra, for the Use of Secondary Schools and Technical Colleges, G. Chrystal, 340; a Treatise on Universal Algebra, with Applications, Alfred North Whitehead, 385
Algeria: L'Algérie, le Sol et les Habitants, J. A. Battandier et L. Trabut, 51; Climate of Algeria, Dr. A. Thevenet, 117
Allaire (H.), Double Iodides and Borates, 635
Allen (Prof. F. J.), a High Rainbow, 175; Stereochemistry and Vitalism, 520
Allen (Dr. Harrison), Study of Hawaiian Skulls, 230
Alloys: the Electrical Resistance and Micro-Structure of, Saville Shaw, 356; Dr. A. Galt on the Heat of Combination of Metals in the Formation of Alloys, 532; Surfusion of Metals and, Prof. W. C. Roberts-Austen, F.R.S., 619; an Old Alloy, D. Berthelot, 635
Alternators, High Speed Telegraph Transmission by Means of, Prof. A. C. Crehore, Lieut. G. O. Squier, 211
Aluminium for Cooking Utensils in India, the Use of, Prof. Chatterton, 488
Amagat (E. H.), Compressibility of Air as Gaseous Mixture, 287
Amazon River at Obydos, Volume of, Dr. Friedrich Katzer, 399
Amazonian Rubber, the Supply of, W. A. Churchill, 603
Amey Clays, the Flora of the, John Strong Newberry, 81
Ameghino (M.), *Arhino lemur*, a New Mammifer, 492
America: American Journal of Mathematics, 22; American Journal of Science, 92, 117, 187, 335, 432, 539, 634; Bulletin of American Mathematical Society, 92, 187, 310, 431; Ceremonial Dances of the American Indians, 125; the American Association, 233; Boston Meeting, 486; the American Excavations in Mesopotamia, J. P. Peters, 243; Bird Neighbours: an Introductory Acquaintance with One Hundred and Fifty Birds commonly found in the Gardens, Meadows, and Woods about our Homes, Neltje Blanchan, 388; Glyptic [and Graphic] Art applied to Palæontology, 392; Bird Studies, an Account of the Land Birds of Eastern North America, W. E. D. Scott, 541
Amsterdam Academy of Sciences, 47, 143, 288, 359, 636
Amu-Daria, the Old Beds of the, 430
Anatomy: Lehrbuch der Entwicklungsgeschichte des Menschen, Dr. J. Kollmann, 77; Anatomy of the Swallows, Dr. R. W. Shufeldt, 199; Death of Dr. E. J. Bonsdorff, 396; Elements of the Comparative Anatomy of Vertebrates, Dr. Robert Wiedersheim, W. N. Parker, 409; *Anatomia vegetale*, Dr. F. Tognini, 100
Anæsthetics, Action on Protoplasm of, J. D. Farmer and A. D. Waller, F.R.S., 93
Analysis of Ores, Methods for the Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149

- Ancient Bronze Implement, Bacteria on an, Wm. Edward Nicholson, 32; Dr. G. L. Johnson, 52
- Anderlini (J. J.), Bone-softening by Phoroglucinol, 47
- Anderlini (F.), Solfataras Gases, 269
- André (G.), Action of Lime and Chalk on Humic Materials, 564
- Andres (Signor A.), Death among Lower Organisms, 628
- Andrews (C. W.), a Preliminary Account of Christmas Island in the Indian Ocean, 587
- Andromeda, the Nebula of, 515; M. Seraphimoff, 605
- Angling Days and an Angler's Books, Jonathan Dale, 292
- Angora Goat, the, and a Paper on the Ostrich, S. C. Cronwright Scheiner, 314
- Animal Intelligence, an Experimental Study of the Associative Processes in Animals, Edward L. Thorndike, Prof. C. Lloyd Morgan, 249, 390
- Animals, the Play of, a Study of Animal Life and Instinct, Karl Groos, 410
- Animals and Poisonous Plants, Alfred W. Bennett, 571; Edward M. Langley, 597
- Animals, the Wanton Mutilation of, Dr. George Fleming, 605
- "Anlage"? What is, Dr. Arthur Willey, 390
- Antagonism between Toxins and Antitoxins, the Nature of the, 323
- Antarctica; Plea for a British Expedition, Sir John Murray, 604
- Antelope Horns, Larvæ in, Dr. Henry Strachan, 468; W. H. McCorquodale, 468
- Anthropology: in Madras, Edgar Thurston, 82; Anthropological Society, 189; Totemism, Prof. E. B. Tylor, F.R.S., 189; Reconstruction of Stature of Prehistoric Races, Karl Pearson, F.R.S., 286; Aspects of Sun Worship among the Moki Indians, 295; Human Effigy Vase from Arizona, J. W. Fewkes, 301; Australian Divisional Systems, R. H. Mathews, 312; the Study of Man, Alfred C. Haddon, 410; Death of Gabriel de Mortillet, 522; Obituary Notice of, 550
- Anti-Tidal Protective Coast Plantation in Japan, Dr. Seiroku Honda, 627
- Anti-Toxins, Bile of Venomous Serpents most powerful, Prof. F. R. Fraser, 461
- Apodidae, Hermaphroditism in the, Henry Bernard, 78
- Applied Geology, J. V. Eldsen, Part I., 615
- Aquatic Hymenopteron, Fred Enock, 175
- Y Aquilæ, the Supposed Variable, 182
- Arabs, Immunity against Typhoid Fever of, M. Vincent, 86
- Arachnidæ: Spider and Pitcher-Plant, R. I. Pocock, 274; *Aranea hungarica*, Cornelio Chyzer, Ladislao Kulczynski, R. I. Pocock, 365
- Archæology: Chinese Antiquities at Shashih, 133; Metal-backed Glass Mirrors of Antiquity, D. Berthelot, 359; the Reliquary and Illustrated Archæologist, 615; the Phylakopi (Melos) Excavations, Mr. Hogarth, 627
- Architects, Underwriters, and the Owners of Buildings, Electric Wiring for the use of, Russell Rob, 313
- Arctica: the Coasts of the Arctic Ocean, Dr. K. Hiksh, 278; suggested "Ice-breaker" Expedition to North Pole, Admiral Makaroff, 353; the German Polar Expedition, 397; Return of the Swedish Expedition, 523; Northward over the "Great Ice," Robert E. Peary, Dr. Hugh Robert Mill, 589
- Argon, Companions of, Prof. William Ramsay, F.R.S., and Morris W. Travers, 182
- Argon, Helium and Krypton, Position of, in Scheme of Elements, Sir William Crookes, F.R.S., 383
- Arizona, Human Effigy Vase from, J. W. Fewkes, 301
- Arloing (S.), Influence of Place and Mode of Introduction on Development of Immunising Effects of Anti-Diphtheritic Serum, 23; Formation in Blood Serum, under Chemical Action, of Material coagulating Bacilli of Tuberculosis, 143; Clinical Value of Agglutination of Koch's Bacillus by Human Serum, 540
- Armitage (E.), Iridescent Clouds, 390
- Arnau (M.), Products of Hydrolysis of Ouabaine, 23; Ouabaine Acid, 47
- Arons (L.), Microscopic Observations of Coherers, 491
- D'Arsonval (M.), Thermogenesis in Tetanus, 336
- Art, the, and Science Buildings at South Kensington, 155
- Artificial Food, Dr. Sidney Williamson, 368
- Arundel (Major Walter B.), Ackworth Birds, being a List of Birds in the District of Ackworth, Yorkshire, 292
- Arzruni (Prof. Andreas), Death of, 603
- Asagena phalerata*, H. W. Freston, 635
- Aschkinass (E.), Absorption and Emission of Steam and Carbonic Acid in Infra-Red Spectrum, 93; Transparency of some Liquids for Rays of Great Wave-length, 93
- Ashanti, Botany of, Surg.-Capt. Cummins, 208
- Asher (Dr. L.), on the Theory of Lymph Production, 481
- Ashworth (J. H.), the *Xeniidae*, 335
- Ashworth (J. Reginald), an Introductory Course of Practical Magnetism and Electricity, 466
- Asia, the Cuneiform Inscriptions of Western, L. W. King, 341
- Assyrian, First Steps in, L. W. King, 341
- Astronomy: a Proposed Revolution in Nautical Astronomy, 10; Our Astronomical Column, 19, 41, 60, 88, 111, 134, 160, 181, 210, 232, 258, 280, 304, 330, 356, 375, 400, 424, 463, 490, 515, 526, 553, 583, 605, 630; Comet Perrine (March 19), 19, 42, 60, 258; Dr. Berberich, 400; Comet Perrine (June 14), 181, 232, 258, 280; Comet Perrine-Chofardet, 515; Tempel's Comet (1867 II.), M. Gautier, 19; Comet Tempel 1866? 515; Herr Pechuele, 490; Kirchhoff's Spectroscope, Prof. Vogel, 19; Jupiter's Red Spot, Dr. Lohse, 20; the Red Spot on Jupiter and its Suspected Identity with Previous Markings, W. F. Denning, 331; the First Satellite of Jupiter, A. E. Douglass, 210; Observations of Jupiter during the Opposition, 1898, Sir J. C. Solà, 526; the Spectrum of Hydrogen in Nebulæ, Prof. Scheiner, 41; the Movement of the Earth's Polar Axis, 1890'0-1897'5, Prof. Albrecht, 42; the Northern "Durchmusterung," 42; the Astronomical Society of Wales, 42; Observations of Variable Stars, Dr. Francesco Porro, 60; a New Long Period Variable, Herren Müller and Kempf, 60; Variable Stars of Short Period, Prof. E. C. Pickering, 181; the Variable α Ceti, Herr W. Stratonoff, Dr. A. A. Nijland, 330; a new Variable Star, Madame Ceraski, 424; Atlas of Variable Stars, Dr. J. G. Hagen, 606; Variable Stars in Clusters, Prof. Bailey, 583; the supposed Variable Y Aquilæ, 182; France and International Time, 60; Astronomical Destination of Cromlechs near Dublin, Prof. J. P. O'Reilly, 61; Sunspot Period, W. Ellis, F.R.S., 61; Magnetism and Sunspots, William Ellis, F.R.S., 78; Sunspot Periods and Natural Phenomena, M. C. Flammarion, 134; a Large Sunspot, 463, 553, 630; Astronomical Occurrences in June, 88; in July, 210; in August, 304; in September, 424; in October, 526; in November, 630; Mr. Tebbutt's Observatory, 88; Photography by the Aurora Borealis, J. E. Turner, 88; the Aurora Borealis of September 9, Baron N. Kaulbars, 569; an Absolute Actinometer, A. Crova, 95; Sun Worship by Tusayan Indians, Dr. J. Walter Fewkes, 111; Stellar Radiations, Prof. Ayrton, 112; the Late Prof. Soullart, 112; the Companion to Procyon, Prof. Schaeberle, 134; the Liverpool Observatory, 134; Double and Multiple Southern Stars, Dr. T. J. J. See, 134; Blurring Aberration in the Telescope, Prof. Schaeberle, 88; J. R. Collins, 88, 280; Nautical Astronomy, Captain J. F. Ruthven, 151; Encke's Comet, 160; the Movement of, Prof. Reginald A. Fessenden, 520; New Determination of the Earth's Density, Dr. C. Braun, 160; the Large Refractors of the World, Prof. G. E. Hale, 160; the Leeds Astronomical Society 160; a New Astronomy, Prof. David P. Todd, 173; Comets now Visible, 181, 210; the 40-inch Yerkes Refractor, Prof. Barnard, 181; the Oxford University Observatory, Prof. Turner, 182; on the Stability of the Solar System, M. H. Poincaré, 183; Elements of Descriptive Astronomy, Herbert Howe, 198; the Meteor Shower of November 13, 1897, 210; August Meteors, 330, 490; Large Meteors in 1897 and 1898, W. F. Denning, 583; Minor Meteoric Radiants, W. F. Denning, 424; Latitude Variation in a Rigid Earth, Prof. Henry Crew, 232; Conference of Astronomers at Harvard, 232; a Fine Collection of Meteorites, 232; Fall of a Meteorite in Bosnia, 375; Cometary News, 258; Stars having Peculiar Spectra, Prof. Pickering, Mrs. Fleming, Miss Cannon, 258; the Constant of Aberration and Stellar Magnitudes, Prof. Doberck, 258; the Eclipsed and Uneclipsed Sun, M. Deslandres, 258; a New Form of Grating Spectroscope, Prof. Michelson, 280; Structure of the H and K Lines, Mr. Jewell, 280; the Minor Planets, John K. Rees, 304; Mars in 1896-1897, Prof. V. Cerulli, 304; Creation Records discovered in Egypt, G. St. Clair, 315; the Moon and Auroræ, Prof. H. A. Hazen, 304; Wolf's Comet, 330, 356, 375; Dr. Gill on Sir John Herschel, 356; the Paris Observatory, 356; the French Astronomical Society, 356; Dogmatism on the Moon and the Weather, 368; the Moon's Course, Sir Samuel Wilks, Bart., F.R.S., 496; J. Hughes Hemming, 545; E. L. Garbett, 571; the New Observatory at Heidelberg, 376; Reminiscences of

- an Astronomer, Prof. Simon Newcomb, 376, 583, 606; a Trip to Venus, John Munroe, 366; the First Philosophers of Greece, Arthur Fairbanks, 386; Parallaxes and Masses of γ Virginis and γ Leonis, Dr. Belopolsky, 400; a Catalogue of Fourth-Type Stars, Rev. T. E. Espin, 401; the Great Telescope for the Paris Exhibition, 424; Planet 1898 DQ, Jean Mascart, 432; the Atmosphere of D. M. + 30° 3639, Prof. Keeler, 463; the Exterior Nebulosity of the Pleiades, 463; Luminosity of Gases in Vacuum Tubes, 463; the Variation of Latitude at Tokyo, H. Kimura, 490; Motion of Stars in the Line of Sight, M. Deslandres, 490; Drawings of the Milky Way, 490; the Nebula of Andromeda, 515; Catalogue of Nebulae, Lewis Swift, 515; the Planet between the Earth and Mars, Herr G. Witt, 526; Photograph of the Chromosphere, Prof. Naegamvala, 526; Periodic Comets, M. Schulhof, 526; Prof. Turner, Mrs. Maunder, and Sir Norman Lockyer on the recent Solar Eclipse Expedition, 533-4; a Text-Book of Geodetic Astronomy, John F. Hayford, 543; New Teaching Observatory for the California University, 553; Annual Report of the Cambridge Observatory, 553; Annual Publication of the Observatory of Rio de Janeiro for 1898, 553; Changes in Large Nebula in Belt of Andromeda, G. Rayet, 564; the Cape Observatory Report, 584; the Andromeda Nebula, M. Seraphimoff, 605; Comet Brooks, 630; Harvard Astrophysical Conference, 630
- Astrophysics: the Harvard Conference, 630; Solar Radiation, J. Evershed, 619
- Asymmetry and Vitalism, Prof. G. Errera, 616; Prof. F. R. Japp, F.R.S., 616
- Athens, the British School at; the Phylakopi (Melos) Excavations, Mr. Hogarth, 626
- Atlantic, North, Pilot Chart for June of, 178
- Atlas of Variable Stars, Dr. J. G. Hagen, 606
- Atmosphere of D. M. + 30° 3639, Prof. Keeler, 463
- Atmosphere, Helium in the, Sir William Crookes, F.R.S., 570
- Atmosphère, Méthode pour abréger les traversées en utilisant les perturbations de l', A. Fieron, 197
- Atmospheric Air, on a New Constituent of, Prof. William Ramsay, F.R.S., and Morris W. Travers, 127
- Atmospheric Electricity, International Conference of Terrestrial Magnetism, and Opening Address, by Prof. A. W. Rücker, Sec. R.S., President of the Conference, 473
- Atoll of Funafuti, the, Ellice Group: its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley, of the Australian Museum, Sydney, N.S.W., 221
- Atolls, the Building of, Stanley Gardiner, 425
- Atomic Theory, Modern Development of the, J. H. Van 't Hoff, 100
- Atoms in Space, the Arrangement of, J. H. Van 't Hoff, 100
- Atwater (Prof.), Does the Law of Conservation of Energy hold good for the Vital Processes going on in the Human Body? 532
- August Meteors, 330, 490
- Aurora Borealis: C. E. Strommeyer, 460; H. Deslandres, 516; the Aurora of September 9, 490; Hon. Rollo Russell, 496; Baron N. Kaulbars, 569; the Altitude of the Aurora Borealis, Prof. C. Abbe, 603; Luminous Clouds or Aurora, J. Edmund Clark, 546; the Origin of the Aurora Spectrum, Prof. Arthur Schuster, F.R.S., 151; the Moon and Aurora, Prof. H. A. Hazen, 304; Photography by the Aurora Borealis, J. E. Turner, 88
- Austen (E. E.) on the Occurrence of *Eristalis tenax* in India, 101
- Austen (Martha), Estimation of Manganese separated as Carbonate, 117
- Australia: Severe Storm off North-West Australia, W. E. Cooke, 178; Obsidian "Buttons" in Australia, 109; Australian Shipworms, C. Hedley, 240; Australian Divisional Systems, R. H. Mathews, 312; Telephonic Communication between Australian Farms, 524
- Automobiles sur Rails, G. Dumont, 495
- Ayrton (Mrs.), on the Drop of Potential at the Terminals of the Electric Arc, 533
- Ayrton (Prof. W. E., F.R.S.), Galvanometers, 93; Stellar Radiations, 112; Opening Address in Section A of the British Association, 448; the Magnetic and Electrolytic Actions of Electric Railways, 533
- Babbitts' Anti-Friction Metal, Prof. H. Behrens and H. Baucke, 359
- Bacteriology: Bacteria on an Ancient Bronze Implement, 51; Wm. Edward Nicholson, 32; Dr. G. Lindsay Johnson, 52; the Bacterial Character of Calf-Lymph, Mrs. Percy Frankland, 44; the Sero-Diagnostic Test for Typhoid Fever, Dr. McWeeney, 47; Vorlesungen über Bakterien, Dr. Alfred Fischer, 76; System der Bakterien, Prof. W. Migula, Prof. A. A. Kanthack, 97; Formation in Blood Serum, under Chemical Action, of Material Coagulating Bacilli of Tuberculosis, S. Arloing, 143; New Microbe Pathogenic to Rats, Dr. Issatschenko, 179; a Bacillus in Milk, Dr. C. McClure, 254; Cyclists and Dust-Bacteria, 254; the Utilisation of Micro-Organisms in the Arts and Manufactures, Dr. Franz Lafar, 265; Report of Cape of Good Hope Institute, 278; Action of Sorbose Bacteria on Xylose, Gabriel Bertrand, 287; Relation of Obligatous Anaerobics to Free Oxygen, Prof. Beyerinck, 288; Locust-Destroying Fungus, Dr. Edington, 354; Artichokes as Culture-Medium for Bacteria, M. Roger, 354; the Culture of Koch's Bacillus, M. Carnot, 354; Clinical Value of Agglutination of Koch's Bacillus by Human Serum, S. Arloing and Paul Courmont, 540; a New Trichophyton productive of Herpes in Horse, MM. Matruchot and Dassonville, 359; the Toxicity of Eel-Serum, and Further Studies on Immunity, Mrs. Percy Frankland, 369; Bacteriology of London Sewage, 374; Prof. Percy Frankland on an Additional Photographic Action—that of Bacteria, 557; Effect of Polluted Soil on Vitality of Typhoid Bacillus, Dr. Sidney Martin, 577; Bacterial Process of Sewage Purification, Rudolph Hering, 628
- Bailey (Charles), Jacquin's Oxlip, 46
- Bailey (L. H.), Garden-Making, 290; the Pruning-Book, 290
- Bailey (Prof.), Variable Stars in Clusters, 583
- Baille (J. B.), New Method of Determining Mechanical Equivalent of Heat, 119
- Baillie (T. C.), Thermal Conductivity of Nickel, 143
- Baker (H. B.), Drying of Ammonia and Hydrogen Chlorides, 23
- Baker (R. T.), Essential Oils of Eucalyptus Genus, 464
- Baker (W. M.), Examples in Analytical Conics for Beginners, 318
- Balfour (Right Hon. Arthur), on the Medical Profession and its Work, 277; on Examinations, 634
- Ballard (M.), Millet, 336
- Balistics: the Phenomena of Air Waves, formed by Projectiles, studied by Means of Interference Bands, Herr Mach, 422
- Ballooning: Fifth International Ascents of June 8, 1898, 278; Experiments in Aerial Research, Percival Spencer, 327; Proposed Balloon-Exploration of Africa, MM. Dex and Dibos, 399; the International Aeronautic Conference, 381; the Instrumental Equipment of Balloons, 382; Captive Kite Balloon Trials, 382; Ascent of Ballon Sonde "Langenburg," 382; Remarkable Balloon Ascent, Stanley Spencer and Dr. Berson, 513; Attempted Passage of Alps, Captain Spelterini, 549
- Baly (Edward C. Cyril), the Spectrum of Metargon, 245; Helium in the Atmosphere, 545
- Barisal Guns, Dr. A. Cancani, 130; Prof. C. Abbe, 353
- Barlow (Dr. W. S. Lazarus), a Manual on General Pathology for Students and Practitioners, 244
- Barnard (Prof.), the 40-inch Yerkes Refractor, 181
- Barnes (Charles Reid), Plant Life, considered with Special Reference to Form and Function, 519
- Barometers, Kew Experiments on Aneroid, Dr. Chree, F.R.S., 215
- Barrett (James W.), a White Sea, 496, 619
- Barringer (D. M.), a Description of Minerals of Commercial Value, 124
- Barry (Sir John Wolfe, K.C.B., LL.D., F.R.S.), Opening Address in Section G of the British Association, 506
- Barry Docks, Visit of Section G of the British Association to, 608
- Barton (E. H.), Attenuation of Electric Waves along Line of Negligible Leakage, 167
- Bartlett (Albert T.), Transference of Heat in Cooled Metal, 411
- Bartrum (Clement O.), Chance or Vitalism, 545
- Barus (C.), the Jelly Theory of the Ether, 634; the Compressibility of Colloid, 634
- Bassenthwaite, Lake, Rotifers in, Prof. Sydney J. Hickson, F.R.S., 200; W. T. Calmen, 271
- Bastian (C. Orme), Electric Current Meter acting by Electrolysis, 61
- Bates (A. S.), Electrical Impressions on Photographic Plates, 32
- Bather (F. A.), the Use of Digraphs, 412
- Batrachians of Europe, the Tailless, G. A. Boulenger, F.R.S., 567

- Battandier (J. A.), L'Algérie. Le Sol et les Habitants, 51
 Baucke (H.), Babbitts' Anti-Friction Metal, 359
 Baugé (H. G.), New Hydrated Chromium Oxide, 635
 Baur (Prof. Georg), Obituary Notice of, 350
 Bayley (W. S.), the Marquette Iron-Bearing District of Michigan, 82
 Bayliss (Dr. W. M.), on the Non-Antagonism of Visceral and Cutaneous Vascular Reflexes, 481; on an Influence of Blood-supply on Peristaltic Movement, 484
 Beacall (Thos.), a Tooth of *Hybodus grossicornis* from the Inferior Oolite, 390
 Beard (Dr. John), the Span of Gestation and the Cause of Birth, Dr. Arthur Robinson, 173
 Bebbler (Prof. Dr. W. J. van), Die Wettvorhersage, 28
 Becquerel (Henri), New Observations on Zeeman Phenomenon, 264
 Becquerel Rays, the, O. M. Stewart, 230
 Bedart (Dr.), on the Action of Arsenic upon the Intoxication produced by Ingestion of the Thyroid Body, 484
 Beddard (Frank E.), Elementary Practical Zoology, 318
 Bee-Poison, the Immunity of Bee-keepers from, Dr. Langer, 18
 Bee Stings, Wasp and, Sir J. F. D. Donnelly, 435
 Beecher (C. E.), the Origin and Significance of Spines, 335, 539, 635
 Beer (Dr. Theodore), upon the Accommodation of the Eye in various Species of the Animal Kingdom, 483
 Behrens (Prof. H.), Babbitts' Anti-Friction Metal, 359
 Belopolsky (Dr.), Parallaxes and Masses of γ Virginis and γ Leonis, 400
 Ben Nevis Observatories, the, 298, 350
 Benham (Prof. W. Blaxland), a Fourth Specimen of *Notornis mantelli*, Owen, 547; a Request for Zoological Literature, 520
 Benin, Cast Metal Work from, 224
 Bennet (Alfred W.), Animals and Poisonous Plants, 571
 Berberich (Dr.), Comet Perrine (March 19), 400
 Berger (Paul), Inter-Capulothoracic Amputation in Malignant Tumours of Humerus, 588
 Berkeley (the Earl of), on the Methods he has adopted for the more Exact Determination of the Densities of Crystals, 556
 Berlin Geographical Society's Greenland Expedition, Erich von Drygalski, Prof. James Geikie, F.R.S., 413
 Bernard (Henry), Hermaphroditism in the Apodidae, 78
 Berndt (L.), Das Optische Drehungsvermögen Organischer Substanzen und Dessen Praktische Anwendung, 172
 Berson (Dr.), Remarkable Balloon Ascent, 513
 Berthelot (Daniel), Apparatus illustrating Berthelot's Interference Method of Measuring High Temperatures, Prof. W. C. Roberts-Austen, F.R.S., 62; Molecular Weights of Easily Liquefiable Gases, 96; the Decomposition of Water by Chromous Salts, 264; Reaction between Hydrogen and Nitric Acid, 264; Decomposition of Nitric Acid by Heat, 287; Metal-backed Glass Mirrors of Antiquity, 359; the Relation between the Energy of Light and Chemical Energy, 375; Bouchard's Theory of Transformation of Fat into Glycogen, 612; an Old Alloy, 635
 Bertrand (Gabriel), Action of Sorbose Bacteria on Xylose, 288
 Besant (Dr. W. H.), Elementary Conics, 318
 Bettoni (Dr. Eugenio), Death of, 626
 Bevan (E. J.), Carbohydrates of Barley-Straw, 23; Action of Hydrogen Peroxide on Carbohydrates in Presence of Iron, 94
 Beyerinck (Prof.), Relation of Obligatory Anaerobics to Free Oxygen, 288
 Bezold (Prof. von), on the Magnetic and Electrolytic Actions of Electric Railways, 533
 Bianchi (A.), Effect of Bicycling on Lungs and Heart, 464
 Bicycling Effect on Lungs and Heart of, by A. Bianchi and F. Regnault, 464
 Biedermann (W.), Electro-Physiology, 150
 Biedl (Dr. Arthur) on the Blocking of the Thoracic Duct on the removal of the Lymph from it by a Cannula producing a Glycosuria even in Fasting Animals, 486
 Bigelow (Prof. F. H.), Magnetism and Meteorology, 86; Solar and Terrestrial Magnetism in relation to Meteorology, 187.
 Bigelow (S. L.), Catalytic Action of Organic Substances on Oxidation of Sodium Sulphate, 400
 Biology: Scientific Worthies: Albert von Kölliker, Prof. W. F. R. Weldon, F.R.S., 1; Micro-Biology as applied to Hygiene, 15; Death of Dr. C. H. Hurst, 58; Organographie der Pflanzen, Dr. K. Goebel, 74; Rotifers in Lake Bassenthwaite, Prof. Sydney J. Hickson, F.R.S., 200; W. T. Calmen, 271; the Life History of the Salmon, 280; Biology of Lake Bologoye, 300; Recent Advances in Science and their Bearing on Medicine and Surgery, Prof. R. Virchow, For. Member R.S., 554; the Development of the Tuatara Lizard, Prof. A. Dendy, 609; Stereo-Chemistry and Vitalism, Prof. Japp, F.R.S., 452; Prof. Karl Pearson, F.R.S., 495; Prof. F. J. Allen, 520; Prof. G. F. Fitzgerald, F.R.S., 545; C. O. Bartrum, 545; Herbert Spencer, 592; Asymmetry and Vitalism, Prof. G. Errera, 616; Prof. F. R. Japp, F.R.S., 616; Death among Lower Organisms, Signor A. Andres, 628; Floral Biology: Handbuch der Blütenbiologie unter zugrundelegung von Hermann Müller's werk: "Die Befruchtung der Blumen durch Insekten, Dr. Paul Knuth, Francis Darwin, F.R.S., 434; Marine Biology: Food-Reception by Sponges, Dr. Vosmaer and Prof. Pekkela, 47; Position of Sponges in Animal Kingdom, Prof. Yves Delage, 425; E. A. Minchin, 426; Mr. Saville-Kent, 426; the Phyto-Plankton of the Atlantic, George Murray, F.R.S., and V. H. Blackman, 70; Relations between Hybrid and Parent Forms of Echinoid Larvæ, H. M. Vernon, 118; Annual Meeting of Marine Biological Association, 228; the *Xeniidae*, J. H. Ashworth, 335; the Building of Atolls, Stanley Gardiner, 425; Origin of Echinoderms, Prof. MacBride, 427; Flying Entomostroca, Herr Ostrovomov, 513; Arborecent Organs of Holothuria, L. Bordas, 635
 Bird (George), a School Geography, 411
 Birds: Birds in London, W. H. Hudson, 172; the Fauna of British India, W. T. Blanford, 195; Wolmer Forest as a Sanctuary for Birds, 255; Ackworth Birds, being a List of Birds in the District of Ackworth, Yorkshire, Major Walter B. Arundel, 292; the Destruction of the Birds and Mammals of the United States, William T. Hornaday, 308; a Dictionary of Bird Notes, C. L. Hett, 366; Bird Neighbours: an Introductory Acquaintance with One Hundred and Fifty Birds commonly found in the Gardens, Meadows, and Woods about our Homes, Neltje Blanchan, 388; Social Instinct in Birds, B. B. Osmaston, 398; Bird Studies, an Account of the Land Birds of Eastern North America, W. E. D. Scott, 541
 Birge (Dr. E. A.), Plankton Studies on Lake Mendota, 259
 Birmingham, the Proposed University for, 226
 Birth, the Span of Gestation and the Cause of, Dr. John Beard, Dr. Arthur Robinson, 173
 Birth, the Time of Day of, Signor Raseri, 523
 Blackie (Dr. Brunton), Examination of the Muscle of Dogs which had been bled to Death, 484
 Blackman (V. H.), the Phyto-Plankton of the Atlantic, 70
 Blake (Prof. J. F.), on Aggregate Deposits and their Relation to Zones, 558
 Blake (R. F.), the Carbonic Anhydride of the Atmosphere, 464
 Blanchan (Neltje), Bird Neighbours: an Introductory Acquaintance with One Hundred and Fifty Birds commonly found in the Gardens, Meadows, and Woods about our Homes, 388
 Blandford (W. T.), the Fauna of British India, Birds, 195
 Blauquez (Antonio), Precise Length of Roman Mile, 109
 Bley (Franz), Botanisches Bilderbuch für Jung und Alt, 466
 Blind, the Effect of Movement imparted by Tactile Impression to the, 588
 Block Island, Prehistoric Fauna of, G. F. Eaton, 432
 Blondlot (R.), Direct Measurements of Electricity in Electromagnetic Units, 191
 Blood, the, How to Examine and Diagnose its Diseases, Alfred C. Coles, 269
 Blurring Aberration in the Telescope, Prof. Schaeberle, 88; J. R. Collins, 88, 280
 Böcher (Prof.), Poisson's Integral, 310
 Bog Iron Ore, Manganese from, 256
 Boilers, Heat Efficiency of Steam, Land, Marine, and Locomotive, Bryan Donkin, 543
 Bois (H. du), Atomic Susceptibilities of Water and Aqueous Solutions, 187
 Bolam (Dr. H. W.), Electrolysis of Ethyl Potassium Diethoxy-succinate, 335
 Bolas (Thomas), Glass Blowing and Working, 101
 Bolas (T.), Reproduction by Protographic Processes, 204
 Bologoye, Lake, Biology of, 300
 Bollettino della Società Sismologica Italiana, 22, 359
 Bolton (Dr. H. C.), Blue Grotto on Lake Minnewaska, N.Y., 525
 Bone (W. A.) Action of Light on Acetylene, 238
 Bone-Softening by Phoroglucinol, J. J. Andeer, 47
 Bonetti (L.), Improvement in Radiographic Tubes, 240

- Bonnefoi (J.), the Ammoniacal Chlorides of Lithium, 432 ;
Combinations of Lithium Chloride with Methylamine, 612
- Bonney (Prof., F.R.S.), Garnet-Actinolite Schists on South Side of St. Gothard, 141
- Bonnier (Gaston), Alpine Character in Plants produced by Alternation of Extreme Temperatures, 384
- Bondsdorff (Dr. E. J.), Death of, 396
- Books of Science, Forthcoming, 535
- Book Worms, Facts about, Rev. J. F. X. O'Connor, 435
- Bordage (M.), Relation of Colour of Lepidoptera Chrysalids to Colour of Environment, 425
- Bordas (L.), Arborescent Organs of Holothuria, 635
- Boruttan (Prof.) Recent Advances in Electrophysiology, 483
- Bosnia, Fall of a Meteorite in, 375
- Botany: Nitrogenous Nutrition of Phanerogamous Plants, L. Lutz, 24; the Ceara Rubber Plant at Kew, 40; New Rubber-Extracting Machine, 58; Gutta-percha and India-rubber, 236; Fiji Rubber, 302; Sources of India-rubber and Gutta-percha, Dr. D. Morris, 514; the Supply of Amazonian Rubber, W. A. Churchill, 603; Jacquin's Oxlip, Charles Bailey, 46; Linnean Society, 46, 141, 189, 215; Structure of *Dendroceros*, A. Gepp, 46; the Present Position of some Cell Problems, Prof. J. B. Farmer, 63; Missouri Botanical Garden, Ninth Annual Report, 77; Economic Botany in the West Indies, J. H. Hart, 87; Lenticels, H. Devaux, 96; Journal of Botany, 117, 264, 635; Growth of Algae Nostoch in Darkness, R. Bouilhac, 143; Open-air Studies in Botany, R. Lloyd Praeger, 150; on the Use of Methylene Blue as a Means of Investigating Respiration in Plants, Prof. J. B. Farmer, 185, 215; Psychrometer applicable to Study of Plant Transpiration, 187; New South Wales Linnean Society, 192, 240, 359, 492, 635; the Making of a Daisy, Eleanor Hughes-Gibb, 198; Death of Prof. Anton Kerner, 206; Obituary Notice of, Dr. Otto Stampf, 251; Death of Prof. Ferdinand Cohn, 206; Obituary Notice of, Prof. J. B. Farmer, 275; Preservative Solution in Use at Ghent Botanic Garden and Prof. Errera's Process, J. M. Hillier, 208; Notes on Ashanti, Surg.-Capt. Cummins, 208; the Atoll of Funafuti, Ellice Group: its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley of the Australian Museum, Sydney, N.S.W., 221; Vegetable Application used to Inflammation Eye by Malingering Egyptian Soldiers, Kenneth Scott, 255; Ingredient of Chinese Herbal Prescription, J. B. Davy, 255; Geological History of Recent British Flora, Clement Reid, 278; Death of Prof. Suringar, 299; Report of Royal Gardens, Ceylon, J. C. Willis, 329; Chromatolysis in Plants, Dr. B. Longo, 329; on the Depletion of the Endosperm of the *Horidium vulgare* during Germination, Horace T. Brown, F.R.S., and F. Escombe, 331; Winter Condition of Reserve Food in *Liriodendron* Stems, E. M. Wilcox, 335; Physiological Function of Iron in Vegetable Organism, Jules Stoklasa, 359; Pietine in Wheat, Louis Mangin, 359; a Yorkshire Moor, Prof. L. C. Miall, F.R.S., 377, 401; Alpine Character in Plants produced by Alternation of Extreme Temperatures, Gaston Bonnier, 384; Tea, Coffee, and Cinchona Cultivation in India, 423; Handbuch der Blütenbiologie unter zugrundelegung von Hermann Müller's werk: "Die Befruchtung der Blumen durch Insekten," Dr. Paul Knuth, Francis Darwin, F.R.S., 434; *Coralorrhiza innata* and its Mycorrhiza, A. V. Jennings and H. Hanna, 464; Essential Oils of Eucalyptus Genus, R. T. Baker and H. G. Smith, 464; Annals of the Royal Botanic Gardens, Calcutta, vol. viii.: the Orchids of the Sikkim Himalaya, Sir George King and Robert Pantling, 465; Botanisches Bilderbuch für Jung und Alt, Franz Bley, 466; Anatomical Structure of Beetroot Stem, G. Fron, 492; a Text-book of Botany, Dr. E. Strasburger, Dr. Fritz Noll, Dr. H. Schenck, and Dr. A. F. W. Schimper, 494; Influence of Light on Wild Grapes and Ground Ivy, M. Maige, 516; the Attempts to fit China Grass and Ramie for Manufacturing Purposes, 523; Blue Grotto on Lake Minnewaska, N.Y., Dr. H. C. Bolton, 525; Botanical Exploration of Mount Kosciusko, J. H. Maiden, 551; Chlorophyll Assimilation in Maritime Plants, Ed. Griffon, 564; Animals and Poisonous Plants, Alfred W. Bennett, 571; Edward M. Langley, 597; Obituary Notice of Surgeon-Major J. E. T. Aitchison, M.D., F.R.S., W. Botting Hemsley, F.R.S., 578; Death of Dr. C. G. Gibbeli, 603; New York Botanical Garden, 603; Flora of County Donegal, H. C. Hart, 615; Silphium among the Ancient Greeks, Dr. Kronfeld, 628; the Temperature of Tree-stems, F. Schlechert, 629; the Knight-Darwin Law, Francis Darwin, F.R.S., 630; Cause of Spiral Structure of Chenopodiaceae Roots, G. Fron, 635
- Bothamley (C. H.), on the Action of certain Substances on the Undeveloped Photographic Image, 557
- Botton (S. R.), Radiography and the X-Rays, 292
- Boubée (Prof. P.), the Disposal of the Town Refuse of Naples, 524
- Bouchard (M.), Increase of Weight of Body by Transformation of Fat in Glycogen, 588
- Bouchard's Theory of the Transformation of Fat into Glycogen, Daniel Berthelot, 612
- Boudouard (O.), Limit of Inflammability of Carbon Monoxide, 71; Radiation of Incandescent Burners, 240
- Bouilhac (R.), Growth of Algae Nostoch in Darkness, 143
- Boulenger (G. A., F.R.S.), the Tailless Batrachians of Europe, 567; Hibernating Reptilian Embryos, 619
- Bourget (Henry), Transference of Heat in Cooled Metal, 200, 521
- Boutan (Prof. Louis), Submarine Photography, 18
- Boyce (Prof.), on the Physiological Structure of the Brain of the Fowl, 485
- Boys (C. V., F.R.S.), on Laboratory Arts, Richard Threlfall, 145
- Brabrook (E. W., C.B., F.S.A.), Opening Address in Section II of the British Association, 506
- Brambilla (Prof.), Steiner's Surfaces, 627
- Branly (E.), Hertzian Oscillations arrested by thin Metallic Envelope, 264; Wireless Telegraphy and Collisions at Sea, 312; Electrical Resistance at Contact of Two Discs of same Metal, 336
- Braun (Dr. C.), New Determination of the Earth's Density, 160
- Braun (F.), Thermophones, 335
- Briggs (W.), Chemical Analysis, Qualitative and Quantitative, 366
- Bright (Charles), Submarine Telegraphs, 289
- Bristol, Meeting of the British Association at, 471, 498; Sectional Forecast, 436; Inaugural Address by Sir William Crookes, F.R.S., V.P.C.S., President of the Association, 438. See also British Association
- Bristol and Mechanical Science, Sir John Wolfe Barry, K.C.B., LL.D., F.R.S., 506
- Bristol: Novel Plan of Increasing Dock-Capacity, 582
- BRITISH ASSOCIATION: Bristol Meeting of the, 36, 205, 392, 412, 471, 498; Sectional Forecast, 436; Inaugural Address, Sir William Crookes, F.R.S., V.P.C.S., President of the Association, 438; Monium, 556; International Conference of Terrestrial Magnetism and Atmospheric Electricity, Opening Address by Prof. A. W. Rücker, Sec. R.S., President of the Conference, 473; International Conferences and the British Association, 522; Phosphorescence, Mr. Herbert Jackson, 559
- Section A (Mathematics and Physics).—Opening Address by Prof. W. E. Ayrton, F.R.S., President of the Section, 448; Prof. Rosa and Prof. Atwater on whether the Law of Conservation of Energy holds good for the Vital Processes going on in the Human Body, 532; Dr. A. Galt on the Heat of Combination of Metals in the Formation of Alloys, 532; Mr. W. N. Shaw on Dalton's Law, 532; Dr. C. H. Lees on the Thermal Conductivity of Rocks at Different Pressures, 532; Mr. S. R. Milner and Prof. Chattock on the Thermal Conductivity of Water, 532; Mr. J. W. Gifford on Lenses not of Glass, 532; Prof. T. Preston on Radiation in a Magnetic Field, 532; Prof. S. P. Thompson on an Experiment by Righi on the Production of the Zeeman Phenomenon by Absorption, 533; Mr. J. Burke on the Luminosity produced by Striking Sugar, 533; Mr. S. Skinner on the Carbon-Consuming Cell of Jaques, 533; Messrs. Cahen and Donaldson on the Results of some Comparisons of the Output and Efficiency of a Secondary Cell (Tudor Type) when charged at Constant Current and Constant Electromotive Force respectively, 533; Mrs. Ayrton on the Drop of Potential at the Terminals of the Electric Arc, 533; Prof. Chattock on Experiments to Determine the Velocity of Electricity in the Electric Wind, 533; Prof. Lodge on a New Magnifying Telephone, 533; Prof. S. Lemström and Dr. E. H. Cook on the Action of Electricity on Plants, 533; Dr. Schott, Prof. Rücker, Dr. Eschenhagen, Prof. von Bezold, W. H. Preece, Signor Palazzo, Prof. Fleming, Prof. S. P. Thompson, Prof. Ayrton on the Magnetic and Electrolytic Actions of

- Electric Railways, 533; Prof. Turner, Mrs. Maunder, Sir Norman Lockyer on the Recent Solar Eclipse Expedition, 533; Mr. Clayden on Meteorological Photography, 534; Prof. Milne on Seismology, 534; Mr. W. H. Shaw on a Pneumatic Analogue of the Potentiometer, 534; Mr. A. W. Warrington on Hydrometers of Total Immersion, 534; Dr. R. J. Lloyd on the Articulation and Acoustics of the Spirate Fricative Consonants, 534; Colonel Allen Cunningham Report on the Work of the Committee for Calculating Tables of certain Mathematical Functions, 534; Prof. Hele-Shaw on a New Instrument for Drawing the Curves which can be got by Rolling One Circle on another, 534; Prof. Hele-Shaw and Sir George Stokes' Experiments on the Motion of a Viscous Fluid between Two Parallel Plates, 535; Mr. E. T. Whittaker on the Recent History of the Theory of the Functions Used in Analysis, 535; Dr. Johnstone Stoney on the Dynamical Explanation of certain Observed Phenomena of Meteor Streams, 535; Prof. G. J. Stokes on the Imaginary of Logic, 535; Lord Kelvin on the Dynamical Theory of Refraction Dispersion and Anomalous Dispersion, 546
- Section B (Chemistry).**—Opening Address by Prof. F. R. Japp, M.A., LL.D., F.R.S. (President of the Section), Stereochemistry and Vitalism, 452; Sir William Crookes on Monium, 438, 556; Prof. Ramsay and Dr. Travers on the Extraction from Air of the Companions of Argon and on Neon and "Xenon," 556; Prof. Emerson Reynolds on the position of Helium, Argon, Krypton, and Neon in his Diagrammatic Representation of the Relations of the Elements, 556; Prof. F. Clowes on Equivalent Replacement of Metals, 556; Prof. Hodgkinson and Mr. Coote on Alkaline Chlorates and Sulphates of the Heavy Metals, 556; Mr. R. G. Durrant on Green Cobaltic Compounds, 556; Prof. Sydney Young on the Thermal Properties of Gases and Liquids, 556; the Earl of Berkeley on the Methods he has adopted for the more exact Determination of the Densities of Crystals, 556; Dr. W. J. Russell on the Action exerted by certain Metals and other Organic Substances on a Photographic Plate, 556; Mr. C. H. Bothamley on the Action of certain Substances on the Undeveloped Photographic Image, 557; Prof. Percy Frankland on an Additional Photographic Action—that of Bacteria, 557; Dr. J. Gordon Parker on Recent Advances in the Tanning Industry, 557; Mr. Vernon Harcourt on his New 10-Candle Pentane Lamp, 557; Prof. Emerson Reynolds's Experiment illustrating the Effect on the Acetylene Flame of Varying Proportions of Carbon Dioxide in the Gas, 557; Dr. Laurie and Mr. Strange on the Results obtained in Studying the Cooling Curves of Fatty Acids, 557; Messrs. Fenton and Jackson on the Oxidation of Polyhydric Alcohols, 557; Dr. Morrell and Mr. Crofts on the Oxidation of Glucose, 557
- Section C (Geology).**—Opening Address by W. H. Hudleston, M.A., F.R.S., President of the Section, 476; Mr. E. Wethered on the Building of the Clifton Rocks, 558; Mr. T. H. Holland on the Comparative Action of Sub-aërial and Submarine Agents in Rock Decomposition, 558; Prof. O. C. Marsh on the Comparative Value of different kinds of Fossils in determining Geological Age, 558; Prof. J. F. Blake on Aggregate Deposits and their Relation to Zones, 558; Mr. T. Groom on the Age and Geological Structure of the Malvern and Abberley Ranges, 558; Mr. E. Greenly on a Case of Boulder-uplift at Llandegfan, Menai Straits, 558; Mr. A. Somervail on the Age and Origin of the Granite of Dartmoor, 558; Mr. R. Etheridge, Prof. Boyd Dawkins, Mr. W. Whitaker, Sir John Evans, Mr. E. Wethered, and Prof. Louis on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 558; Dr. Marsden Manson on the Laws of Climatic Evolution, 559; Prof. E. Hull on the Sub-oceanic Physical Features of the North Atlantic, 559; Mr. W. H. Wheeler on the Action of Waves and Tides on the Movement of Material on the Sea-coast, 559
- Section D (Zoology).**—Opening Address by Prof. W. F. R. Weldon, M.A., F.R.S., President of the Section, Natural Selection, 499; Mr. F. Galton on Photographic Records of Pedigree Stock, 584; Mr. W. Garstang on the Races and Migrations of the Mackerel, 584; Mr. H. N. Dickson on the Connection between the Appearance of Mackerel and the Changes of Sea Temperature in Spring and Autumn, 584; Dr. Arthur Willey on the Phylogeny of the Arthropod Amnion, 584; Mr. H. M. Vernon on the Relations between Marine, Animal and Vegetable Life in Aquaria, 585; Prof. W. A. Herdman on the Final Report of the Oyster Committee, 585; Dr. H. Lyster Jameson on a Race of Protectively-Coloured Mice, 585; Prof. Poulton and Miss C. B. Sanders on the Struggle for Existence in certain Common Insects, 585; Prof. Lloyd Morgan on Animal Intelligence, 585; Dr. A. J. Harrison on the so-called Fascination of Snakes, 585; Prof. Julin on the Formation of the Heart, 585; the Peptone Committee Experiments, 585
- Section E (Geography).**—Opening Address by Colonel George Earl Church, President of the Section, 586; Mr. H. N. Dickson on the Salinity and Temperature of the North Atlantic, 586; Dr. K. Natterer on the Oceanographical Results of the Austro-Hungarian Deep-Sea Expeditions in the Eastern Mediterranean, Sea of Marmora, and Red Sea, 586; Dr. J. W. Gregory on the Theory of the Arrangement of Oceans and Continents on the Earth's Surface in the Light of Geological and Physical Observations, 586; Mr. R. D. Oldham on the Great Indian Earthquake of June 12, 1897, 586; Dr. J. Scott Keltie on "Political Geography," 586; Prof. Reclus on his Scheme for a Great Terrestrial Globe, 586; Prof. Patrick Geddes on an Experiment in the Practical Teaching of Geography about to be tried in Edinburgh, 586; Dr. H. R. Mill on the Prospects of Antarctic Research, 587; Mr. C. W. Andrews, a Preliminary Account of Christmas Island in the Indian Ocean, 587
- Section G (Mechanical Science).**—Opening Address by Sir John Wolfe Barry, K.C.B., LL.D., F.R.S., President of the Section; Bristol and Mechanical Science, 506; Mr. Forster Brown on the Economic and Mechanical Features of the Coal Question, 608; State Purchase of Railways as a Means of Reducing Freight Charges, 608; Visit to Barry Docks, 608; Mr. A. Siemens, Mr. H. H. Gibbins and Mr. W. Geipel on the Application of the Electric Motor to the Engineering Workshop, 608; Prof. Silvanus Thompson and Mr. Walker on Electric Traction by Surface Contacts, 608
- Section H (Anthropology).**—Opening Address by E. W. Brabrook, C.B., F.S.A., President of the Section, 527
- Section K (Botany).**—Prof. Klebs on Alternation of Generations in *Thallophyta*, 632; Lloyd Williams on the Reproduction of *Diclyota dichotoma*, 632; Prof. Philips on the Form of the Protoplasmic Body in certain Floridæ, 633; Prof. Errera on the Structure of the Yeast Cell, 633; Harold Wager on the Structure of the Yeast Cell, 633; Prof. Marshall Ward on a New Potato Disease, 633; Mr. Lang on the Discovery of the Prothallus of *Lycopodium clavatum*, 633; Dr. Scott on the Anatomy of Coal-Measure Plants, 633; A. C. Seward on the Malayan Fern *Matonia*, 633; Prof. Errera on the Theoretical Calculation of an Osmotic Optimum, 633; Prof. Reynolds Green on the Enzyme of the Yeast Plant, 633; Mr. Burkill on Changes in the Sex of Willows, 633
- British East Africa, Travels in the Coastlands of, and the Islands of Zanzibar and Pemba, W. W. A. FitzGerald, 6
- British India, the Flora and Fauna of, 250
- British Institute of Preventive Medicine, Annual Meeting of, 206; Transactions of the, 339
- British Medical Association, Meeting of the, Dr. F. W. Tunnicliffe, 349
- British Pharmaceutical Conference, Presidential Address of Dr. Charles Symes, 398
- British Rainfall, Symons's, 1897, G. J. Symons, F.R.S., and H. Sowerby Wallis, 389
- Brodie (F. J.), Abnormal Weather of January in 1898, 95
- Bronze Implement, Bacteria on an Ancient, William Edward Nicholson, 32; Dr. G. L. Johnson, 52
- Bronze Medals, Treatment of the Surface of, Prof. Roberts-Austen, F.R.S., 236
- Broom (Dr. R.), *Thylacoleo*, 192
- Brough (Bennett H.), Indian Coals at the Imperial Institute, 380
- Brown (Prof. Crum), Origin of Phœnician Alphabet Characters, 143; Electrolysis of Ethyl Potassium Diethoxysuccinate, 335
- Brown (Forster), on the Economic and Mechanical Features of the Coal Question, 608
- Brown (Horace T., F.R.S.), on the Depletion of the Endosperm of *Hordeum vulgare* during Germination, 331
- Browne (Sir J. C.), the Sale of Poisons, 577

- Browne (Montague), Rules for Compositors and Readers, 368
 Browning (P. E.), Detection of Sulphides, Sulphates, Sulphites and Theosulphates in each other's Presence, 634
 Bruce (Robert), Food Supply: a Practical Handbook for the Use of Colonists and all intending to become Farmers Abroad or at Home, 245
 Bruni (Giuseppe), the Phenomenon of Equilibrium in Isomorphous Mixtures, 627
 Bruyn (Prof. L. de), State of Insoluble Amorphous Substances made to form in Gelatine, 360
 Bryan (Prof. G. H., F.R.S.), Dendritic Patterns caused by Evaporation, 174
 Buchan (Dr.), Mean Atmospheric Pressure and Temperature of British Islands, 178
 Buchanan (J. Y., F.R.S.), Nomenclature and Notation in Calorimetry, 30
 Budgett (Prof. S. P.), on Physical Absorption of Isotonic and Anisotonic Salt Solutions, 484
 Bugonia-Superstitions, Notes on—the Occurrence of *Eris-talis tenax* in India, Kumagusu Minakata, 101
 Buisson (H.), Velocity of Electrified Particles during Discharge of Ultra-Violet Light, 336
 Bulletin of American Mathematical Society, 92, 187, 310, 431
 Bulletin de l'Académie des Sciences de St. Pétersbourg, 492
 Bunsen's (Dr. Robert) Life Work, 229
 Buoys, Illuminated, J. Pintsch, 489
 Burch (G. J.), Electrical Response of Nerve to a Single Stimulus investigated with Capillary Electrometer, 166; Photographs of the Electrical Response of Nerve to Excitation, 483
 Burch (Prof. G.), on Temporary Colour-Blindness, 486
 Burgess (Dr. James), on finding Log Sines and Log Tangents of Small Arcs, 336
 Burke (J.), Luminosity produced by Striking Sugar, 533
 Burkill (Mr.), Changes in Sex of Willows, 633
 Burma, Petroliferous Sands and Mud Volcanoes in, Dr. Fritz Noetling, 20
 Burstall (Prof. Frederick W.), Experiments on the Working of Gas Engines, 21
 Butler (C. P.), Simple Interference Method of Calibrating Spectrometer, 62; Simple Method of Reducing Prismatic Spectra, 119
 Butter and Milk, the Adulteration of, R. H. Wallace, 133
 Buttons, Obsidian, in Australia, 109
 Buzzard (Dr.), Influence of Micro-Organisms on Diseases of Nervous System, 350
 Cahen (Mr.), Results of some Comparisons of the Output and Efficiency of a Secondary Cell (Tudor Type) when charged at constant current and constant electro-motive force respectively, 533
 Calabro-Messinese Earthquakes, Prof. G. Mercalli, 229
 "Calaveras Skull," Prof. Whitney's, 17
 Calculus, an Elementary Course of Infinitesimal, Horace Lamb, F.R.S., 292
 Calcutta, Annals of the Royal Botanic Gardens, Vol. viii.: the Orchids of the Sikkim Himalaya, Sir George King and R. Pantling, 465
 Calcutta, the Plague in, Dr. Haffkine's Methods and, 85
 Calf Lymph, the Bacterial Character of, Mrs. Percy Frankland, 44
 California University, New Teaching Observatory for the, 553
 Callandreaux (M.), Obituary Notice of Prof. Soullart, 112
 Calman (W. T.), Rotifers in Lake Bassenthwaite, 271.
 Calorimetry, Nomenclature and Notation in, J. Y. Buchanan, F.R.S., 30
 Cambridge, International Congress of Zoology at, 390
 Cambridge Observatory, Annual Report of the, 553
 Cambridge Philosophical Society, 95, 142
 Camera Lucida, a Modified, Frederick Ives, 311
 Campion (Henry), the Secret of the Poles, 495
 Canalisation Électriques, R. V. Picou, 519
 Cancani (Dr. A.), Barisal Guns, 130
 Cancani's (Dr.) Horizontal Seismographical Pendulum at Rocca di Papa, 158
 Cannon (Miss), Stars having Peculiar Spectra, 258
 Cape Colony, Trout Acclimatisation in, J. D. F. Gilchrist, 628; Forestry in, D. E. Hutchins, 605
 Cape of Good Hope Bacteriological Institute, Report of, 278
 Cape Observatory Report, the, 584
 Carnot (A.), Silicon and Chromium in Steels, 47
 Carnot (M.), the Culture of Koch's Bacillus, 354
 Carus-Wilson (C. A.), Electro Dynamics: the Direct Current Motor, 366
 Cast Metal Work from Benin, 224
 Castets (J. S. J.), Protective Mimicry, 223.
 Catskills, the Deer Park in the, 487
 Caucasian Branch of Russian Geographical Society, 539
 Cayley (Arthur, F.R.S.), the Collected Mathematical Papers of, 50
 Cazeneuve (P.), Preparation of Mixed Carbonic Ethers, 240
 Cell Problems, the Present Position of some, Prof. J. B. Farmer, 63
 Centipede, Gigantic, in Zoological Gardens, 326
 Centipede-Whale, the, Kumagusu Minakata, 570
 Centnerszwer (Herr), Catalytic Influence of Gases on Oxidation of Phosphorus, 279
Cephalodiscus dodecalophus, Anatomy of, Dr A. T. Masterman, 190
 Ceraski (Madame), a New Variable Star, 424
 Ceremonial Dances of the American Indians, 125
 Cerulli (Prof. V.), Mars in 1896-7, 304
 Ceti, the Variable, Herr W. Stratonoff, 330; Dr Nijland, 330
 Ceylon, the Abnormal Rainfall of December 1897 in, H. Parker, 132
 Ceylon, Report of Royal Botanic Gardens, J. C. Willis, 329
 Chance or Vitalism?, Prof. Karl Pearson, F.R.S., 495; Prof. Geo. Fras. Fitzgerald, F.R.S., 545; Clement O. Bartrum, 545
 Chaney (H. J.), Our Weights and Measures: a Practical Treatise on the Standard Weights and Measures in use in the British Empire, with some Account of the Metric System, 268
 Chank-Shell, the Value of a Right-handed, Edgar Thurston, 627
 Charpentier (Aug.), Visibility of Blind Spot in Retina, 168
 Charrin (M.), Thermogenesis in Tetanus, 336
 Chatterton (Prof.), the Use of Aluminium for Cooking Utensils in India, 488
 Chaddock (Prof.), on the Thermal Conductivity of Water, 532; Experiments to Determine the Velocity of Electricity in the Electric Wind, 533
 Chavastelon (R.), New Combination of Acetylene with Cuprous Oxylchloride, 264
 Cheetham (T. A.), Elementary Chemistry, Practical and Theoretical, 29
 Chemistry: *Explosifs nitrés*, J. Daniel, 4; Notes on Observations, Sydney Lupton, 7; Carbohydrates of Barley-Straw, C. F. Cross, E. J. Bevan, and C. Smith, 23; Isomeric Borylamines, M. O. Forster, 23; Derivatives of Benzophenone, F. E. Matthews, 23; Drying of Ammonia and Hydrogen Chloride, H. B. Baker, 23; Liquid Hydrogen, 55; Dr. W. Hampson, 77, 174, 246, 292; Prof. J. Dewar, F.R.S., 125, 199, 270, 319; Boiling Point and Density of Liquid Hydrogen, J. Dewar, 189; Liquefaction of Hydrogen and Helium, J. Dewar, 142; Action of Hydrogen Peroxide on Carbohydrates in Presence of Iron, C. F. Cross, E. J. Bevan, and C. Smith, 94; Action of Hydrogen Bromide on Carbohydrates, H. J. H. Fenton and Mildred Gostling, 189; Preparation of Standard Acid Solution by Direct Absorption of Hydrogen Chloride, G. T. Moody, 238; Action of Hydrogen on Silver Sulphide and *vice versa*, H. Pelabon, 240; Behaviour of Calcium heated in Hydrogen, Henri Moissan, 257; Reaction between Hydrogen and Nitric Acid, M. Berthelot, 264; Action of Hydrogen on Potassium Paratungstate, L. A. Hallopeau, 264; Action of Pure Hydrogen Phosphide on Cupric Sulphate, E. Rubenovitch, 359; Properties of Methylene Di-iodide, H. G. Madan, 23; Condensation of Chloral Hydrate with Orcinol, J. T. Hewitt and F. G. Pope, 23; Hexamethylene and its Derivatives, E. C. Fortey, 23; Yellow Colouring Matter of Leaves of *Arctostaphylos uva ursi*, A. G. Perkin, 23; Synthesis of Cis- and Trans-Caronic Acids, W. H. Perkin, jun., and J. F. Thorpe, 23; Preparation of Solid Ammonium Cyanate, J. Walker and J. K. Wood, 23; Simple Experimental Illustrations of Law of Multiples, A. W. Jones, 23; Lauronic Acid, R. W. Collinson and W. H. Perkin, jun., 23; Action of Bromacetol on Sodium Derivative of Ethylic Malonate, W. H. Perkin, jun., and C. H. G. Sprankling, 23; Separation of Optical Isomerides, F. S. Kipping and W. J. Pope, 23; Industrial Treatment of Emerald in Electric Furnace, P. Lebeau, 23; the Quinoneoximes, A. Valeur, 23; Products of Hydrolysis of Ouabaine, M. Arnaud, 23; Ouabaic Acid, M. Arnaud, 47; Chlorinating Action of Ferric Chloride in Aro-

- matic Series, V. Thomas, 24; Saccharification of Starch by Malt, H. Pottevin, 24; Nitrogenous Nutrition of Phanerogamous Plants, L. Lutz, 24; Elementary Chemistry, Practical and Theoretical, T. A. Cheetham, 29; Silicon and Chromium in Steels, MM. A. Carnot and Goutal, 47; Iodide of Beryllium, P. Lebeau, 47; New Reaction of Tertiary Alcohols and their Ethers, G. Denigès, 47; Action of Sulphuric Acid of 35-40 per cent. on Acid Aliphatic and Neutral Nitramines and their Isomers, Prof. Franchimont and Dr. Umbgrove, 47; Method of Detecting and Estimating Small Amounts of Carbon Monoxide in Air in Presence of Traces of Hydrocarbons, A. Gautier, 71; Limit of Inflammability of Carbon Monoxide, MM. H. Le Chatelier and Boudouard, 71; a Boro-carbide of Beryllium, P. Lebeau, 71; some Halogen Salts of Lead, V. Thomas, 71; Text-book of Physiology, Dr. T. H. Milroy, 73; Redetermination of Atomic Weights of Nickel and Cobalt, Prof. T. W. Richards, 87; Wiedemann's Annalen, 93, 117, 187, 335, 491; Chemical Society, 94, 142, 189, 238; Affinity-Constants of Dihydroxymaleic, Dihydroxyfumaric, Dihydroxy-tartaric and Tartaric Acids, S. Skinner, 94; Resolution of Tetrahydropapaverine into its Optically Active Components, W. J. Pope and S. J. Peachey, 94; Molecular Weights of Permanganates, Perchlorates and Periodates in Solution, J. M. Crofts, 94; Causes of Uncertainty in Estimating Carbonic Acid and Water Vapour, A. Gautier, 95; Molecular Weights of easily Liquefiable Gases, Daniel Berthelot, 96; Anhydrous Beryllium Fluoride and Oxyfluoride of Beryllium, P. Lebeau, 96; Synthetic Preparation of Potassium Carbonyl Ferrocyanide, J. A. Muller, 96; the Arrangement of Atoms in Space, J. H. Van't Hoff, 100; the Industrial Applications of Electro-Chemistry, Dr. Thomas Ewan, 112; Estimation of Manganese separated as Carbonate, Martha Austin, 117; Osmosis of Liquids through Vulcanised Rubber, G. Flusin, 120; Action of Aluminium Chloride and Chlorine on Anhydrous Chloral, A. Mouneyrat, 120; Carbon Monoxide in Blood, Maurice Nicloux, 120; the Rudiments of Physics and Chemistry, 123; on a New Constituent of Atmospheric Air, Prof. W. Ramsay, F.R.S., and Morris W. Travers, 127; Obituary Notice of Lyon Playfair, 128; Action of Formaldehyde on Naphthalene Amines, I., G. T. Morgan, 142; Oleic Acid and its Derivatives, I., F. G. Edmed, 142; Stereoisomeric Derivatives of Camphor, T. M. Lowry, 142; Solubility of Camphor, C. Istrati and A. Zaharia, 635; the Di-Alkylamidoanthraquinones, A. Haller and A. Guyot, 143; Halogen Derivatives of Ethyl-Phenyl-Ketone, A. Collet, 143; Production of Carbon Monoxide in Organism, Maurice Nicloux, 143; Cinnamic Methyl Ether in *Alpinia Malaccensis*, Dr. P. van Romburgh, 143; Recent Experiments on certain of the Chemical Elements in relation to Heat, Prof. W. A. Tilden, F.R.S., 160; the Carbonic Acid of the Air, MM. Albert Levy and H. Henriet, 168; Companions of Argon, Prof. William Ramsay, F.R.S., and Morris W. Travers, 182; Position of Helium, Argon, and Krypton in Scheme of Elements, Sir William Crookes, F.R.S., 383; Helium in the Atmosphere, E. C. C. Baly, Prof. William Ramsay, F.R.S., and Dr. Morris W. Travers, 545; Sir William Crookes, 570; Atomic Susceptibilities of Water and Aqueous Solutions, H. du Bois, 187; Atomic Weight of Nitrogen, M. Vézes, 191; Atomic Weight of Tellurium, R. Metzner, 191; a New Carbide of Tungsten, Percy Williams, 191; Production of Tungsten Blue, Albert Granger, 287; a Silicide of Tungsten, E. Vigouroux, 492; a Double Carbide of Iron and Tungsten, Percy Williams, 516; a Double Carbide of Iron and Chromium and Iron and Tungsten, Percy Williams, 588; New Iodide of Tungsten, Ed. Defacqz, 612; Crystallised Tungsten Dioxide and Tungsto-Lithium Tungstate, L. A. Hallopeau, 612; New Method of Separating Geraniol and Citronnellol, J. Flatau and H. Labbé, 191; Liquid Air at One Operation, Lord Rayleigh, F.R.S., 199; the Spectrum of Metargon, Prof. Arthur Schuster, F.R.S., 199, 269; the Preparation of Crystallised Calcium, M. Moissan, 209; Boiling Point of Liquid Ozone, L. Troost, 216; Chlorination of Acetylene, A. Mouneyrat, 216; Dr. Robert Bunsen's Life Work, 229; a New Isomeride of Malic Acid, J. H. Abernethy, 232; Halogen Derivatives of Fenchene, J. A. Gardner and G. B. Cockburn, 238; Oxidation of Fenchene, J. A. Gardner and G. B. Cockburn, 238; Isodynamic Forms of Nitrocamphor, T. M. Lowry, 238; Cannabinol, T. B. Wood, W. T. N. Spivey and T. H. Easterfield, 238; Action of Light on Acetylene, W. A. Bone and J. Wilson, 238; Solubility of Isomeric Substances, J. Walker and J. K. Wood, 238; Azobenzene Derivative of Chrysin, A. G. Perkin, 238; Constituents of "Waras," A. G. Perkin, 238; Oxidation of Charcoal by Nitric Acid, G. Dickson and T. H. Easterfield, 238; Combination of Fatty Ketones with Mercuric Sulphate, G. Denigès, 240; Preparation of Mixed Carbonic Ethers, P. Cazeneuve and Albert Morel, 240; Acids of Essential Oils of Geranium, MM. Flatau and Labbé, 240; Practical Organic Chemistry, George George, 245; Chemical Works in Germany, 256; the Decomposition of Water by Chromous Salts, M. Berthelot, 264; Blue Glass with Chromium Base, André Duboin, 264; Use of Copper Selenate in making Selenic Acid, R. Metzner, 264; Volumetric Analysis in Alkaline Solution, André Job, 264; New Combination of Acetylene with Cuprous Oxychloride, R. Chavastelon, 264; Solfataral Gases, Prof. R. Nasini, F. Anderlini and R. Salvadori, 269; Catalytic Influence of Gases on Oxidation of Phosphorus, Herr Centnerszwer, 279; Sodium Perborate, M. Tanatar, 279; Decomposition of Nitric Acid by Heat, D. Berthelot, 287; Compressibility of Air as Gaseous Mixture, E. H. Amagat, 287; Mode of Oxidation of Cobalt Salts on Alkaline Solutions, André Job, 287; Compounds of Rhodium, A. Jolly and E. Leidié, 287; Brominating Action of Aluminium Bromide in Fatty Series, A. Mouneyrat, 287; Ovalbuminic Acid, J. M. Albahari, 288; Action of Sorbose Bacteria on Xylose, Gabriel Bertrand, 288; Anhydrous-Crystallised Magnesium Sulphide, A. Mourlot, 312; Freezing Point of Aqueous Solutions of Sodium Mellitate, W. W. Taylor, 335; Determination of Arsenic in Antimony, O. Ducru, 336; Action of Sodammonium on Arsenic, C. Hugot, 635; Composition of Phosphorescent Sulphides of Strontium, J. R. Morelo, 336, 432; Crystallisation of Anhydrous Sulphides of Calcium and Strontium, M. Mourlot, 516; Estimation of Methyl Alcohol in Ethyl Alcohol, A. Trillat, 336; Millet, M. Ballard, 336; Text-Book of Physical Chemistry, Clarence L. Speyers, 344; Synthesis of Albuminous Substances, Dr. Leo Lilienfeld, 351; Action of Bromine on Normal Propyl Bromide in presence of Anhydrous Aluminium Bromide, A. Mouneyrat, 359; Hydrolysis of Ethane-Dipyrrocatechin, Ch. Moureu, 359; Babbit's Antifriiction Metal, Prof. H. Behrens and H. Baucke, 359; State of Insoluble Amorphous Substances made to form in Gelatine, Prof. L. de Bruyn, 360; Composition and Volumes of co-existing Phases of Mixtures of Methyl Chloride and Carbonic Acid, C. M. A. Hartman, 360; Chemical Analysis, Qualitative and Quantitative, W. Briggs and K. W. Stewart, 366; Artificial Food, Dr. Sidney Williamson, 368; Death of J. A. R. Newlands, 372; Obituary Notice of, 395; the Relations between the Energy of Light and Chemical Energy, D. Berthelot, 375; Monopyrocatechin Glyoxal, Gaston Bonnier, 384; Action of Oxygen on Yeast, Jean Effront, 384; Study of Phosphoric Acid dissolved by the Water of the Soil, Th. Schloesing, Fils, 384; Chemical Manufacture of Perfumes, 398; Catalytic Action of Organic Substances on Oxidation of Sodium Sulphate, S. L. Bigelow, 400; the Oxides of Sodium, M. de Forcrand, 432; Atmospheric Carbon Dioxide, Albert Levy and H. Henriet, 408; the Production and Uses of Ozone, 416; the Ammoniacal Chlorides of Lithium, J. Bonnefoi, 432; the Estimation of Tannin, Leo Vignon, 432; Stereochemistry and Vitalism, Prof. Japp, F.R.S., 452, 616; Prof. Karl Pearson, F.R.S., 495; Prof. F. J. Allen, 520; Prof. G. F. Fitzgerald, F.R.S., 545; C. O. Bartrum, 545; Herbert Spencer, 592; Prof. Giorgio Errera, 616; Essential Oils of Eucalyptus Genus, R. T. Baker and H. G. Smith, 464; the Carbonic Anhydride of the Atmosphere, Dr. E. Letts and R. F. Blake, 464; Toxicity of Copper Salts for Wheat, Henri Coupin, 492; Death of Dr. H. Trimble, 513; Commercial Extraction of Thorium, MM. Wyronhoff and A. Verneuil, 516; Dr. T. S. Hunt, F.R.S., as a Chemist, James Douglas, 551; Action of Lime and Chalk on Humic Materials, G. André, 564; Influence of Chemical Composition of Glass on its Coefficient of Expansion, A. Granger, 581; Colours of Natural Waters, Prof. W. Spring, 580; Double Salicylates of Metals and Antipyrin, C. Schuyten, 583; Analysis of Commercial Calcium Carbide, Henri Moissan, 588; a Chemical Laboratory Course, A. F. Hogg, 592; Calcium Nitride, H. Moissan, 612; Combinations of Lithium Chloride with Methylamine, J. Bonnefoi, 612; Diodo-quinoline, C. Istrati, 612; Phenyl-Phosphoric and Phenylene Phosphoric Acids, P. Genvresse, 612; Volumetric Estimation of Acetaldehyde, X. Roques,

- 612; Surlusion of Metals and Alloys, Prof. W. C. Roberts Austen, F.R.S., 619; Detection of Sulphides, Sulphates, Sulphites and Thiosulphates in each other's Presence, P. E. Browning and E. Howe, 634; an Old Alloy, D. Berthelot, 635; New Hydrated Chromium Oxide, H. G. Baugé, 635; Researches on Double Iodides and Borates, H. Allaire, 635
- Child (C. D.), Potential Gradients at Electrodes discharged by X-Rays, 187
- Chili, Earthquakes in, 299
- China: Geographical Notes on Central and Southern, 133
- Chinese Antiquities at Shashih, 133
- Chinese Herbal Prescription, Ingredients of, J. B. Davy, 255
- Cheriton (W. W.), a Simplified Euclid, 150
- Chree (Dr. C., F.R.S.), Kew Experiments on Aneroid Barometers, 215; Recent Work in Thermometry, 304; Magnetic Storm, 468
- Chromatolysis in Plants, Dr. B. Longo, 329
- Chromosphere, Photograph of the, Prof. Naegamvala, 526
- Chrystal (G.), Introduction to Algebra, for the Use of Secondary Schools and Technical Colleges, 340
- Church (Colonel George Earl), Opening Address in Section E of the British Association, 586
- Churchill (W. A.), the Supply of Amazonian Rubber, 603
- Chyzer (Cornelio), *Araneæ hungaricæ*, 365
- Cinchona Cultivation in India, 423
- Cirrhus, Hepatic, Clinical Varieties of, Dr. Alex. James, 349
- City Banquet to the Medical Profession, 37
- City Pavements, Mirage on, R. W. Wood, 596
- Clark (J. Edmund), Luminous Clouds or Aurora, 546
- Clayden (Mr.), Meteorological Photography, 534
- Clayton (H. H.), Diurnal Changes in Temperature and Humidity at different Heights in Free Air, 59; Record Broken for High Kite Flight, 513
- Clemow (Dr. F. G.), Rats and the Plague, 551
- Clouds, Iridescent, E. Armitage, 390
- Clouds, Luminous, Arthur P. Jenkin, 521
- Clouds, Luminous, or Aurora, J. Edmund Clark, 546
- Clowes (Prof. F.), on Equivalent Replacement of Metals, 556
- Coal Question, on the Economic and Mechanical Features of the, Forster Brown, 608
- Coals at the Imperial Institute, Indian, Bennett H. Brough, 380
- Cocaine, the Injection of, as a Remedy for Stings, 497
- Coccus, a New, *Echinospira ventricosa*, L. Leger, 516
- Cockburn (G. B.), Halogen Derivatives of Fenchene, 238; Oxidation of Fenchene, 238
- Cockerell (Prof. T. D. A.), a Case of Inherited Instinct, 546
- Coffee Cultivation in India, 423
- Cohen (E.), the Weston Standard Cell, 335
- Cohen (Prof. Ferdinand), Death of, 206; Obituary Notice of, Prof. J. B. Farmer, 275
- Colenso (Rev. W.), a Maori-English Lexicon, 364
- Coles (Alfred C.), the Blood: how to Examine and Diagnose its Diseases, 269
- Colin (E.), Destruction of the French Observatory in Madagascar, 259
- Collins (J. R.), Blurring Aberration in the Telescope, 88, 280
- Collinson (R. W.), Lauronic Acid, 23
- Colloids, the Compressibility of, C. Barus, 634
- Colnaghi (Sir D.), Ten Pound Island (Massachusetts) Fish Hatchery, 489
- Coloration, Assimilative, W. L. Distant, 525
- Coloration of Insects, Observations on the, Brunner von Wattenwyl, 193
- Colour Bands, Flow of Water shown by, Prof. Osborne Reynolds, F.R.S., 467; Prof. H. S. Hele-Shaw, 467
- Colour Photography, Krömsköp, Frederick Ives, 124
- Colours of Natural Waters, Prof. W. Spring, 580
- Colours, Warning, Mimicry and, Frank Finn, 279
- Comets: Comet Perrine (March 19), 19, 42, 60; Dr. Berberich, 400; Comet Perrine (June 14), 232, 280; Tempel's Comet, 1867 II., M. Gautier, 19; Comet Tempel (1866?), Herr Pechuele, 490; Comets Tempel (1866) and Perrine-Chofardet, 515; Encke's Comet, 160; the Movement of Encke's Comet, Prof. Reginald A. Fessenden, 520; Comets now Visible, 181, 210; Cometary News, 258; Wolf's Comet, 330, 356, 375; Periodic Comets, M. Schulhof, 526; Comet Brooks, 630
- Commission Bill, the University of London, 176
- Companions of Argon, Prof. William Ramsay, F.R.S., and Morris W. Travers, 182
- Compositors and Readers, Rules for, Montague Browne, 368
- Compressibility of Colloids, the, C. Barus, 634
- Conference on the International Catalogue of Scientific Literature, 578
- Conference, International, on Scientific Literature, Report of, 623
- Congress at Dieppe, International Sea Fisheries, 461, 511
- Congress of Sanitary Institute, 522
- Conics, Elementary, Dr. W. H. Besant, 318
- Conics, Examples in Analytical, for Beginners, W. M. Baker, 318
- Constant of Aberration and Stellar Magnitudes, Prof. Doberck, 258
- Convection Currents: the supposed Photographs of Currents from Human Body, Dr. A. Guébbard, 207
- Conway (Sir W. M.), Ascent of Yllimani, 513
- Cook (Prof. A. J.), the Nature and Habits of Pliny's Solpuga, 247
- Cook (Dr. E. H.), on the Action of Electricity on Plants, 533
- Cooke (W. E.), Severe Storm off N.W. Australia, 178
- Cooled Metal, Transference of Heat in, Henry Bourget, 200, 521; Albert T. Bartlett, 411; John Stone Stone, 596
- Coote (Mr.), on Alkaline Chlorates and Sulphates of the Heavy Metals, 556
- Copeland (Prof.), the Total Solar Eclipse of January 21, 1898, 311
- Corals, the Stramberg, Maria M. Ogilvie, Dr. J. W. Gregory, 282
- Corals, the Building of Atolls, Stanley Gardiner, 425
- Corbino (O. M.), New Action of Light traversing Metallic Vapours in Magnetic Field, 635
- Cornelius (H.), Psychologie als Erfahrungswissenschaft, 316
- Cornish (Vaughan), Sea-Beaches and Sandbanks, 42
- Corundum in Ontario, 256
- Cos (F.), Meteorological Observations at Madrid, 1860-94, 230
- Costa (A.), Reciprocal Action of Animal Toxins, 303
- Coupin (H.), Toxicity of Copper Salts for Wheat, 492
- Couriot (H.), Mixture of Marsh Gas and Air not Exploded by Glowing Filaments of Incandescent Lamp, 635
- Courmont (P.), Experiments with Anti-streptococci Serum, 278; Clinical Value of Agglutination of Koch's Bacillus by Human Serum, 540
- Cox (S. Herbert), Prospecting for Minerals, 7
- Crab in Mythology, the, Prof. D'Arcy Thompson, 143
- Craniology: Study of Hawaiian Skulls, Dr. Harrison Allen, 230
- Crannog on the Clyde, Discovery of a, 488; W. A. Donnelly, 488
- Crannoges in Estuaries, W. F. Sinclair, 521; R. J. Ussher, 571
- Crawford (Robert), South American Sketches, 198
- Crawshay (Rosemary), Distant Thunderstorms affecting Flowers, 390
- Creation, the Process of, Discovered, James Dunbar, 8
- Creation Records Discovered in Egypt, G. St. Clair, 315
- Crehore (Prof. A. C.), High Speed Telegraph Transmission by Means of Alternators, 211
- Crew (Prof. Henry), Latitude Variation in a Rigid Earth, 232
- Crofts (J. H.), Molecular Weights of Permanganates, Perchlorates, and Periodates in Solution, 94
- Crofts (Mr.), on the Oxidation of Glucose, 557
- Cromer, Iridescent Surf at, Constance F. Gordon Cumming, 174
- Cromlachs near Dublin, Astronomical Destination of, Prof. J. P. O'Reilly, 61
- Crookes (Sir William, F.R.S.), Position of Helium, Argon and Krypton in Scheme of Elements, 383; Helium in the Atmosphere, 570; Inaugural Address at the Meeting of the British Association at Bristol, 438; Monium, 556
- Crookes' Tube, Circulation of Residual Gaseous Matter in, A. A. C. Swinton, 119
- Cross (C. F.), Action of Hydrogen Peroxide on Carbohydrates in Presence of Iron, 94; Carbohydrates of Barley-Straw, 23
- Cross (Whitman), Geology of the Denver Basin in Colorado, 82
- Crova (A.), an Absolute Actinometer, 95
- Crustacea: Plankton Studies on Lake Mendota, Dr. E. A. Birge, 259; Capture of Curious Crustaceans, E. L. J. Ridsdale, 597
- Crystal Palace, Photography at the, 14
- Crystallography: a Compensated Interference Dilatometer, A. E. Tutton, 118; a New Dilatometer, Mr. Tutton, 311; the

- Physical Properties of Crystals, Dr. Woldemar Voigt, W. H. and G. Chisholm Young, 99
- Cuba, the Climate of, Dr. Phillips, 256
- Cuckoo, a Late, Mrs. E. Hubbard, 487
- Cumming (Constance F. Gordon), Iridescent Surf at Cromer, 174
- Cummins (Surg.-Captain), Food of the Uropoda, 189; Botany of Ashanti, 208
- Cuneiform Inscriptions of Western Asia, the, L. W. King, 341
- Cunningham (Colonel Allen), Report on the Work of the Committee for Calculating Tables of certain Mathematical Functions, 534
- Cunningham (J. T.), Organic Variations and their Interpretation, 593
- Curie (P.), a New Radio-Active Substance in Pitchblende, 312
- Curie (S.), a New Radio-Active Substance in Pitchblende, 312
- Curious Phenomenon, N. W. Thomas, 294
- Cyclists and Dust Bacteria, 254
- Cycloidal Curves and Envelopes, Instruments for Describing, Prof. Hele-Shaw, 61
- Cyclones, Navigation and, A. Fieron, 197
- Cyclones, Variation of Air Temperature in, Rev. M. Dechevrens, 301
- Cytology: the Present Position of some Cell Problems, Prof. J. B. Farmer, 63
- Czernik (M.), Mineral Hail in Russian Poland, 352
- Daisy, the Making of a, Eleanor Hughes-Gibb, 198
- Dale (Jonathan), Angling Days and an Angler's Books, 292
- Dalton's Law, Mr. W. N. Shaw on, 532
- Dammann (Dr. C.), the Wupper, 109
- Dances, Ceremonial, of the American Indians, 125
- Daniel (J.), *Explosifs Nitrés*, 4
- Dante's Ten Heavens, Edmond G. Gardner, N. Perini, 362
- Darwin (Francis, F.R.S.), Observations on Stomata, 212; Text-Book of Floral Biology, Dr. Paul Knuth, 434; the Knight-Darwin Law, 630
- Dassonville (M.), a New Trichophyton Production of Herpes in Horse, 359
- Davy (J. B.), Ingredients of Chinese Herbal Prescription, 255
- Dawkins (Prof. Boyd), on the Relation and Extension of the Franco-Belgian Coalfield to that of Kent and Somerset, 558
- Dawson (C.), Natural Gas in East Sussex, 189
- Dawson (W. Bell), Character and Progress of the Tides in the Gulf and River St. Lawrence as ascertained by Simultaneous Observations with Self-Registering Tide-Gauges, 260
- Deafness: Dr. H. W. Meyer and Adenoid Growths, 625
- Deas (Lizzie), Flower Favourites, their Legends, Symbolism, and Significance, 8
- Death, Röntgen Rays as a Means of Certifying Death, 59
- Death, the Time of Day of, Signor Raseri, 523
- Death among Lower Organisms, Signor A. Andres, 628
- Dechevrens (Rev. M.), Variations of Air Temperature in Cyclones, 301
- Décombe (L.), Constitution of Explosive Spark in Dielectric Liquid, 23
- Deep-Sea Expedition in the Steamship *Valdivia*, German, 346
- Deer Park in the Catskills, the, 487
- Defacqz (Ed.), New Iodide of Tungsten, 612
- Déherain (P. P.), Method of Reducing Losses of Ammonia in Manufacture of Farm Manure, 71
- Delages (Prof. Yves), *Traité de Zoologie Concrète*, 25; Position of Sponges in Animal Kingdom, 425
- Delezenne (Prof.), Is the Congestion of the Limbs and Skin Produced in Asphyxia due to the Active Dilatation of the Blood Vessels of those parts, or Mechanical Dilatation by the Blood driven out of the Visceral Blood Vessels?, 486
- Demontzey (M.), Death of, 16
- Demoor (Dr. J.), on the Changes in the Form of the Neurons of the Cortex Cerebri under Various Conditions of Rest and Excitation, 481
- Dendritic Patterns caused by Evaporation, Prof. G. H. Bryan, F.R.S., 174; Catherine A. Raisin, 224
- Dendy (Prof. A.), the Development of the Tuatara Lizard, 609
- Denigès (G.), New Reaction of Tertiary Alcohols and their Isomers, 47; Combination of Fatty Ketones with Mercurial Sulphate, 240
- Denning (W. F.), the Red Spot on Jupiter and its suspected Identity with Previous Markings, 331; the Recent Perseid Meteoric Shower, 371; Minor Meteoric Radiants, 424; Large Meteors in 1897-1898, 583
- Density, New Determination of the Earth's, Dr. C. Braun, 160
- Denver Basin in Colorado, Geology of the, S. F. Emmons, Whitman Cross, and G. H. Eldridge, 82
- Denys (Prof.), Experiments towards Distinguishing Distinct Species among the Leucocytes of Mammals, 486
- Deruyts (F.), Properties of Gauche Curves, 604
- Deslandres (H.), the Eclipsed and Un-Eclipsed Sun, 258; New Observations in Zeeman Phenomenon, 264; Motion of Stars in the Line of Sight, 490; an Aurora Borealis, 516
- Destruction of the French Observatory in Madagascar, E. Colin, 259
- Detmer (Dr. W.), Practical Plant Physiology, 592
- Devaux (H.), Lenticels, 96
- Devine (Mlle.), on the Results of Further Investigation of the Respiration of the Heart of the Tortoise, 481
- Devonshire (the Duke of), on University Extension, 260; Bill relating to Secondary Education, 324
- Dewar (Prof. J., F.R.S.), Liquid Hydrogen, 125, 199, 270, 319; Boiling Point and Density of Liquid Hydrogen, 189; Liquefaction of Hydrogen and Helium, 142; Metargon, 319
- Dex (M.), Proposed Balloon-Exploration of Africa, 399
- Diary, Notes from a, 1873-1881, Right Hon. Sir Mountstuart E. Grant Duff, 198
- Dibos (M.), Proposed Balloon Exploration of Africa, 399
- Dickson (G.), Oxidation of Charcoal by Nitric Acid, 238
- Dickson (H. N.), on the Connection between the Appearance of Mackerel and the Changes of Sea Temperature in Spring and Autumn, 584; on the Salinity and Temperature of the North Atlantic, 586
- Dickson (Dr. L. E.), Structure of Hypoabelian Groups, 431
- Dictionary of Bird Notes, a, C. L. Hett, 366
- Dierer (Dr. Karl), Palaeontology of Himalayas, 257
- Dieppe, International Sea Fisheries Congress at, 511
- Diesselhorst (H.), Conductivities of Electrolytes, 93
- Differential Equations, Partial, E. Goursat, 266
- Digestion, Effect of Mixed Diet on Salivary, Dr. W. A. Robertson, 311
- Digraphs, the Use of, F. A. Bather, 412
- Dilatometer, a Compensated Interference, A. E. Tutton, 118
- Dilatometer, a New, Mr. Tutton, 311
- Dina (Signor A.), Simple Method of Converting Alternating into Direct Current, 132
- Diseases of the Lungs, the, James Kingston Fowler and Rickman J. Godlee, 291
- Disinfecting Ship, a; the U.S. Steamship *Protector*, 488
- Distant (W. L.), Assimilative Coloration, 525
- Distillery Pollution, C. A. Stevenson, 319
- Distribution of Prepotency, the, Francis Galton, F.R.S., 246
- Dobbie's Horticultural Handbooks, 318
- Doberck (Prof.), Constant of Aberration and Stellar Magnitudes, 258
- Dock Capacity, Novel Plan of increasing, 582
- Dogmatism on the Moon and the Weather, 368
- Domestic Science, Lessons in, Ethel R. Lush, 173
- Domestic Science Readers, Vincent T. Murché, 8
- Donaldson (Mr.), Results of some Comparisons of the Output and Efficiency of a Secondary Cell (Tudor Type) when charged at constant current and constant electro-motive force respectively, 533
- Donegal, Flora of County, H. C. Hart, 615
- Donkin (Bryan), the Heat Efficiency of Steam Boilers, Land, Marine, and Locomotive, 543
- Donnan (Dr.), the Theory of the Hall Effect in a Binary Electrolyte, 215
- Donnelly (Sir J. F. D.), Wasp and Bee Stings, 435
- Donnelly (W. A.), Discovery of a Crannog on the Clyde, 488
- Douglas (James), Dr. T. S. Hunt, F.R.S., as a Chemist, 551
- Douglass (A. E.), the First Satellite of Jupiter, 210
- Douglas (Sir J. N., F.R.S.), Death of, 177
- Double and Multiple Southern Stars, Dr. T. J. J. See, 134
- Dove (Stuart), the Blue-Tongued Tasmanian Lizard as a Snake-Destroyer, 422
- Dragon of the Prime, a, 418
- Drawing, Machine, Thomas Jones and T. Gilbert Jones, 543
- Drawing, Mechanical, a Course in, John S. Reid, 8
- Dream, a Holiday, Potential Matter, Prof. Arthur Schuster, F.R.S., 367, 618
- Dreyer (Dr. J. L. E.), *Cœuvres complètes de Christiaan Huygens*, 361
- Drieberg (C.), Heavy Rainfalls, 78

- Drygalski (Erich von), Grönland-Expedition der Gesellschaft für Erdkunde zu Berlin, 1891-93, 413
- Dublin, Cromlechs near, Astronomical Destination of, Prof. J. P. O'Reilly, 61
- Dublin Royal Society, 47, 191, 464
- Duboin (André), Blue Glass with Chromium Base, 264
- Dubois (E.), the Brain of *Pithecanthropus erectus*, 427
- Dubois (M.), Electrical Resistance of Human Body, 216
- Dubois (P.), Function of Condenser in Induction Apparatus, 187
- Duckworth (Sir Dyce), the Harveian Oration, 602
- Ducretet (E.), Receiver for Hertzian Telegraphy without Wires, 47
- Ducru (O.), Determination of Arsenic in Antimony, 336
- Duerden (J. E.), the Fisheries of Jamaica, 158
- Dufet (H.), Recueil de Données Numériques Optique, 344
- Duff (Right Hon. Sir Mountstuart E. Grant), Notes from a Diary, 198
- Dumont (G.), Automobiles sur Rails, 495
- Dunbar (James), the Process of Creation Discovered, or the Self-evolution of the Earth and Universe by Natural Causes, 8
- Durchmusterung, the Northern, 42
- Durham (Mr.), the Tsetse Disease in Mammals, 426
- Durrant (R. G.), on Green Cobaltic Compounds, 556
- Durward (Arthur), Temperature Coefficients of certain Seasoned Hard Steel Magnets, 92
- Dust-Bacteria and Cyclists, 254
- Dynamics : Theoretical Mechanics : an Introductory Treatise on the Principles of Dynamics with Applications and Numerous Examples, A. E. H. Love, F.R.S., Prof. A. G. Greenhill, F.R.S., 169; the Mathematical Theory of the Top, Prof. Felix Klein, 244; Electrodynamics : the Direct Current Motor, C. A. Carus-Wilson, 366; Lord Kelvin on the Dynamical Theory of Refraction; Dispersion and Anomalous Dispersion, 546; the Dynamics of Impact, D. de Francesco, 582
- Earth, Rigid, Latitude Variation in a, Prof. Henry Crew, 232
- Earth and Mars, the Planet between, Herr G. Witt, 526
- Earth's Density, New Determination, Dr. C. Braun, 160
- Earth's Polar Axis, the Movement of the, 1890-0-1897-5, Prof. Albrecht, 42
- Earthquakes : Rainfall and Earthquake Periods, Prof. J. P. O'Reilly, 103; Earthquake in Italy, 206; Earthquakes of Pacific Coast, 1767-1897, Dr. E. S. Holden, 231; Earthquakes in Chile, 299
- Easterfield, (T. H.), Cannabinol, 238; Oxidation of Charcoal by Nitric Acid, 238
- Eaton (G. F.), Prehistoric Fauna of Block Island, 432
- Ebbing and Flowing Well at Newton Nottage, H. G. Madan, 45
- Ebbing and Flowing Wells, W. F. Sinclair, 52; F. R. Mallet, 104
- Ebers (Prof. Georg), Death of, 352; Obituary Notice of, 396
- Echinoderm Fauna of New Zealand, the, H. Farquhar, 636
- Echinoderms, Origin of, Prof. MacBride, 427
- Eclipse, the Total Solar, of January 21, 1898, Prof. Copeland, 311
- Eclipsed and Un-Eclipsed Sun, the, M. Deslandres, 258
- Edinburgh Mathematical Society, 167, 191
- Edinburgh Meeting of the British Medical Association, Dr. F. W. Tunnicliffe, 349
- Edinburgh Royal Society, 46, 143, 190, 239, 311, 335
- Edington (Dr.), Locust-Destroying Fungus, 354
- Edmed (F. G.), Oleic Acid and its Derivatives, I., 142
- Edmundson (T. W.), the Disruptive Discharge in Air and Liquid Dielectrics, 230
- Eder (Edwin), Apparatus exhibiting Peculiarities of Interference Fringes when formed between Silvered Surfaces, 62; Simple Interference Method of Calibrating a Spectrometer, 62; Simple Method of Reducing Prismatic Spectra, 119
- Education : University Education, Dr. Michael Foster, Sec. R.S., 283; a Minister of Education at Last, 324; the Board of Education Bill, 358; Rt. Hon. Arthur Balfour on Examinations, 634; Sir W. H. White on Engineering Education, 634; Gifts to Educational Institutions in United States, 634; Technical Education, Technical High Schools, a Comparison, Sir Philip Magnus, 52
- Edward (Robert), the Mechanical Engineer's Handy Office Companion, 318
- Eel in Open Sea, Léon Vaillant, 96
- Eel-Serum, the Toxicity of, and Further Studies on Immunity, Mrs. Percy Frankland, 369
- Effront (Jean), Action of Oxygen on Yeast, 384
- Egyptology : Prehistoric Egypt, Prof. W. M. Flinders Petrie, 31; Egyptian Native Remedies for Rabies, 301; Creation Records discovered in Egypt, G. St. Clair, 315; Death of Prof. George Ebers, 352; Obituary Notice of, 396
- Eldridge (G. H.), Geology of the Denver Basin in Colorado, 82
- Electricity : Thermo-Electric Electromotive Forces in Crystallised Bismuth, Louis Perrot, 23; Constitution of Explosive Spark in Dielectric Liquid, L. Décombe, 23; Electrical Impressions on Photographic Plates, A. S. Bates, 32; Figures produced on Photographic Plates by Electric Discharges, J. A. McClelland, 142; the Action of Electric Discharges on Photographic Plates, A. A. C. Swinton, 151; Improvements on Melloni Thermo-pile, Prof. H. Rubens, 39; Receiver for Hertzian Telegraphy without Wires, E. Ducretet, 47; Comparison of Hertzian Field in Air and Oil, Albert Turpain, 167; Resonators, M. Oudin, 167; Hertzian Oscillations arrested by Thin Metallic Envelope, E. Branly, 264; Stationary Hertzian Waves as studied with Use of Coherer, Prof. O. Murani, 552; Electric Light Wires as Telephonic Circuits, Rev. F. J. Jervis-Smith, F.R.S., 51; Electric Current Meter acting by Electrolysis, C. O. Bastian, 61; Kathode Ray Lamps, A. A. C. Swinton, 61; Light Nodes in Kathode Ray Bundle under Influence of Magnetic Field, E. Wiedemann and A. Wehnelt, 93; the Kathode Rays, P. Villard, 143; Kathode Fall in Potential of Gases, J. W. Capstick, 214; Behaviour of Kathode Rays parallel to Electric Force, P. Lenard, 491; the Dark Kathode Space, A. Wehnelt, 491; Circulation of Residual Gaseous Matter in Crookes' Tubes, A. A. C. Swinton, 61, 119, 627; a Crookes' Tube Revivable by Osmosis, P. Villard, 96; Series Dynamo Machines, Carl Kinsley, 72; New Form of Make and Break, C. T. Knipp, 92; Galvanometers, Prof. W. E. Ayrton and T. H. Mather, 93; Conductivities of Electrolytes, F. Kohlrausch, L. Holborn, and H. Diesselhorst, 93; a Property of Fluorescent Screens, P. Villard, 96; the Industrial Applications of Electro-Chemistry, Dr. Thos. Ewan, 112; Modifications in Quadrant Electrometer, J. Elster and H. Geitel, 117; Fluorescence and Actinogenicity, G. C. Schmidt, 117; the Theory of Sound, J. W. Strutt, Baron Rayleigh, F.R.S., 121; Infra-Electric Radiations, Prof. P. de Heen, 132; Simple Method of Converting Alternating into Direct Currents, Signor A. Dina, 132; Possibility of Deducing Magneto-Optic Phenomena from Direct Modification of Electro-dynamic Energy Function, J. G. Leatham, 142; Electro-physiology, W. Biedermann, 150; Recent Advances in Electro-physiology, Prof. Boruttan, 483; Electrical Response of Nerve to a Single Stimulus investigated with Capillary Electrometer, Prof. F. Gotch, F.R.S., and G. J. Burch, 166; the Complete Scheme of Electro-dynamic Equations of a Moving Material Medium, Joseph Larmor, F.R.S., 166; Attenuation of Electric Waves along Line of Negligible Leakage, E. H. Barton, 167; Diffusive Convection, A. Griffiths, 167; Electric Properties of Gases, Prof. E. Wiedemann and Dr. G. C. Schmidt, 180; Function of Condenser in Induction Apparatus, P. Dubois, 187; Potential Gradients at Electrodes discharged by X-Rays, C. D. Child, 187; Exploration of Stratification of the Electric Discharge in Geissler Tubes, H. V. Gill, 187; Aluminium as Electrode, Ernest Wilson, 188; Direct Measurements in Electromagnetic Units of Electricity, A. Blondlot, 191; Electrical Resistance of Steel, H. Le Chatelier, 191; the Theory of the Hall Effect in a Binary Electrolyte, Dr. Donnan, 215; Hall's Effect in Electrolytes, E. van Everdinger, jun., 288, 514; Action of Two Electro-Motors Coupled so as to rotate at Different Speeds, Prof. Carus-Wilson, 215; Influence of Tempering on Resistance of Steel, H. Le Chatelier, 216; Electrical Resistance of Human Body, M. Dubois, 216; First Stage Magnetism and Electricity, R. H. Jude, 222; the Disruptive Discharge in Air and Liquid Dielectrics, T. W. Edmundson, 230; the Becquerel Rays, O. M. Stewart, 230; the Potentiometer and its Adjuncts, W. Clark Fisher, Prof. A. Gray, F.R.S., 313; the Principles of Alternate Current Working, Alfred Hay, Prof. A. Gray, F.R.S., 313; Electric Wiring for the Use of Architects, Underwriters, and the Owners of Buildings, Russell Rob, Prof. A. Gray, F.R.S., 313; Electric Transmission of Water Power in Switzerland, 328; Electrolysis of Ethyl Potassium Diethoxysuccinate, Prof. Crum Brown and Dr. H. W. Bolam, 335; the Leidenfrost Drop, J. Stark, 335; Electromotive Behaviour of Chromium, W. Hittori, 335;

- Electrical Discharge from Kinetic Point of View, J. E. Moore, 335; the Weston Standard Cell, P. Kohnstamm and E. Cohen, 335; Thermophones, F. Braun, 335; Electric Discharge in Rarefied Gases, W. Wien, 335; Polarisation of Röntgen Rays, L. Graetz, 335; Electrical Resistance at Contacts of Two Discs of same Metal, E. Branly, 336; Velocity of Electrified Particles during Discharge by Ultra-Violet Light, H. Buisson, 336; the Electrical Resistance and Micro-Structure of Alloys, Saville Shaw, 356; a Five-Cellar Quadrant Electrometer, Prof. Haga, 360; Electrodynamics: the Direct Current Motor, C. A. Carus-Wilson, 366; Obituary Notice of Dr. John Hopkinson, F.R.S., 419; Influence of Electricity on Sedimentation of Turbulent Liquids, W. Spring, 422; Essai sur la Théorie des Machines Electriques à Influence, V. Schaffers, 466; an Introductory Course of Practical Magnetism and Electricity, J. Reginald Ashworth, 466; International Conference of Terrestrial Magnetism and Atmospheric Electricity, Opening Address by Prof. A. W. Rücker, Sec. R.S., President of the Conference, 473; Prof. A. D. Waller, F.R.S., on the Influence of Salts upon the Electromobility of Medullated Nerve, 482; Microscopic Observations of Coherers, L. Arons, 491; Electrolytic Solution of Platinum and Gold, M. Margules, 491; Canalisations Electriques, R. V. Picou, 519; Prof Chattock on Experiments to Determine the Velocity of Electricity in the Electric Wind, 533; Electrosynthesis, W. G. Mixer, 539; the Jungfrau Railway, 550; Nature of Discharges in Air and Gases, Prof. John Trowbridge, 604; on the Application of the Electric Motor to the Engineering Workshop, A. Siemens, H. H. Gibbings, and W. Geipel, 608; Magneto and Electric Currents, Prof. J. A. Fleming, 614; Photographing Lightning by Day, F. H. Glew, 627; Mixture of Marsh Gas and Air not exploded by Glowing Filaments of Incandescent Lamp, H. Couriot and J. Meunier, 635; Variation of Dielectric Constants with Temperature, H. Pellat and P. Sacerdote, 635; See also Section A, British Association
- Elephant, the Strangling of an, 115
- Ellis (William, F.R.S.), Sun-spot Period, 61; Magnetism and Sun-spots, 78
- Elsden (J. V.), Applied Geology, 615
- Elster (J.), Modification in Quadrant Electrometer, 117
- Embryos, Hybernating Reptilian, G. A. Boulenger, F.R.S., 619
- Emery (Dr. C. E.), Death of, 206
- Emmons (S. F.), Geology of the Denver Basin in Colorado, 82
- Encke's Comet, 160; the Movement of, Prof. Reginald A. Fessenden, 520
- Endosperm, on the Depletion of the, of *Hordeum vulgare* during Germination, Horace T. Brown, F.R.S., and F. Escombe, 331
- Energy, the Doctrine of, a Theory of Reality, 269
- Engineering: Experiments on the Working of Gas Engines, Prof. Frederick W. Burstall, 21; Death of Sir Robert Rawlinson, 131; Science in the Theatre, Edwin O. Sachs, 162; Death of Sir J. N. Douglas, F.R.S., 177; Death of Dr. C. E. Emery, 206; the Oldest known Steam Engine, 255; Machine Drawing, Thomas Jones and T. Gilbert Jones, 543; Novel Plan of increasing Dock Capacity, 582; on the Application of the Electric Motor to the Engineering Workshop, A. Siemens, H. H. Gibbings, and W. Geipel, 608; Engineering Education, Sir W. H. White, 634
- English Lexicon, a Maori, Rev. W. Colenso, 364
- Enock (Fred), Aquatic Hymenopteron, 175
- Entomology: Entomological Society, 71, 189, 611; Horn-Feeding Larvæ, W. H. McCorquodale, 140; Capt. G. G. Traherne, R.A., 521; Larvæ in Antelope Horns, Dr. Henry Strachan, 468; W. H. McCorquodale, 468; Maggots in Sheep's Horns, W. H. McCorquodale, 546; Death of W. M. Maskell, 108; Varieties of *Abraxas grossulariata*, Rev. J. Greene, 110; Drinking Habits of Butterflies and Moths, T. W. Tutt, 110; Obituary Notice of Osbert Salvin, F.R.S., 128; Food of the Uropoda, Surgeon-Captain Cummins, 189; Anatomy of *Cephalodiscus dodecalophus*, Dr. A. T. Masterman, 190; Observations on the Coloration of Insects, Brunner von Wattenwyl, 193; Lead-boring Insects, Dr. L. O. Howard, 230; a Text-Book of Entomology, including the Anatomy, Embryology and Metamorphoses of Insects, for Use in Agricultural and Technical Schools and Colleges, Prof. Alpheus S. Packard, 244; Gigantic Centipede in Zoological Gardens, 326; South African Coleoptera, L. Péringuey, 423; the Classification of Insects, Dr. David Sharp, 425; Evolution of Colour in Lepidoptera, M. C. Piepers, 425; Relation of Colours of Lepidoptera Chrysalids to Colour of Environment, M. Bordage, 425; Traces of Six Primitive Segments in Insects' Heads, Ch. Janet, 426; Handbuch der Blütenbiologie unter zugrundelegung von Hermann Müller's Werk, "Die Befruchtung der Blumen durch Insekten," Dr. Paul Knuth, Francis Darwin, F.R.S., 434; a New Coccus, *Echinospira ventricosa*, L. Leger, 516; Individual Wing-Variation in Lepidoptera, W. L. W. Field, 524; *Precis octavia-natalensis* and *P. Sesamus* Seasonal Forms of same Species, G. A. K. Marshall, 611; Colouring of Pupæ of *Papilio machaon* and *P. napi* derived from Surroundings, F. Merrifield, 611; *Asagena phalerata*, H. W. Freston, 635
- Epidemics among Mice, W. F. Kirby, 223
- Equations, Partial, Differential, E. Goursat, 266
- Eristalis tenax* in India, the Occurrence of, Notes on the Bugonia-Superstitions, Kumagusu Minakata, 101
- Errera (Prof. G.), Asymmetry and Vitalism, 616; Theoretical Calculation of Osmotic Optimum, 633; Structure of Yeast Cell, 633; Process for Preserving Flowers in Natural Colours, J. M. Hillier, 208; Errors, the Theory of; a Theory of Recurring Means, C. Lagrange, 487
- Eruptions, Geyser, some Conditions affecting, T. A. Jaggard, jun., 261
- Eschenhagen (Dr.), on the Magnetic and Electrolytic Actions of Electric Railways, 533
- Escombe (F.), on the Depletion of the Endosperm of *Hordeum vulgare* during Germination, 331
- Espin (Rev. T. E.), a Catalogue of Fourth-Type Stars, 401
- Essays on Museums and other Subjects connected with Natural History, Sir William Henry Flower, K.C.B., and Prof. R. Meldola, F.R.S., 217
- Essex, the Mammals, Reptiles and Fishes of, H. Laver, 242
- Estuaries, Crannoges in, W. F. Sinclair, 521; R. J. Ussher, 571
- Ether, the Jelly Theory of the, C. Barus, 634
- Etheridge (R.), on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 558
- Ethic, Moral Sense and, Dr. St. George Mivart, 294
- Ethnology: Death of Prof. F. Müller, 108; the Atoll of Funafuti, Ellice Group: its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley of the Australian Museum of Sydney, N.S.W., 221; Cast Metal Work from Benin, 224
- Etiology and Prevention of Malarial Fever, the, Dr. E. Klein, F.R.S., 175
- Etymology: the Use of Digraphs, F. A. Bather, 412
- Euclid on Balances and the Lever, an Obsolete Book of, Dr. G. Vailati, 207
- Euclid, a Simplified, W. W. Cheriton, 150
- Euclid's Geometry? is Continuity of Space necessary to, W. M. Strong, 310
- Euphrates, Nippur; or, Explorations and Adventures on the, J. P. Peters, 243
- Europe, the Tailless Batrachians of, G. A. Boulenger, F.R.S., 567
- Evans (Sir John), on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 559
- Evaporation, Dendritic Patterns caused by, Prof. G. H. Bryan, F.R.S., 174; Catherine A. Raisin, 224
- Everdingen (E. van, jun.), Hall's Effect in Electrolytes, 288, 514
- Evershed (J.), Solar Radiation, 619
- Evolution: the Origin and Growth of the Moral Instinct, Alexander Sutherland, 241; Mathematical Contributions to Theory of Evolution, V., Reconstruction of Stature of Pre-historic Races, Karl Pearson, F.R.S., 286; the Distribution of Prepotency, Prof. Karl Pearson, F.R.S., 292; Moral Sense and Ethic, Dr. St. George Mivart, F.R.S., 294; the Origin and Significance of Spines, C. E. Beecher, 335, 539, 635; the Descent of Man, Prof. Haeckel, 427; the Brain of *Pithecanthropus erectus*, E. Dubois, 427; Organic Variations and their Interpretation, J. T. Cunningham, 593; Rev. George Henslow, 594; Prof. W. F. R. Weldon, F.R.S., 595; Walter Garstang, 619
- Ewan (Dr. Thos.), the Industrial Applications of Electro-Chemistry, 112
- Examinations, Right Hon. Arthur Balfour on, 634
- Examinations, Science and Art, 435
- Expedition, the German Polar, 397
- Experimental Physics, Eduard Riecke, Prof. A. Gray, F.R.S., 566
- Explosifs Nitrés*, J. Daniel, 4

- Faby (C.), Method of Determining Order of Interference Fringe of High Order, 143
- Fairbanks (Arthur), the First Philosophers of Greece, 386
- Falconry, Hints on the Management of Hawks, J. E. Harting, 122
- Farmer (Prof. J. B.): the Present Position of some Cell Problems, 63; Action of Anæsthetics on Protoplasm, 93; on the Use of Methylene Blue as a Means of Investigating Respiration in Plants, 185, 215; Obituary Notice of Ferdinand Cohn, 275
- Farquhar (H.), the Echinoderm Fauna of New Zealand, 636
- Fat Transformation by Direct Oxidation, M. Hanriot, 635
- Fauna of British India, the, W. T. Blanford, 195
- Fauna of British India, the Flora and, 250
- Fauna and Flora of the Pamir, the, A. W. Alcock, 493
- Fauna, the Marine, in Lake Tanganyika, and the Advisability of Further Exploration in the Great African Lakes, J. E. S. Moore, 404
- Fellowships for Research, Prof. A. Gray, F.R.S., 600
- Fenton (H. J. H.): Action of Hydrogen Bromide on Carbohydrates, 189; on the Oxidation of Polyhydric Alcohols, 557
- Ferguson (Mr.), Record broken for High Kite Flight, 513
- Fergusson (R. Menzies), a Student of Nature, 543
- Ferns: Alternation of Generations in Thallophyta, Prof. Klebs, 632; Malayan Fern *Matonia*, A. C. Seward, 633
- Féry (C.), New Method of Determining Mechanical Equivalent of Heat, 119; a New Standard of Light, 23
- Fessenden (Prof. Reginald A.), the Movement of Encke's Comet, 520
- Fever, Malarial, the Etiology and Prevention of, Dr. E. Klein, F.R.S., 175
- Fewkes (Dr. J. Walter): Sun Worship by Tusayan Indians, 111; Tusayan Kacinas, 126; Tusayan Snake Ceremonies, 127; Human Effigy Vase from Arizona, 301
- Field (W. L. W.), Individual Wing-Variation in Lepidoptera, 524
- Fieron (A.), Méthode pour Abréger les Traversées en Utilisant les Perturbations de l'Atmosphère, 197
- Fiji Rubber, 302
- Finn (F.), Mimicry and Warning Colours, 88, 279; the Habits of Indian Birds, 208
- Fischer (Dr. Alfred), Vorlesungen über Bacterien, 76
- Fisher (W. Clark), the Potentiometer and its Adjuncts, 313
- Fishes: the Transport of Live Fish, D. O'Connor, 125; the Fisheries of Jamaica, J. E. Duerden, 158; the Mammals, Reptiles, and Fishes of Essex, H. Laver, 242; the Life-history of the Salmon, 280; the Memory of Fishes, Prof. W. C. McIntosh, 422; International Sea Fisheries Congress at Dieppe, 461, 511
- FitzGerald (Prof. Geo. Fras., F.R.S.), Chance or Vitalism, 545
- Fitzgerald (W. W. A.), Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, 6
- Fizeau Interference Dilatometer, a Compensated, A. E. Tutton, 118
- Flammarion (M. Camille), Sunspot Periods and Natural Phenomena, 134
- Flatau (J.), New Method of Separating Geraniol and Citronellol, 191; Acids of Essential Oils of Geranium, 240
- Fleming (Dr. George), the Wanton Mutilation of Animals, 605
- Fleming (Prof. J. A.), on the Magnetic and Electrolytic Actions of Electric Railways, 533; Magnets and Electric Currents, 614
- Fleming (Mrs.), Stars having Peculiar Spectra, 258
- Fletcher (W. M.), on the Methods employed in his Investigation on the CO₂ Discharge of Excised Tissues, 481
- "Flicker," T. C. Porter, 188
- Flint Implements, Henry Lewis, W. J. L. Abbott, 16
- Flora of the Amboy Clays, the, John Strong Newberry, 81
- Flora of County Donegal, H. C. Hart, 615
- Flora and Fauna of British India, the, 250
- Flora of Perthshire, the, Dr. F. Buchanan White, 124
- Flow of Water, Prof. H. Hele-Shaw, 34, 520
- Flow of Water shown by Colour Bands, Prof. Osborne Reynolds, F.R.S., 467; Prof. H. Hele-Shaw, 467
- Flower (Sir William Henry, K.C.B.), Essays on Museums and other Subjects connected with Natural History, 217
- Flower Favourites, their Legends, Symbolism, and Significance, Lizzie Deas, 8
- Flowers, Distant Thunderstorms affecting, Rosemary Crawshaw, 390
- Flowing Wells, Ebbing and, H. G. Madan, 45; W. F. Sinclair, 52; F. R. Mallet, 104
- Fluorescent Screens, a Property of, P. Villard, 96
- Flusin (G.), Osmosis of Liquids through Vulcanised Rubber, 120
- Folk-Lore: Flower Favourites, their Legends, Symbolism, and Significance, Lizzie Deas, 8; Notes on the Bugonia Superstitions, the Occurrence of *Eristalis tenax* in India, Kumagasa Minakata, 101
- Folk Medicine in Ancient India, Dr. M. Winternitz, 233
- Food, Artificial, Dr. Sidney Williamson, 368
- Food Supply, Robert Bruce, 245
- Forcrand (M. de), the Oxides of Sodium, 432
- Forel (F. A.), Water-circulation in Rhône Glacier, 635
- Forestry, Proposed Model State Forest in Scotland, 277; Forestry in Cape Colony, D. E. Hutchins, 605; Anti-Tidal Protective Coast Plantation in Japan, Dr. Seiroku Honda, 627
- Forster (M. O.), Isomeric Bornylamine, 23
- Fortey (E. C.), Hexamethylene and its Derivatives, 23
- Fossils: Prof. O. C. Marsh on the Comparative Value of Different Kinds of Fossils in Determining Geological Age, 558; Anatomy of Coal-Measure Plants, Dr. Scott, 633; Malayan Fern *Matonia*, A. C. Seward, 633
- Foster (Dr. Le Neve, F.R.S.), the Causes of the Snaefell Lead Mine Accident, 178; Mining Accidents in 1897, 461
- Foster (Dr. Michael, Sec. R.S.), University Education, 283; the Scientific Memoirs of Thomas Henry Huxley, 613
- Fourier's Series, Prof. Albert A. Michelson, 544; A. E. H. Love, F.R.S., 569
- Fourth-Type Stars, a Catalogue of, Rev. T. E. Espin, 401
- Fowler (James Kingston), the Diseases of the Lungs, 291
- France: France and International Time, 60; Destruction of the French Observatory in Madagascar, E. Colin, 259; French Match Manufactories, Dr. T. Oliver, 327; the French Astronomical Society, 356
- Francesco (D. de), the Dynamics of Impact, 582
- Franchimont (Prof.), Action of Sulphuric Acid of 35-40 % on Acid Aliphatic and Neutral Nitramines and their Isomers, 47
- Frankland (Prof. Percy, F.R.S.), a Life of Pasteur, 290; an Additional Photographic Action, that of Bacteria, 557
- Frankland (Mrs. Percy), the Bacterial Character of Calf Lymph, 44; a Life of Pasteur, 290; the Toxicity of Eel-serum and Further Studies on Immunity, 369
- Franks (G. F.), *Globigerina*-Marls of Barbados, 190
- Fraser (Prof. F. R.), Bile of Venomous Serpents a most Powerful Antidote against Snake Venom, 461
- Fredericq (Léon), the Physiological Value of Salt, 462
- Freston (H. W.), *Asagena phalerata*, 635
- Frey (Prof. V.), on the Adequate Stimulation of Touch Nerves, 485
- Frog taken out of a Snake, Live, Rose Haig Thomas, 367; H. Ling Roth, 368
- Frogs: Climbing Habit in, 111; Air and Water as Factors in Food of Frogs, S. Jourdain, 612
- Fromme (C.), Magnetic After-Effect, 187
- Fron (George), Anatomical Structure of Beetroot Stem, 492; Cause of Spiral Structure of Chenopodiaceæ Roots, 635
- Frost (Rev. Percival, F.R.S.), Death of, 131
- Funafuti, the Atoll of, Ellice Group: its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley of the Australian Museum, Sydney, N.S.W., 221
- Future Rainfall, 30
- Gaedicke (J.), Der Gummidruck, 343
- Galt (Dr. A.), on the Heat of Combination of Metals in the Formation of Alloys, 532
- Galton (Francis, F.R.S.), the Distribution of Prepotency, 246; on Photographic Records of Pedigree Stock, 584
- Galvanometers, Prof. W. E. Ayrton and T. Mather, 93
- Gannett (Henry), the Geography of the United States, 497
- Garbett (E. L.), the Moon's Course, 571
- Garden-Making (L. H. Bailey), 290
- Gardiner (Stanley), the Building of Atolls, 425
- Gardner (Edmond G.), Dante's Ten Heavens, 362
- Gardner (J. A.), Halogen Derivatives of Fenchene, 238; Oxidation of Fenchone, 238
- Garstang (W.), on the Races and Migrations of the Mackerel, 584; Organic Variations and their Interpretation, 619
- Gas Engines, Experiments on the Working of, Prof. Frederick W. Burstall, 21
- Gas, Water; Opinion of Public Control Committee of London County Council, 276

- Gases, Solfatara, Prof. R. Nasimi, F. Anderlini, and R. Salvadori, 269
- Gases in Vacuum Tubes, Luminosity of, 463
- Gautier (A.), Causes of Uncertainty in Estimating Carbonic Acid and Water Vapour, 95; Method of Detecting and Estimating small amounts of Carbon Monoxide in Air in presence of Traces of Hydrocarbons, 71
- Gautier (M.), Tempel's Comet, 19
- Geddes (Prof. Patrick), on an Experiment in the Practical Teaching of Geography about to be tried in Edinburgh, 586
- Geikie (Sir Archibald), Scenery and Literature, 179
- Geikie (Prof. James, F.R.S.), the Berlin Geographical Society's Greenland Expedition, Erich von Drygalski, 413
- Geipel (W.), on the Application of the Electric Motor to the Engineering Workshop, 608
- Geitel (H.), Modifications in Quadrant Electrometer, 117
- Genvesse (P.), Phenyl-Phosphoric and Phenylene Phosphoric Acids, 612
- Geodetic Astronomy, a Text-book of, John F. Hayford, 543
- Geography: Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, W. W. A. Fitzgerald, 6; Geographical Society Medals and Awards, 38; the Lob-Nor Controversy, P. K. Kozloff, 41; Sea Beaches and Sandbanks, Vaughan Cornish, 42; Vasco Da Gama, Sir Clements R. Markham, F.R.S., 67; a Northern Highway of the Tzar, Aubyn Trevor-Battye, 75; the Wupper River, Dr. C. Dammann, 109; Geographical Notes on Central and South China, 133; the Coasts of the Arctic Ocean, Dr. K. H. H. Kish, 278; Five Years in Siam, from 1891 to 1896, H. Warington Smyth, Dr. Hugh Robert Mill, 322; Through Unknown Tibet, Captain M. S. Wellby, 347; Progressive Increase of Po Delta, Prof. Marinelli, 353; Volume of Amazon River at Obydos, Dr. Friedrich Katzer, 399; a School Geography, George Bird, 411; Grönland-Expedition der Gesellschaft für Erdkunde zu Berlin 1891-93, Erich von Drygalski, Prof. James Geikie, F.R.S., 413; the Old Beds of the Amu-Daria, 430; the Geography of the United States, Henry Gannett, Dr. Hugh Robert Mill, 497; Papaguera, W. J. McGee, 525; the Adochidarja Gulf, 525; Memoirs of Caucasian Branch of Russian Society, 539; Northward over the "Great Ice," Robert E. Peary, Dr. Hugh Robert Mill, 589; Death of Don F. C. de Portugal, 626
- Geology: Death of Dr. K. L. F. von Sandberger, 16; Petro-liferous Sands and Mud Volcanoes in Burma, Dr. Fritz Noetling, 20; Maryland Geological Survey, 29; Iowa Geological Survey, 29; Geological Society, 45, 71, 141, 189, 239; Ebbing and Flowing Well at Newton Nottage, H. G. Madan, 45; Ebbing and Flowing Wells, W. F. Sinclair, 52; F. R. Mallet, 104; the Auriferous Conglomerates of Gold Coast Colony, T. B. F. Sam, 46; Death of W. C. Lucy, 57; the Earth's Age, J. G. Goodchild, 59; Discovery of Crater of Mesozoic Age in Pennsylvania by E. Goldsmith, 59; the Petrification of Fossil Bones, E. Goldsmith, 59; Carboniferous Limestone of Country round Llandudno, G. H. Morton, 71; Monographs of the United States Geological Survey, 81; the Glacial Lake Agassiz, Warren Upham, 81; the Flora of the Amboy Clays, John Strong Newberry, 81; Geology of the Denver Basin in Colorado, S. F. Emmons, Whitman Cross and G. H. Eldridge, 82; the Marquette Iron-bearing District of Michigan, C. R. van Hise and W. S. Bayley, 82; Death of Edward Wilson, 85; Obsidian Buttons in Australia, 109; Lava Flows of California, F. L. Ransome, 117; New Jurassic Vertebrates from Wyoming, W. C. Knight, 117; Huge Gypsum Boulder, T. M. Reade, 132; Garnet Actinolite Schists on South Side of St. Gothard, Prof. Bonney, F.R.S., 141; Volcanic Series in Malvern Hills, H. D. Acland, 142; Orthoclase as Gangue Mineral in Fissure Vein, W. Lindgren, 187; Natural Gas in East Sussex, C. Dawson, 189; Dr. G. T. Hewitt, 190; High Level Gravels in Berkshire and Oxfordshire, O. A. Shrubsole, 190; *Globigerina*-Marls of Barbados, G. F. Franks and Prof. J. B. Harrison, 190; Post-Glacial Beds exposed in cutting of New Bruges Canal, T. M. Reade, 239; High Level Marine Drift at Colwyn Bay, T. M. Reade, 239; Geology of Franz Josef Land, Dr. R. Koettlitz, 239; Corallian Rocks of Upware, C. B. Wedd, 239; Glaciers of Russia in 1896, Prof. Mushketoff, 256; Indian Palaeontology, Dr. Fritz Noetling, 257; Dr. Carl Diener, 257; Geological History of Recent British Flora, Clement Reid, 278; Death of Prof. James Hall, 351; Obituary Notice of, 372; Death of M. Pomel, 373; the Inter-glacial Submergence of Great Britain, H. Munthe, 374; a Yorkshire Moor, Prof. L. C. Miall, F.R.S., 377, 401; Iowa Geological Survey, 389; Glaciation of North-Central Canada, J. B. Tyrrell, 399; a Dragon of the Prime, 418; the Old Birds of the Amu-Daria, 430; Report on the Natural History Results of the Pamir Boundary Commission, A. W. Alcock, 493; Death of Mr. de Windt, 513; Geology for Beginners, W. W. Watts, 518; Purple Patches, F. Southerden, 521; the Work of Prof. O. M. Torell, 603; Applied Geology, J. V. Elsdon, Part I., 615; Eolian Origin of Loess, C. R. Keys, 634; See also Section C, British Association
- Geometry: Ludwig Otto Hesse's *Gesammelte Werke* herausgegeben von der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften, 124; Is Continuity of Space necessary to Euclid's Geometry? W. M. Strong, 310
- George (George), Practical Organic Chemistry, 245
- Gepp (A.), Structures of *Dendroceros*, 46
- Germany: the Wupper River, Dr. C. Dammann, 109; Chemical Works in Germany, 256; German Deep-sea Expedition in the Steamship *Vaidavia*, 346; the German Polar Expedition, 397
- Germination, on the Depletion of the Endosperm of *Hordeum vulgare* during, Horace T. Brown, F.R.S., and F. Escombe, 331
- Gestation, the Span of, and the Cause of Birth, Dr. John Beard and Dr. Arthur Robinson, 173
- Geyser Eruptions, some Conditions affecting, T. A. Jagger, jun., 261
- Ghost-dance Religion, the, and the Sioux Outbreak of 1890, James Mooney, 125
- Gibbins (H. H.), on the Application of the Electric Motor to the Engineering Workshop, 608
- Gibbeli (Dr. C. G.), Death of, 603
- Gifford (J. W.), on Lenses, not of Glass, 532
- Gilchrist (J. D. F.), Trout Acclimatisation in Cape Colony, 628
- Gill (H. V.), Explanation of Stratification of the Electric Discharge in Geissler Tubes, 187
- Gill (Dr.), on Sir John Herschel, 356
- Giraffe, the Senegal, 277; Death of, 373
- Glacial Lake Agassiz, the, Warren Upham, 81
- Glaciation of North Central Canada, J. B. Tyrrell, 399
- Glacier, Rhône, Water Circulation in, F. A. Forel, 635
- Glaciers of Russia in 1896, Prof. Mushketoff, 256
- Glanville (E. E.), Death of, 421
- Glass Blowing and Working, Thomas Bolas, 101
- Glass, Blue, with Chromium Base, André Duboin, 264
- Glazebrook (R. T., F.R.S.), James Clerk Maxwell and Modern Physics, 219
- Glycogen, Bouchard's Theory of Transformation of Fat into, Daniel Bertholet, 612
- Glyptic and Graphic Art applied to Palaeontology, 392
- Goat, the Angora, and a Paper on the Ostrich, S. C. Cronwright Scheiner, 314
- Godfrey (C.), Röntgen Rays and Ordinary Light, 142
- Godfrey (F. R.), Why the New Zealand Kea attacks Sheep, 110
- Godlee (Rickman J.), the Diseases of the Lungs, 291
- Goebel (Dr.), Organographie der Pflanzen, 74
- Goitre, the Hematozoa of, E. Grosset, 264
- Gold in British Guiana, 352
- Goldsmith (E.), Discovery of Crater of Mesozoic Age in Pennsylvania, by, 59; the Petrification of Fossil Bones, 59
- Goodchild (J. G.), the Earth's Age, 59
- Gordon (Dr. Samuel), Death of, 16
- Gostling (Mildred), Action of Hydrogen Bromide on Carbohydrates, 189
- Gotch (Prof. F., F.R.S.), Electrical Response of Nerve to a Single Stimulus investigated with Capillary Electrometer, 166; Photographs of the Electrical Response of Nerve to Excitation, 483
- Göttingen Royal Society of Sciences, 360, 540
- Gottlieb (Prof.), Examination of the Muscle of Dogs which had been Bled to Death, 484
- Gouirand (G.), the Adherence of Copper Washes Used to Destroy Vine-Parasites, 336
- Goursat (E.), Leçons sur l'intégration des Équations aux dérivées partielles du Second ordre à deux Variables Indépendantes, 266
- Goutal (M.), Silicon and Chromium in Steels, 47

- Graetz (L.), Polarisation of Röntgen Rays, 335
 Granger (Albert), Production of Tungsten Blue, 287; Influence of Chemical Composition of Glass on its Coefficient of Expansion, 581
 Grating Spectroscope, a New Form of, Prof. Michelson, 280
 Gravity: Local Variations in Intensity near Mount Etna, and in Eastern Sicily generally, A. Ricco, 354
 Gray (Prof. A., F.R.S.), James Clerk Maxwell and Modern Physics, R. T. Glazebrook, F.R.S., 219; the Potentiometer and its Adjuncts, W. Clark Fisher, 313; the Principles of Alternate Current Working, Alfred Hay, 313; Electric Wiring for the Use of Architects, Underwriters, and the Owners of Buildings, Russell Rob, 313; Lehrbuch der Experimental-Physik, Eduard Riecke, 566; Fellowships for Research, 600
 Greece, the First Philosophers of, Arthur Fairbanks, 386
 Green (Prof. Reynolds), Enzyme of Yeast Plant, 633
 Greene (Rev. J.), Varieties of *Abraxas grossulariata*, 110
 Greenhill (Prof. A. G., F.R.S.), Theoretical Mechanics: an Introductory Treatise on the Principles of Dynamics, with Applications and Numerous Examples, A. E. H. Love, F.R.S., 169
 Greenland Expedition, the Berlin Geographical Society's, Erich von Drygalski, Prof. James Geike, F.R.S., 413
 Greenly (E.), on a Case of Boulder-Uplift at Llandegfan, Menai Straits, 558
 Greenwich, the Royal Observatory, Annual Report, 134
 Gregory (Dr. J. W.), the Stramberg Corals, Maria M. Ogilvie, 282; on the Theory of Arrangement of Oceans and Continents on the Earth's Surface in the Light of Geological and Physical Observations, 586
 Griffini (Dr. Achille), Storia Naturale, per la Gioventù Italiana, 389
 Griffiths (A.), Diffusive Convection, 167
 Griffon (Ed.), Chlorophyll Assimilation in Maritime Plants, 564
 Groom (T.), on the Age and Geological Structure of the Malvern and Abberley Ranges, 558
 Groos (Karl), the Play of Animals: a Study of Animal Life and Instinct, 410
 Grosset (E.), the Hematozoa of Goitre, 264
 Ground-Sloths, a Living Representative of the Old, 547
 Guébbard (Dr. A.), the Supposed Photographs of Currents from Human Body, 207
 Guiana, British, Gold in, 352
 Guillet (A.), Mode of Supporting Motion of Pendulum, 287
 Guillon (G. M.), the Adherence of Copper Washes Used to Destroy Vine-Parasites, 336
 Gulf and River St. Lawrence, Character and Progress of the Tides in the, as Ascertained by Simultaneous Observations with Self-Registering Tide-Gauges, W. Bell Dawson, 260
 Günther (Dr. Albert, F.R.S.), the Medusa of Lake Urumiah, 319
 Günther (R. T.), the "Jelly-fish" of Lake Urumiah, 435
 Guntz (M.), Heat of Formation of Lithium Carbide, 240
 Gutta-Percha, Dr. Eugene F. A. Obach, 136
 Gutta-Percha and India-Rubber, 236; Sources of, Dr. D. Morris, 514
 Guyau (M.), Morality Independent of Obligation or Sanction, 567
 Guyot (A.), the Di-alkylamidoanthraquinones, 143
 Guyou (E.), les Problèmes de Navigation et la Carte Marine, 10
 Gypsum Boulder, Huger, T. M. Reade, 132
 Haddon (Alfred C.), the Study of Man, 410
 Haeckel (Prof.), the Descent of Man, 427
 Haffkine's (Dr.) Methods and the Plague in Calcutta, 85
 Haffkine's (Prof.) Inoculation System as a Plague Preventive, 354
 Haga (Prof.), Maxima and Minima of Apparent Brightness due to Optical Illusion, 288; a Five-Cellar Quadrant Electrometer, 360
 Hagemann (Prof.), Researches on the Actual Nutritional Value of the Feed of the Horse, 484
 Hagen (Dr. J. G.), Atlas of Variable Stars, 606
 Hahn (Dr. Martin), on the Chemical and Immunising Properties of Plasmines, 484
 Hail, Mineral, in Russian Poland, M. Czernik, 352
 Hailstones, Remarkable, Samuel N. Player, 223
 Hairless Rat, a, T. V. Hodgson, 546
 Hale (Prof. G. E.), the Large Refractors of the World, 160
 Hall (Prof. James), Death of, 351; Obituary Notice of, 372
 Hall-Effect in Electrolytes, Dr. E. van Everdingen, jun., 288, 514
 Haller (A.), the Di-Alkylamidoanthraquinones, 143
 Ha-liburton (Prof.), on the Influence of Cholin, Neurine, and some Allied Substances upon the Arterial Blood-pressure, 483
 Hallopeau (L. A.), Action of Hydrogen on Potassium Paratungstate, 264; Crystallised Tungsten Dioxide and Tungsto-Lithium Tungstate, 612
 Halo, Solar, of July 3, Catharine O. Stevens, 224
 Halos, Solar, W. Larden, 344
 Hamburger (Prof. H.), on the Influence of Solutions of Inorganic Salts on the Volume of Animal Cells, 481
 Hampson (Dr. W.), Liquid Hydrogen, 77, 174, 246, 292
 Hamy (Maurice), Interference Fringes Applied to Study of Micrometers, 216
 Hanna (H.), *Corallorhiza innata* and its Mycorrhiza, 464
 Harriot (M.), Fat Transformation by Direct Oxidation, 635
 Harcourt (Vernon), on his New 10-Candle Pentane Lamp, 557
 Hargrave (Lawrence), a Propeller Kite, 312
 Harraca (J. M.), Contributions a l'Étude de l'Hérédité et des Principes de la Formation des Races, 519
 Harrison (Dr. A. J.), on the so-called Fascination of Snakes, 585
 Harrison (Prof. J. B.), *Globigerina*-Marls of Barbados, 190
 Hart (H. C.), Flora of County Donegal, 615
 Hart (J. H.), Economic Botany in the West Indies, 87
 Harting (J. E.), Hints on the Management of Hawks, 122
 Hartley (E. G. J.), Analysis of Cornish Chalcophyllite, 311
 Hartman (C. M. A.), Composition and Volumes of Co-existing Phases of Mixtures of Methyl Chloride and Carbonic Acid, 360
 Harvard Astrophysical Conference, the, 630
 Harvard, Conference of Astronomers at, 232
 Harveian Oration, the, Sir Dyce Duckworth, 602
 Haswell (Prof. W. A., F.R.S.), a Text-book of Zoology, 25; Zoology as a Higher Study, 247
 Haswell's, Parker and, Text-book of Zoology, Prof. W. N. Parker, 200
 Hawaiian Skulls, Study of, Dr. Harrison Allen, 230
 Hawks, Hints on the Management of, J. E. Harting, 122
 Hay (Alfred), the Principles of Alternate Current Working, 313
 Hay (O. P.), Species of Ichthyodectes, 539
 Hayford (John F.), a Text-book of Geodetic Astronomy, 543
 Hazen (Prof. H. A.), the Weather of Manila, 256; the Moon and Auroræ, 304
 Heat: Improvements on Melloni Thermo-Pile, Prof. H. Rubens, 39; Apparatus illustrating Berthelot's Interference Method of Measuring High Temperatures, Prof. W. C. Roberts-Austen, F.R.S., 62; Temperature Coefficients of certain Seasoned Hard Steel Magnets, Arthur Durward, 92; New Method of determining Mechanical Equivalent of Heat, J. B. Baille and C. Féry, 119; Method of Facilitating Measurement of Temperature by Platinum Thermometry, E. B. H. Wade, 142; Thermal Conductivity of Nickel, T. C. Baillie, 143; Recent Experiments on certain of the Chemical Elements in Relation to Heat, Prof. W. A. Tilden, F.R.S., 160; Transference of Heat in Cooled Metal, Henry Bourget, 200, 521; Albert T. Bartlett, 411; John Stone Stone, 596; Boiling Point of Liquid Ozone, L. Troost, 216; Heat Dissipated by Platinum Surface at High Temperatures, J. E. Petavel, 237; Error of M. Regnault in determination of Specific Heat of Air at Constant Pressure, A. Leduc, 240; Heat of Formation of Lithium-Carbide, M. Guntz, 240; Recent Work in Thermometry, Dr. C. Chree, F.R.S., 304; Variation of Thermic Conductivity with Temperature, Paolo Straneo, 329; Freezing Point of Aqueous Solutions of Sodium Mellitate, W. W. Taylor, 335; Melting Points of Substances under High Pressure, E. Mack, 432; Theoretical Derivation of Constant of Dulong and Petit's Law, H. Staigmüller, 491; Thermal Conductivity of Sandstone increased by Pressure, Dr. Lees, 524; Transition Temperature of Sodid Sulphate, T. W. Richards, 539; the Heat Efficiency of Steam Boilers, Land, Marine, and Locomotive, Bryan Donkin, 543; Surface of Metals and Alloys, Prof. W. C. Roberts-Austen, F.R.S., 619
 Heavy Rainfalls, C. Driberg, 78
 Hébert (A.), Use of Manures in Horticulture, 216
 Hedley (C.), Australian Ship Worms, 240
 Heen (Prof. P. de), Infra-Electric Radiations, 132
 Heger (Prof.), on the Changes in the Form of the Neurons of the Cortex Cerebri under Various Conditions of Rest and Excitation, 481

- Heidelberg, the New Observatory at, 376
 Hele-Shaw (Prof. H. S.), the Flow of Water, 34, 520; of Flow of Water shown by Colour Bands, 467; on the Motion of a Viscous Fluid between Two Parallel Plates, 535; Instruments for describing Cycloidal Curves and Envelopes, 61; on a New Instrument for Drawing the Curves which can be got by Rolling One Circle on Another, 534
 Helium, Argon and Krypton in Scheme of Elements, Position of, Sir William Crookes, F.R.S., 383
 Helium in the Atmosphere: E. C. C. Baly, Prof. William Ramsay, F.R.S., and Dr. Morris W. Travers, 545; Sir William Crookes, F.R.S., 570
 Hemming (J. Hughes), the Moon's Course, 545
 Hemsley (Dr. Botting, F.R.S.), Obituary Notice of Surgeon-Major J. S. T. Aitchison, M.D., F.R.S., 578
 Hennig (Dr.), the Cold Days of May, 374
 Henriët (H.), the Carbonic Acid of the Air, 168; Atmospheric Carbon Dioxide, 408
 Henslow (Rev. George), Organic Variations and their Interpretations, 594
 Hepatic Cirrhosis, Clinical Varieties of, Dr. Alexander James, 349
 Herdman (Prof. W. A., F.R.S.), Modified Pedal Muscles in Oyster, 216; on the Final Report of the Oyster Committee, 585
 Heredity: the Distribution of Prepotency, Francis Galton, F.R.S., 246; Prof. Karl Pearson, F.R.S., 292; a Case of Inherited Instinct, Captain T. W. Hutton, F.R.S., 411; Prof. T. D. A. Cockerell, 546; Contributions à l'Étude de l'Hérédité et des Principes de la Formation des Races, J. M. Harraca, 519; Recent Advances in Science and their Bearing on Medicine and Surgery, Prof. R. Virchow, For. Member R.S., 554
 Hering (Dr.), Demonstration in the Monkey (*Macacus*) of Inhibition of the Contraction of Voluntary Muscle evoked by Electrical Excitation of certain Points of the Cortex Cerebri, 483
 Hering (Rudolph), the Bacterial Process of Sewage Purification, 628
 Hermaphroditism in the Apodidæ, Henry Bernard, 78
 Hérouard (E.), Traité de Zoologie Concrète, 25
 Herpes in the Horse, a New Trichophyton productive of, MM. Matruchet and Dassonville, 359
 Herschel (Sir John), Dr. Gill on, 356
 Hesse's (Ludwig Otto) Gesammelte Werke, Herausgegeben von der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften, 124
 Hett (C. L.), a Dictionary of Bird Notes, 366
 Hewitt (J. T.), Condensation of Chloral Hydrate with Orcinol, 23; Natural Gas in East Sussex, 190
 Heymans (Prof.), upon Physiological and Artificial Disintoxication, 482
 Hibernating Reptilian Embryos, Prof. A. Dendy, 609; G. A. Boulenger, F.R.S., 619
 Hickson (Prof. Sydney J., F.R.S.), Rotifers in Lake Bassenthwaite, 200
 Hidden (W. E.), Rhodolite, 92
 High Speed Telegraph Transmission by Means of Alternators, Prof. A. C. Crehore, Lieut. G. O. Squier, 211
 Hikish (Dr. R.), the Coast of the Arctic Ocean, 278
 Hill (Dr. Leonard), on the Influence of Gravity on the Circulation of the Blood, 481
 Hillebrand (W. F.), Vanadium and Molybdenum in United States, 539
 Hillier (J. M.), Preservative Solution in Use at Ghent Botanic Garden and Prof. Errera's Process, 208
 Himalaya, Sikkim, Orchids of the, Sir George King and Robert Pantling, 465
 Histology: Sleep and the Theory of its Cause, 8
 History of Scientific Instruction, a Short, Sir Norman Lockyer, K.C.B., F.R.S., 572
 Hittorf (W.), Electromotive Behaviour of Chromium, 335
 Hodgkinson (Prof.), on Alkaline Chlorates and Sulphates of the Heavy Metals, 556
 Hodgson (Shadworth H.), the Metaphysic of Experience, 517
 Hodgson (T. V.), a Hairless Rat, 546
 Hogarth (Mr.), the Phylakopi (Melos) Excavations, 627
 Hogg (A. F.), a Chemical Laboratory Course, 592
 Holborn (L.), Conductivities of Electrolytes, 93
 Holden (Dr. E. S.), Earthquakes of Pacific Coast, 1767-1897, 231
 Holiday Dream, a, Potential Matter, Prof. Arthur Schuster, F.R.S., 367, 618
 Holland (T. H.), on the Comparative Action of Sub-aerial and Submarine Agents in Rock Decomposition, 558
 Holothuria, Arborescent Organs of, L. Borda, 635
 Holtermann (Dr. Carl), Mykologische Untersuchungen aus den Tropen (Mycological Researches in the Tropics), 590
 Homfrey (D.), a Pocket Dictionary of Hygiene, 495
 Honda (Dr. Seiroku), Anti-Tidal Protection Coast Plantation in Japan, 627
 Hooker (Sir J. D.), Linnean Society Commemoration Medal presented to, 107
 Hope (W. B.), on the Questions of the Nucleo-Proteids as Dietetic Precursors of Uric Acid, 484
 Hopkins (Dr. F. G.), on the Questions of the Nucleo-Proteids as Dietetic Precursors of Uric Acid, 484
 Hopkins (Prof. William J.), the Telephone: Outlines of the Development of Transmitters and Receivers, 568
 Hopkinson (Dr. John, F.R.S.), Obituary Notice of, 419
Hordeum vulgare, on the Depletion of the Endosperm of the, during Germination, Horace T. Brown, F.R.S., and F. Escombe, 331
 Hornaday (William T.), the Destruction of the Birds and Mammals of the United States, 308
 Horn-Feeding Larvæ, W. H. McCorquodale, 140; Captain G. G. Traherne, R.A., 521
 Horns, Antelope, Larvæ in, Dr. Henry Strachan, 468; W. H. McCorquodale, 468
 Horns, Maggots in Sheep's, W. H. McCorquodale, 546
 Horse, a New Trichophyton Productive of Herpes in, MM. Matruchet and Dassonville, 359
 Horse-Chestnut, Re-Blossoming of, 521
 Horticulture: the Slime Flux Disease of Fruit Trees, George Masse, 133; Use of Manures in Horticulture, A. Hébert and G. Truffaut, 216; Garden-Making, L. H. Bailey, 290; the Pruning-Book, L. H. Bailey, 290; Dobbie's Horticultural Handbooks, 318
 Hose (Ernest), Wild Pigs and Python, 133
 Howard (Dr. L. O.), Lead-Boring Insects, 230
 Howe (E.), Detection of Sulphides, Sulphates, Sulphites, and Thiosulphates in each other's Presence, 634
 Howe (Herbert), Elements of Descriptive Astronomy, 198
 Hubbard (Mrs. E.), a Late Cuckoo, 487
 Hubrecht (Prof.), Origin of Red Blood Corpuscles in *Tarsius*, 428
 Hudleston (W. H., M.A., F.R.S.), Opening Address in Section C of the British Association, 476
 Hudson (W. H.), Birds in London, 172
 Hughes-Gibb (Eleanor), the Making of a Daisy, 198
 Hugot (C.), Action of Sodammonium on Arsenic, 635
 Hull (Dr. Edward, F.R.S.), Sub-Oceanic Terraces and River Channels off the Coast of Spain and Portugal, 51; the Sub-Oceanic Physical Features of the North Atlantic, 559
 Hungary, Spiders of, Cornelio Chyzer, Ladislao Kulczynski, R. I. Pocock, 365
 Hunt (Dr. T. S., F.R.S.) as a Chemist, James Douglas, 551
 Huret (Dr. C. H.), Death of, 58
 Hurricane, Windward Islands, 512; Meteorological Statistics of, H. Powell, 551
 Hutchins (D. E.), Forestry in Cape Colony, 605
 Hutton (Captain F. W., F.R.S.), a Case of Inherited Instinct, 411
 Huxley's Memoirs, the First Volume of, W. T. Thiselton-Dyer, F.R.S., 613
 Huygens (Christian), Œuvres Complètes de, Dr. J. L. E. Dreyer, 361
Hybodus grossicornis, a Tooth of, from the Inferior Oolite, Thos. Beacall, 390
 Hydraulics: the Flow of Water, Prof. H. S. Hele-Shaw, 34, 520; Flow of Water shown by Colour Bands, Prof. Osborne Reynolds, F.R.S., 467; Prof. H. S. Hele-Shaw, 467; the Flow of Water in Uniform Pipes and Channels, G. H. Knibbs, 354
 Hydrogen, Liquid, 55; Dr. W. Hampson, 77, 174, 246, 292; Prof. James Dewar, F.R.S., 125, 199, 270, 319
 Hydrogen, the Spectrum of, in Nebulae, Prof. Scheiner, 41
 Hydrography: Méthode pour Abrégier les Traversées en Utilisant les Perturbations de l'Atmosphère, A. Fieron, 197; Undercurrents in the Strait of Bab-el-Mandeb, Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., 544
 Hydrometer, a New, Rev. H. O'Toole, 191, 524

- Hygiene: Micro-Biology as Applied to Hygiene, 15; the Septic Treatment of Sewage, 229; the U.S. Steamship *Protector*, 488; a Pocket Dictionary of Hygiene, C. T. Kingzett and D. Homfrey, 495; Congress of Sanitary Institute, 522; the Disposal of the Town Refuse of Naples, Prof. P. Boubée, 524; Natural Hygiene, H. Lahmann, 614; the Bacterial Process of Sewage Purification, Rudolf Hering, 628
- Hymenopteron, Aquatic, Fred Enock, 175
- Hypnotism, the Psychological Side of, Mr. Myers, 350
- Iceland: Th. Thoroddsen, Geschichte der Isländischen Geographie, Vorstellungen von Island und seines Natur, und Untersuchungen darüber in alter und neuer Zeit, 568
- Ichthyology: Eel in Open Sea, Léon Vaillant, 96; the Transport of Live Fish, D. O'Connor, 125; *Aethoprora perpicillata*, Mr. Ogilby, 192; the Life-History of the Salmon, 280
- Idealism, the Return from, Shadworth H. Hodgson, 517
- Illuminated Buoys, J. Pintsch, 489
- Immunity, the Toxicity of Eel-Serum and further Studies on, Mrs. Percy Frankland, 369
- Impact, the Dynamics of, D. de Francesco, 582
- Imperial Institute, Indian Coals at the, Bennett H. Brough, 380
- Incandescent Burners, Radiation of, H. Le Chatelier and O. Boudouard, 240
- Incombustible Wood-Making Process, 328
- Index-Calculator, an Osteometric, David Waterston, 597
- India: Notes on the Bugonia Superstitions—the Occurrence of *Eristalis tenax* in India, Kumagusu Minakata, 101; the Fauna of British India, Birds, W. T. Blanford, 195; the Habits of Indian Birds, Frank Finn, 208; Folk-Medicine in Ancient India, Dr. M. Winternitz, 233; the Flora and Fauna of British India, 250; Indian Paleontology, Dr. Fritz-Noetling, 257; Dr. Carl Diener, 257; Indian Coals at the Imperial Institute, Bennett H. Brough, 380; Tea, Coffee and Cinchona Cultivation in India, 423; the Use of Aluminium for Cooking Utensils in India, Prof. Chatterton, 488; Inoculation against Plague, 581
- India-Rubber, Artificial, 302
- India-Rubber, Gutta-Percha, and, 236; *see also* Rubber
- Indians, American, Ceremonial Dances of the, 125
- Industrial Applications of Electro-Chemistry, the, Dr. Thos. Ewan, 112
- Infinitesimal Calculus, an Elementary Course of, Horace Lamb, F.R.S., 292
- Injection of Cocaine as a Remedy for Stings, 497
- Ink, Printer's, Photographic Action of, W. Trueman Tucker, 32
- Ink, Printer's, and Photographic Plates, Rev. F. J. Jarvis-Smith, F.R.S., 78
- Insects, Observations on the Coloration of, Brunner von Wattenwyl, 193
- Insects, a Text-book of Entomology, including the Anatomy, Embryology and Metamorphoses of, for use in Agricultural and Technical Schools and Colleges, Prof. Alpheus S. Packard, 244
- Instinct, a Case of Inherited, Captain F. W. Hutton, F.R.S., 411; Prof. T. D. A. Cockerell, 546
- Instinct, Moral, the Origin and Growth of the, Alexander Sutherland, 241
- Instinct, a Study of Animal Life and, the Play of Animals, Karl Groos, 410
- Instruction, a short History of Scientific, Sir Norman Lockyer, K.C.B., F.R.S., 597
- International Aeronautic Conference, 380
- International Conference of Zoologists, 376, 424
- International Conferences and the British Association, 522
- International Conference on Scientific Literature, Report of, 623
- International Sea Fisheries Congress at Dieppe, 461, 511
- International Time, France and, 60
- Interplanetary Medium, Metargon and the, J. R. Rydberg, 319
- Inwards (Richard), Weather Lore, 222
- Iowa Geological Survey, 29, 389
- Iridescent Clouds, E. Armitage, 390
- Iridescent Surf at Cromer, Constance F. Gordon Cumming, 174
- Iron: Method of Demonstrating Allotropic Change in, A. Stansfield, 62; Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149; Manganese from Bog Ore, 256; the Swedish Iron Industry, R. A. Ker-
- man, 430; Swedish Iron Ore Mining, Prof. G. Nordenström, 430; the Iron Ore Deposits of Swedish Lapland, H. Lundbohm, 430; Journal of the Iron and Steel Institute, 150; the Stockholm Meeting of the Iron and Steel Institute, 430
- Isham (G. S.), Registering Solar Radiometer, 432
- Isomorphous Mixtures, the Phenomenon of Equilibrium in, Giuseppe Bruni, 627
- Issatschenko (Dr.), New Microbe Pathogenic to Rats, 179
- Istrati (C.), Diodo-Quinoline, 612; Solubility of Camphor, 635
- Italy, Earthquake in, 206
- Ives (Frederick), Krömsköp Colour Photography, 124; a Modified Camera Lucida, 311; a Monochromatic Green Screen, 311
- Jackson (Mr.), on the Oxidation of Polyhydric Alcohols, 557
- Jackson (Herbert), Phosphorescence, 559
- Jacques Carbon Consuming Cell, S. Skinner, 533
- Jaeger (Gustav), Problems of Nature, Researches and Discoveries of, 222
- Jaggat (T. A., jun.), some Conditions affecting Geyser Eruptions, 261
- Jamaica, the Fisheries of, J. E. Duerden, 158
- Jama (Dr. Alexander), Clinical Varieties of Hepatic Cirrhosis, 349
- Jameson (Dr. H. Lyster), on a Race of Protectively Coloured Mice, 585
- Japan, Anti-Tidal Protective Coast Plantation, D. Seiroku Honda, 627
- Japp (Prof. F. R., LL.D., F.R.S.), Opening Address in Section B of the British Association Stereo-Chemistry and Vitalism, 452; Asymmetry and Vitalism, 616
- Jelly-fish, the, of Lake Urumiah, R. T. Günther, 435
- Jenkin (Arthur), the Motion of Falling Spray, 460
- Jenkin (Arthur P.), Luminous Clouds, 521
- Jennings (A. S.), *Corallorhiza innata* and its Mycorrhiza, 464
- Jerome (Dr. W. J. S.), Pharmacology, its Aims and Methods, 158
- Jervis-Smith (Rev. F. J., F.R.S.), Electric Light Wires as Telephonic Circuit, 51; Printer's Ink and Photographic Plates, 78
- Jewell (Mr.), Structure of the H and K lines, 280
- Job (André), Volumetric Analysis in Alkaline Solution, 264; Mode of Oxidation of Cobalt Salts in Alkaline Solutions, 287
- Johnson (Dr. G. Lindsay), Bacteria on an Ancient Bronze Implement, 52
- Johnstone (J.), Thymus and Thyroid Glands in Marsupialia, 46
- Jolly (A.), Compounds of Rhodium, 287
- Jones (A. W.), Simple Experimental Illustrations of Law of Multiples, 23
- Jones (Lionel M.), Elementary General Science, 123
- Jones (Thomas and T. Gilbert), Machine Drawing, 543
- Jourdain (S.), Air and Water as Factors in Food of Frogs, 612
- Journal of Botany, 117, 264, 635
- Journal of the Iron and Steel Institute, the, 150
- Jude (R. H.), First Stage Magnetism and Electricity, 222
- Julin (Prof.), on the Formation of the Heart, 585
- Jungfrau Electric Railway, the, 550
- Jupiter: Jupiter's Red Spot, Dr. Lohse, 20; the Red Spot on Jupiter and its Suspected Identity with previous Markings, W. F. Denning, 331; the First Satellite of, A. Douglass, 210; Observations of Jupiter during the Opposition 1898, Sir J. Comas Solá, 526
- Kaiserling (Dr. Carl), Practicum der Wissenschaftlichen Photographie, 268
- Kanthack (Prof. A. A.), System der Bakterien, Prof. W. Migula, 97; the Tsetse Disease in Mammals, 426
- Kathode Rays, the, P. Villard, 143
- Kathode and Röntgen Radiations, some New Studies in, Alan A. Campbell Swinton, 88; *see also* Radiography
- Katzer (Dr. Friedrich), Volume of Amazon River at Obydos, 399
- Kaulbars (Baron N.), the Aurora Borealis of September 9, 569
- Kea of New Zealand, the, Why it attacks Sheep, F. R. Godfrey, 110
- Keeler (Prof.), Atmosphere of D.M. + 30° 3639, 463
- Kellicott (Prof. D. S.), Death of, 39
- Keltie (Dr. J. Scott), on Political Geography, 586
- Kelvin (Lord) on the Dynamical Theory of Refraction, Dispersion and Anomalous Dispersion. 546

- Kelvin's (Lord) Scientific Work, Prof. Oliver Lodge, 581
 Kempf (Herr), a New Long Period Variable, 60
 Kent (Saville), Position of Sponges in Animal Kingdom, 426
 Kerner (Prof. Anton), Death of, 206; Obituary Notice of, Dr. Otto Stapf, 251
 Kerr (Richard), Wireless Telegraphy, 495
 Kew, Royal Gardens, Bulletin of Miscellaneous Information, 1897, 245
 Keyes (C. R.), Eolian Origin of Loess, 634
 Kimura (H.), the Variation of Latitude at Tokyo, 490
 Kinematograph Films, the Manufacture of, 552
 King (Sir George), Annals of the Royal Botanic Gardens, Calcutta, Vol. viii., the Orchids of the Sikkim Himalaya, 465
 King (L. W.), First Steps in Assyrian, 341
 Kingdon (J. A.), Applied Magnetism: an Introduction to the Design of Electro-Magnetic Apparatus, 591
 Kingzett (C. T.), a Pocket Dictionary of Hygiene, 495
 Kinsley (Carl), Series Dynamo Electric Machines, 72
 Kipping (F. S.), Separation of Optical Isomerides, 23
 Kirby (W. F.), Epidemics among Mice, 223
 Kirchhoff's Spectroscope, Prof. H. C. Vogel, 19
 Kirchner (Herr), Leprosy in Russia, 158
 Kirstädter (F.), Magnetisation of Hollow and Solid Iron Rings, 187
 Kite, a Propeller, Lawrence Hargrave, 312
 Kite Flight, High, Record broken for, Messrs. Clayton and Ferguson, 513
 Klebs (Prof.), Alternation of Generations in Thallophyta, 632
 Klein (Dr. E., F.R.S.), the Etiology and Prevention of Malarial Fever, 175
 Klein (Prof. Felix), the Mathematical Theory of the Top, Lectures delivered on the Occasion of the Sesquicentennial Celebration of Princeton University, 244
 Knibbs (G. H.), Water-Flow in Uniform Pipes and Channels, 354
 Knipp (C. T.), New Form of Make and Break, 92
 Knight (W. C.), New Jurassic Vertebrates from Wyoming, 117
 Knight-Darwin Law, the, Francis Darwin, F.R.S., 630
 Knott (Prof. C. G.), Magnetic Strains, 190
 Knuth (Dr. Paul), Handbuch der Blütenbiologie unter zugrundelegung von Hermann Müller's werk, "Die Befruchtung der Blumen durch Insekten," Francis Darwin, F.R.S., 434
 Koch (Prof.), a Plague Centre in German East Africa, 254
 Koettlitz (Dr. R.), Geology of Franz Josef Land, 239
 Kohlrusch (F.), Conductivities of Electrolytes, 93
 Kohnstamm (P.), the Weston Standard Cell, 335
 Kölliker (Albert von), Prof. W. F. R. Weldon, F.R.S., 1
 Kollmann (Dr. J.), Lehrbuch der Entwicklungsgeschichte des Menschen, 77
 Kossel (Prof. A.), on Albumens, 481
 Kozloff (P. K.), the Lob-Nor Controversy, 41
 Krömsköp Colour Photography, Frederick Ives, 124
 Kronecker (Prof.), on the Results of Further Investigation of the Respiration of the Heart of the Tortoise, 481
 Kronfeld (Dr.), Silphium among the Ancient Greeks, 628
 Kübler (Herr), Leprosy in Russia, 158
 Kulczynski (Ladislaw), *Aranea hungarica*, 365
 Küttner (Prof.), the Röntgen Rays in Surgery, 302
- La Cour (Prof.), the Utilisation of Wind Power, 300
 Labbé (H.), New Method of Separating Geraniol and Citronellol, 191; Acids of Essential Oils of Geranium, 240
 Laboratories: the New Physical Research Laboratory at the Sorbonne, 12; on Laboratory Arts, Richard Threlfall, C. V. Boys, F.R.S., 145; the National Physical Laboratory, 548, 565; Opening of the Thompson-Yates Laboratories at University College, Liverpool, 575, 606; a Chemical Laboratory Course, A. F. Hogg, 592; New Physical Laboratory of Owens College, Manchester, 621
 Ladd (G. T.), Outlines of Descriptive Psychology, 316
 Lafar (Dr. Franz), the Utilisation of Micro-Organisms in the Arts and Manufactures: a Practical Handbook on Fermentation and Fermentative Processes, &c., 265
 Lafouge (M. le Général), Essai synthétique sur la formation du Système Solaire, 342
 Lagrange (C.), the Theory of Errors; a Theory of Recurring Means, 489
 Lahmann's (Dr. H.) Natural Hygiene, 614
 Lake Bassenthwaite, Rotifers in, Prof. Sydney J. Hickson, F.R.S., 200; W. T. Calmen, 271
 Lake Mendota, Plankton Studies on, Dr. E. A. Birge, 259
- Lake Minnewaska, N.Y., Blue Grotto on, Dr. H. C. Bolton, 525
 Lake Tanganyika, the Marine Fauna in, and the Advisability of Further Exploration in the Great African Lakes, J. E. S. Moore, 404
 Lake Urumiah, the Medusa of, Dr. Albert Günther, F.R.S., 319; the Jelly-fish of, R. T. Günther, 435
 Lamb (Horace, F.R.S.), an Elementary Course of Infinitesimal Calculus, 292
 Landolt (H.), Das optische Drehungsvermögen organischer Substanzen und dessen praktische Anwendung, 172
 Lang (Mr.), Prothallus of *Lycopodium clavatum* discovered, 633
 Langer (Dr.), the Immunity of Bee Keepers from Bee Poison, 18
 Langley (Edward M.), Animals and Poisonous Plants, 597
 Langley (Dr. J. N., F.R.S.), on the Discovery of the Possibility of obtaining an Experimental Union between the Nerve-fibres of the Vagus Nerve and the Sympathetic Nerve-cell of the Superior Cervical Ganglia, 482
 Langlois (Prof.), Observations upon the Resistance of Diving Animals to Asphyxia, 485
 Lankester (Prof. E. Ray, F.R.S.), a Text-Book of Zoology, Prof. T. Jeffery Parker, F.R.S., and Prof. W. A. Haswell, F.R.S., 25; Traité de Zoologie Concrète, Prof. Yves Delages and E. Hérouard, 25; a Student's Text-Book of Zoology, Adam Sedgwick, F.R.S., 147; the Scientific Memoirs of Thomas Henry Huxley, Vol. i., 613
 Larden (W.), Solar Halos, 344
 Larmor (Joseph, F.R.S.), the Complete Scheme of Electro-dynamic Equations of a Moving Material Medium, 166
 Larvæ, Horn-Feeding, W. H. McCorquodale, 140, 546; Captain G. G. Traherne, R.A., 521
 Larvæ in Antelope Horns, Dr. Henry Strachan, 468; W. H. McCorquodale, 468
 Latitude Variation in a Rigid Earth, Prof. Henry Crew, 232
 Latitude at Tokyo, the Variation of, H. Kimura, 490
 Laurie (Dr.), on the Results obtained in Studying the Cooling Curves of Fatty Acids, 557
 Laver (H.), the Mammals, Reptiles, and Fishes of Essex, 242
 Le Chatelier (H.), Limit of Inflammability of Carbon Monoxide, 71; Electrical Resistance of Steel, 191; Influence of Tempering on Electrical Resistance of Steel, 216; Radiation of Incandescent Burners, 240
 Lead-Boring Insects, Dr. L. O. Howard, 230
 Leatham (F. G.), Possibility of deducing Magneto-Optic Phenomena from Direct Modification of Electro-Dynamic Energy Function, 142
 Leavitt (R. G.), Pyschrometer applicable to Study of Plant Transpiration, 187
 Lebeau (P.), Industrial Treatment of Emerald in Electric Furnace, 23; Iodide of Beryllium, 47; a Boro-Carbide of Beryllium, 71; Anhydrous Beryllium Fluoride and Oxide of Beryllium, 96
 Lecornu (L.), Régularisation du Mouvement dans les Machines, 495
 Leduc (A.), Error of M. Regnault in Determination of Specific Heat of Air at Constant Pressure, 240
 Lee (Dr. F. S.), on the Fatigue of Muscle, 484
 Leeds Astronomical Society, the, 160
 Lees (Dr. C.), Increase of Thermal Conductivity of Sandstone by Pressure, 524; on the Thermal Conductivity of Rocks at Different Pressures, 532
 Leger (L.), a New Coccus, *Echinospira ventricosa*, 516
 Leidié (E.), Compounds of Rhodium, 287
 Leidenfrost Drop, the, J. Stark, 335
 Leist (M.), a Local Magnetic Pole at Kotchétoivka, 72, 86
 Lemström (Prof. S.), on the Action of Electricity on Plants, 533
 Lenard (P.), Behaviour of Kathode Rays Parallel to Electric Force, 491
 Lenses, not of Glass, Mr. J. W. Gifford on, 532
 γ Leonis, Parallaxes and Masses of γ Virginis and, Dr. Belopolsky, 400
 Lepidoptera, Varieties of *Abraxas grossulariata*, Rev. J. Greene, 110; Drinking Habits of Butterflies and Moths, T. W. Tutt, 110; Individual Wing-Variation in Lepidoptera, W. L. W. Field, 524
 Leprosy in the Far East, Distribution of, S. B. J. Skertchly, 514
 Leprosy in Russia, MM. Kirchner and Kübler, 158

- Letts (Dr. E. A.), the Carbonic Anhydride of the Atmosphere, 464
- Levy (Albert), Atmospheric Carbon Dioxide, 408
- Lewis (Henry), W. J. L. Abbott, 16
- Lexicon, a Maori-English, Rev. W. Colenso, 364
- Life-history of the Salmon, the, 280
- Light, Röntgen Rays and Ordinary, Prof. J. J. Thomson, F.R.S., 8
- Light, a New Standard of, Ch. Féry, 23
- Light-Mirrors, a Simple Method of Making, Prof. Charles B. Thwing, 571
- Lightning Flash, Triplet, C. E. Stromeyer, 570
- Lightning by Day, Photographing, F. H. Glew, 627
- Lilienfeld (Dr. Leo), Synthesis of Albuminous Substances, 351
- Lilienfeld's Synthesis, Dr. John W. Pickering, 468
- Linacre Reports, the, 100
- Lincei, Reale Accademia dei, Royal Prize Awards, 420
- Lindgren (W.), Orthoclase as Gangue Mineral in Fissure Vein, 187
- Lindner (P.), Das optische Drehungsvermögen organischer Substanzen und dessen praktische Anwendung, 172
- Line of Sight, Motion of Stars in the, M. Deslandres, 490
- Linnean Society, 46, 141, 189, 215; Anniversary Meeting of the, 107
- Lion-Tiger Hybrid, R. I. Pocock, 200
- Lippmann (G.), Maintenance of Motion of Pendulum without Disturbance, 264
- Liquid Air at One Operation, Lord Rayleigh, F.R.S., 199
- Liquid Hydrogen, 55; Dr. W. Hampson, 77, 174, 246, 292; Prof. J. Dewar, F.R.S., 125, 199, 270, 319
- Liquids, Absorption of, by Textiles, Leo Vignon, 264
- Liquids, Method of Measuring Surface-Tension of, Dr. F. T. Trouton, F.R.S., 191
- Lister (Lord), on Experimental Medicine, 606
- Literature, a Request for Zoological, Prof. Blaxland Benham, 520
- Literature and Scenery, Sir Archibald Geikie, 179
- Literature, Scientific, Report of International Conference on, 623
- Live Fish, the Transport of, D. O'Connor, 125
- Liverpool Observatory, the, 134
- Liverpool, University College, Opening of the Thompson-Yates Laboratories at, 575
- Livon (Prof.), Observations on the Action of Extract of the Pituitary Body upon the Function of the Vagus Nerve, 484
- Lizard, the Blue-Tongued Tasmanian, as a Snake-Destroyer, Stuart Dove, 422
- Lizard, the Development of the Tuatara, Prof. A. Dendy, 609; G. A. Boulenger, 619
- Lloyd (Dr. R. J.), the Spirate Fricatives, 46; on the Articulation and Acoustics of the Spirate Fricative Consonants, 534
- Lob-Nor Controversy, the, P. K. Kozloff, 41
- Lockyer (Sir Norman, K.C.B., F.R.S.), on the Recent Solar Eclipse Expeditions, 534; a Short History of Scientific Instruction, 572, 597
- Locust-Destroying Fungus, Dr. Edington, 354
- Locusts, a Case of Inherited Instinct, Captain F. W. Hutton, F.R.S., 411
- Lodge (Prof. Oliver, F.R.S.), Improvements in Magnetic Space-Telegraphy, 62; the Scientific Work of Lord Rayleigh, 461; New Magnifying Telephone, 533; Lord Kelvin's Scientific Work, 581
- Loess, Eolian Origin of, C. R. Keyes, 634
- Lohse (Dr.), Jupiter's Red Spot, 20
- Londe (A.), Causes of Imperfections in Radiographs from Use of Reinforcing Screens, 168
- London, Birds in, W. H. Hudson, 172
- London Sewage, Bacteriology of, 374
- London, the University of, Commission Bill, 154, 176
- Longo (Dr. B.), Chromatolysis in Plants, 329
- Lorenz (Prof. H. A.), Optical Phenomena depending on Electric Charge and Mass of Ions, 48, 144
- Lories, Dr. St. G. Mivart, F.R.S., 189
- Los Angeles, Experiments in the Utilisation of Wave-Power at, 207
- Louis (Prof.), on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 559
- Love (A. E. H., F.R.S.), Theoretical Mechanics: an Introductory Treatise on the Principles of Dynamics, with Applications and Numerous Examples, 169; Fourier's Series, 569
- Lovett (Prof. E. O.), the Infinitesimal Projective Transformations of Concentric Conics, 431
- Lowry (T. M.), Stereoisomeric Derivatives of Camphor, 142
- Isodynamic Forms of Nitro Camphor, 238
- Lubbock (Sir John), Opening Address at the International Congress of Zoology, 391
- Lucifer Matches, Phosphorus in, 345
- Lucy (W. C.), Death of, 57
- Lumière (M.), Action of Ammonium Persulphate on Silver in Photographic Negatives, 168
- Luminosity of Gases in Vacuum Tubes, 463
- Luminous Clouds, Arthur P. Jenkin, 521
- Luminous Clouds or Aurora, J. Edmund Clark, 546
- Lundbohm (H.), the Iron Ore Deposits of Swedish Lapland, 430
- Lungs, the Diseases of the, James Kingston Fowler and Rickman J. Godlee, 291
- Lupton (Sydney), Notes on Observations, 7
- Lush (Ethel R.), Lessons in Domestic Science, 173
- Lusk (Prof. Graham), on the Administration of Phlorhizin to Starving Dogs, 486
- Lutz (L.), Nitrogenous Nutrition of Phanerogamous Plants, 24
- Lymph Production, on the Theory of, Dr. L. Asher, 481
- Mabille (Dr.), on the Action of Arsenic upon the Intoxication produced by Ingestion of the Thyroid Body, 484
- Macallum (Prof. A. B.), on his Method for Detection and Localisation of Phosphorus in Animal and Vegetal Cells, 483
- Macaluso (D.), New Action of Light traversing Metallic Vapours in Magnetic Field, 635
- MacBride (Prof.), Origin of Echinoderms, 427
- McClellan (J. A.), Figures produced on Photographic Plate by Electric Discharges, 142
- McClintock (Emory), Further Researches in Theory of Quintic Equations, 22
- McClure (Dr. C.), a Bacillus in Milk, 254
- McCorquodale (W. H.), Horn-Feeding Larvæ, 140; Larvæ in Antelope Horns, 468; Maggots in Sheep's Horns, 546
- Macdonald (Dr. J. S.), on the Electromotive Changes in the Phrenic Nerve, 483
- MacDowall (A. B.), Summer Rainfall, 237; the Weather of this Summer, 247
- McGee (W. J.), Papagueria, 525
- Mach (Herr), the Phenomena of Air Waves formed by Projectiles, studied by means of Interference Bands, 422
- Mack (E.), Melting Points of Substances under High Pressure, 432
- Machine Drawing, Thomas Jones and T. Gilbert Jones, 543
- Machines, Régularisation du Mouvement dans les, L. Lecornu, 495
- McIntosh (Prof. W. C.), the Memory of Fishes, 422
- Mackenzie (Dr. W. Leslie), Studies in Psychological Research, Frank Podmore, 5
- Mackerel, on the Races and Migrations of the, W. Garstang, 584; H. N. Dickson, 584
- Macpherson (Rev. H. A.), the Life-Work of William Turner, 398
- McWeeney (Dr.), the Sero-Diagnostic Test for Typhoid Fever, 47
- Madagascar, Destruction of the French Observatory in, E. Colin, 259
- Madan (H. G.), Properties of Methylene Di-iodide, 23; Ebbing and Flowing Well at Newton Nottage, 45; Organic Substances available for Mounting Microscopical Specimens, 94
- Madras, Anthropology in, Edgar Thurston, 82
- Madrid, Meteorological Observations at, 1860-94, F. Cos, 230
- Maggots in Sheep's Horns, W. H. McCorquodale, 546
- Magnetism: Improvements in Magnetic Space-Telegraphy, Prof. O. Lodge, F.R.S., 62; a Local Magnetic Pole at Kotchétoivka, M. Leist, 72, 86; Magnetism and Sun-spots, William Ellis, F.R.S., 78; Magnetism and Meteorology, Prof. F. H. Bigelow, 86; Solar and Terrestrial Magnetism in Relation to Meteorology, F. H. Bigelow, 187; Temperature Co-efficient of certain Seasoned Hard Steel Magnets, Arthur Durward, 92; Properties of Seasoned Magnets of Self-hardening Steel, B. O. Peirce, 117; New Method of Measuring Dip and Horizontal Intensity, G. Meyer, 117; Possibility of Deducing Magneto-Optic Phenomena from Direct Modification of Electro-Dynamic Energy Function, J. G. Leatham, 142; Magnetic After-Effect, C. Fromme, 187; Magnetisation of

- Hollow and Solid Iron Rings, F. Kirstädter, 187; Magnetic Strains, Prof. C. G. Knott, 190; First Stage Magnetism and Electricity, R. H. Jude, 222; an Introductory Course of Practical Magnetism and Electricity, J. Reginald Ashworth, 466; Magnetic Storm, Dr. Charles Chree, F.R.S., 468; International Conference of Terrestrial Magnetism and Atmospheric Electricity, Opening Address, by Prof. A. W. Rücker, Sec. R.S. President of the Conference, 473; Applied Magnetism: an Introduction to the Design of Electro-Magnetic Apparatus, J. A. Kingdon, 591; the Energy of a Magnetic Field, H. Pellat, 612; Magnets and Electric Currents, Prof. J. A. Fleming, 614; New Action of Light Traversing Metallic Vapours in Magnetic Field, D. Macaluso and O. M. Corbino, 635
- Magnitudes, Stellar, Constant of Aberration and, Prof. Doberck, 258
- Magnus (Sir Philip), Technical High Schools, a Comparison, 52
- Magnus (Dr. R.), on the Reaction of the Pupil of the Isolated Eye under Various Homogeneous Lights, 485
- Maiden (J. H.), Botanical Exploration of Mt. Kosciusko, 551
- Maize (M.), Influence of Light on Wild Grape and Ground Ivy, 516
- Major (Colonel F. W.), a Living Toad in a Snake, 344
- Makaroff (Admiral), Suggested "Ice-breaker" Expedition to North Pole, 353
- Malaria Parasite, the Mosquito the Host of, Surgeon-Major Ronald Ross, 523
- Malarial Fever, the Etiology and Prevention of, Dr. E. Klein, F.R.S., 175
- Malcolm (Dr.), Metabolism of Nucleins, 239
- Mallet (F. R.), Ebbing and Flowing Wells, 104
- Mammalian Heart, on the, Prof. Townsend Porter, 482
- Mammals, the Origin of, Prof. Seeley, 426; Prof. Osborn, 426; Prof. Marsh, 427; A. Sedgwick, 427; Prof. Hubrecht, 427
- Mammals, Reptiles and Fishes of Essex, the, H. Laver, 242
- Mammals of the United States, the Destruction of the Birds and, William T. Hornaday, 308
- Mammifer, a New, M. Ameghino, 492
- Man, the Descent of, Prof. Haeckel, 427
- Man, the Study of, Alfred C. Haddon, 410
- Manchester Literary and Philosophical Society, 46, 635
- Manchester, New Physical Laboratory of Owens College, 621
- Manganese from Bog Iron Ore, 256
- Mangin (Louis), Pietine in Wheat, 359
- Manila, the Weather of, Prof. Hazen, 256
- Manson (Dr. Marsden), on the Laws of Climatic Evolution, 559
- Manual Training: Woodwork, a Handbook for Teachers, Geo. Ricks, 124
- Maori English Lexicon, a, Rev. W. Colenso, 364
- Marage (M.), Study of Speaking Voice by Phonograph, 23
- Margules (M.), Electrolytic Solution of Platinum and Gold, 491
- Marine Biology: Food-reception by Sponges, Dr. Vosmaer and Prof. Pekelharing, 47; the Phyto-Plankton of the Atlantic, George Murray, F.R.S., and V. H. Blackman, 70; Relations between Hybrid and Parent Forms of Echinoid Larvae, H. M. Vernon, 118; Annual Meeting of Marine Biological Association, 228; the *Xenidae*, J. H. Ashworth, 335; the Building of Atolls, Stanley Gardiner, 425; Position of Sponges in Animal Kingdom, Prof. Yves Delage, 425; E. A. Minchin, 426; Saville Kent, 426; Origin of Echinoderms, Prof. MacBride, 427; Flying Entomostraca, Herr Ostrovomov, 513; Arborescent Organs of Holothuria, L. Bordas, 635
- Marine Fauna in Lake Tanganyika, and the Advisability of further Exploration in the Great African Lakes, J. E. S. Moore, 404
- Marinelli (Prof.), Progressive Increase of Po Delta, 353
- Markham (Sir Clements R., F.R.S.), Vasco Da Gama, 67
- Marquette Iron-bearing District of Michigan, the, C. R. van Hise and W. S. Bayley, 82
- Mars in 1896-7, Prof. V. Cerulli, 304
- Mars, the Planet between the Earth and, Herr G. Witt, 526
- Marsh (Prof. O. C.), on the Comparative Value of Different Kinds of Fossils in Determining Geological Age, 558
- Marshall (G. A. K.), *Præcis octavia-natalensis* and *P. Sesamus* Seasonal Forms of same Species, 611
- Marsupialia, Thymus and Thyroid Glands in, J. Johnstone, 46
- Martin (Dr. Sidney), Effect of Polluted Soil on Vitality of Typhoid Bacillus, 577
- Martyn (A. J. K.), a Monochromatic Rainbow, 224
- Maryland Geological Survey, 29
- Mascart (Jean), Planet 1898 DQ, 432
- Maskell (W. M.), Death of, 108
- Masse (George), the "Slime-Flux" Disease of Fruit Trees, 133; Mykologische Untersuchungen aus den Tropen (Mycological Researches in the Tropics), Dr. Carl Holtermann, 590
- Masterman (Dr. A. T.), Anatomy of *Cephalodiscus dodecalophus*, 190
- Match Manufactories, French, Dr. T. Oliver, 327
- Matches, Phosphorus in Lucifer, 345
- Mathematics: American Journal of Mathematics, 22; Focal Surfaces of Congruences of Tangents to given Surface, A. Pell, 22; Further Researches in Theory of Quintic Equations, Emory McClintock, 22; Mathematical Society, 23, 95, 190; the Collected Mathematical Papers of Arthur Cayley, F.R.S., 50; Instruments for Describing Cycloidal Curves and Envelopes, Prof. Hele-Shaw, 61; Bulletin of American Mathematical Society, 92, 187, 310, 431; Connection of Algebraic with Automorphic Functions, E. T. Whittaker, 93; Ludwig Otto Hesse's Gesammelte Werke, herausgegeben von der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften, 124; Death of Rev. Percival Frost, F.R.S., 131; Edinburgh Mathematical Society, 167, 191; an Obsolete Book of Euclid on Balances and the Lever, Dr. G. Vailati, 207; Mathematical Theory of the Top, Lectures Delivered on the Occasion of the Sesquicentennial Celebration of Princeton University, Prof. Felix Klein, 244; the Mathematical Gazette, 263; Leçons sur l'Intégration des Equations aux dérivées partielles du second ordre à deux Variables Independantes, E. Goursat, 266; Memoirs of Novorossian Society, 286; on Finding Log Sines and Log Tangents of Small Arcs, W. James Burgess, 336; Mathematical Contributions to Theory of Evolution, V., Reconstruction of Stature of Prehistoric Races, Karl Pearson, F.R.S., 286; an Elementary Course of Infinitesimal Calculus, Horace Lamb, F.R.S., 292; Example of Single-valued Function with Natural Boundary, whose Inverse is also Single-valued, Prof. Osgood, 310; Poisson's Integral, Prof. Bôcher, 310; Polynomials of Stieltjes, Prof. van Vleck, 310; Is Continuity of Space necessary to Euclid's Geometry? W. M. Strong, 310; Elementary Conics, Dr. W. H. Besant, 318; Examples in Analytical Conics for Beginners, W. M. Baker, 318; a Treatise on Universal Algebra, with Applications, Alfred North Whitehead, 385; Structure of Hypoabelian Groups, Dr. L. E. Dickson, 431; the Hamilton Groups, Dr. G. A. Miller, 431; the Infinitesimal and Projective Transformation, Prof. E. O. Lovett, 431; Infinitesimal Transformations of Concentric Conics, Prof. E. O. Lovett, 431; a Theory of Recurring Means, C. Lagrange, 489; Mathematical Examination Papers for Use in Navy Classes in Schools, Rev. J. L. Robinson, 568; Properties of Gauche Curves, F. Deruyts, 604; Steiner's Surfaces, Prof. Brambilla, 627
- Mather (T.), Galvanometers, 93
- Mathews (R. H.), Australian Divisional Systems, 312
- Matruchot (M.), a New Trichophyton productive of Herpes in Horse, 359
- Matter, Potential, Prof. A. Schuster, F.R.S., 618
- Matteucci (Prof.), Volcanic Flames, 303
- Matthews (F. E.), Derivatives of Benzophenone, 23
- Maubeuge (H. de), the Green Ray at Sunrise, 564
- Mauder (Mrs.), on the Recent Solar Eclipse Expeditions, 533
- Maxwell (James Clerk) and Modern Physics, R. T. Glazebrook, F.R.S., Prof. A. Gray, F.R.S., 219
- Mechanical Engineering: Experiments on the Working of Gas Engines, F. W. Burstall, 21; the Mechanical Engineer's Handy Office Companion, Robert Edwards, 318
- Mechanics: a Course in Mechanical Drawing, John S. Reid, 8; Experimental Mechanics, G. H. Wyatt, 101; Theoretical Mechanics, an Introductory Treatise on the Principles of Dynamics, with Applications and Numerous Examples, A. E. H. Love, F.R.S., Prof. A. G. Greenhill, F.R.S., 169; Maintenance of Motion of Pendulum without Disturbance, G. Lippmann, 264; Principles of Mechanism: a Treatise on the Modification of Motion by Means of the Elementary Combinations of Mechanism, or the Parts of Machines for Use in College Classes by Mechanical Engineers, &c., S. W. Robinson, 268; Mode of Supporting Motion of Pendulum, A. Guillet, 287; the Utilisation of Wind Power, Prof. La Cour, 300; Apparatus for Representing Resultant of Two Pendulum Oscillations in same Straight Line, Prof. A. Righi, 488

- Medals, Treatment of the Surface of, Prof. Roberts-Austen, F.R.S., 236
- Medwedew (Dr.), Studies concerning the Oxidation of Salicyl Aldehyde in Tissue-Extracts, 484
- Medicine: Death of Dr. Samuel Gordon, 16; City Banquet to the Medical Profession, 37; Annual Meeting of British Institute of Preventive Medicine, 206; Transactions of, 339; Medical Missions in their Relation to Oxford, Sir Henry W. Acland, K.C.B., F.R.S., 222; Folk-Medicine in Ancient India, Dr. M. Winternitz, 233; Masters of Medicine: William Stokes, his Life and Work, 1804-1878, Sir William Stokes, 245; Ingredients of Chinese Herbal Prescription, J. B. Davy, 255; Rt. Hon. Arthur Balfour on the Medical Profession and its Work, 277; Meeting of the British Medical Association, Dr. F. W. Tunnicliffe, 349; Death of Dr. William Pepper, 372; Obituary Notice of, 420; Clinical Value of Agglutination of Koch's Bacillus of Human Serum, S. Arloing and Paul Courmont, 540; Recent Advances in Science and their Bearing on Medicine and Surgery, Prof. R. Virchow, For. Member R.S., 554; the Opening Addresses at the Medical Schools, F. W. Tunnicliffe, 576; the Present Position of the Medical Profession, Mr. Turner, 577; the Sale of Poisons, Sir J. C. Browne, 577; Death of Dr. Müller, 625; the Harveian Oration, Sir Dyce Duckworth, 602; Lord Lister on Experimental Medicine, 606
- Medusa of Lake Urumiah, the, Dr. Albert Günther, F.R.S., 319
- Mehner (Dr. E.), Biomechanik erschlossen aus dem Principe der Organogenese, 591
- Meinardus (Dr. W.), Meteorological Relations between North Atlantic and Europe in Winter, 131
- Meldola (Prof. R., F.R.S.), Essays on Museums and other Subjects connected with Natural History, Sir William Henry Flower, K.C.B., 217
- Melloni Thermo-Pile, Improvements on, Prof. H. Rubens, 39
- Melos, the Phylákopi Excavations, Mr. Hogarth, 627
- Memoirs of Caucasian Branch of Russian Geographical Society, 539
- Memoirs of Novorossian Society of Naturalists, 285
- Memoirs of St. Petersburg Society of Naturalists, 491
- Mendota, Lake, Plankton Studies on, Dr. E. A. Birge, 259
- Menschen, Lehrbuch der Entwicklungsgeschichte des, Dr. J. Kollmann, 77
- Mercalli (Prof. G.), Calabro-Messinese Earthquakes, 329
- Mercier (M.), Improvement of Over-Exposed Negatives, 120
- Merrifield (F.), Colouring of Pupæ of *Papilio machaon* and *P. napi* derived from Surroundings, 611
- Mesopotamia, the American Excavations in, J. P. Peters, 243
- Metal, Cooled, Transference of Heat in, Henry Bourget, 200, 521; Albert T. Bartlett, 411; John Stone Stone, 596
- Metal Work, Cast, from Benin, 224
- Metals and Alloys, Surfusion of, Prof. W. C. Roberts-Austen, F.R.S., 619
- Metallurgy: Method of Demonstrating Allotropic Change in Iron, A. Stansfield, 62; on Evaporation of Iron at Ordinary Temperature, H. Pellatt, 71; Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149; Manganese from Bog Iron Ore, 256; Corundum of Ontario, 256; the Electrical Resistance and Micro-Structure of Alloys, Saville Shaw, 356; Iron and Steel Institute, 430; the Swedish Iron Industry, R. Akerman, 430; Swedish Iron Ore Mining, Prof. G. Nordenström, 430; the Iron Ore Deposits of Swedish Lapland, H. Lundbohm, 430
- Metargon, Prof. James Dewar, F.R.S., 319
- Metargon and the Interplanetary Medium, J. R. Rydberg, 319
- Metargon, the Spectrum of, Prof. Arthur Schuster, F.R.S., 199, 269; Prof. W. Ramsay, F.R.S., M. W. Travers, and Edward C. Cyril Baly, 245
- Metaphysic of Experience, the, Shadworth H. Hodgson, 517
- Meteorology: Thunderstorms in Netherlands, 17; Climate of Paris, J. Jaubert, 22; Forty Years' Observations at Camden Square, 22, 117, 237, 311, 491, 539; Symons's Monthly Meteorological Magazine, 22, 117, 237, 310, 491, 539; Die Wettervorhersage, Prof. Dr. W. J. van Bebbler, 28; Future Rainfall, 30; Rainfall of Great Britain for First Quarter of 1898, 40; Heavy Rainfalls, C. Driehberg, 78; Frequency of Rainy Days in British Islands, R. H. Scott, F.R.S., 95; Rainfall and Earthquake Periods, Prof. J. P. O'Reilly, 103; the Abnormal Rainfall of December 1897 in Ceylon, H. Parker, 132; Summer Rainfall, A. B. MacDowall, 237; Rainfall for United Kingdom, April-June 1898, 353; Symons's British Rainfall 1897, G. J. Symons, F.R.S., and H. Sowerby Wallis, 389; Sunshine at Eastbourne, 40; Catania Soil-Temperature Observations, Dr. Tringali, 40; Diurnal Changes in Temperature and Humidity at Different Heights in the Air, H. H. Clayton, 59; Cloud-Production by Ultra-Violet Light, C. T. R. Wilson, 62; Meteorology and Magnetism, Prof. F. H. Bigelow, 86; Solar and Terrestrial Magnetism in relation to, F. H. Bigelow, 187; the Abnormal Weather of January 1898, F. J. Brodie, 95; Meteorological Society, 95, 190; Search Lights and Weather Signals, 109; Climate of Algeria, Dr. A. Thevenet, 117; Barisal Guns, Dr. A. Cancani, 130; Prof. C. Abbe, 353; Death of Henry Perigal, 131; Meteorological Relations between North Atlantic and Europe in Winter, Dr. W. Meinardus, 131; a High Rainbow, Prof. Sidney T. Moreland, 151; Prof. F. J. Allen, 175; a Monochromatic Rainbow, A. J. K. Martyn, 224; Pilot Chart of North Atlantic for June, 178; for August, 399; Mean Atmospheric Pressure and Temperature of the British Islands, Dr. Buchan, 178; Severe Storm off North-west Australia, W. E. Cooke, 178; Australasian Weather Charts and New Zealand Storms, Major-General Schaw, 582; Non-instrumental Phenomena in London, 1763-1897, R. C. Mossman, 190; Free-Air Exploration by Kites, A. L. Rotch, 190; the Use of Kites and Balloons in Meteorology, 382; Record Broken for High Kite Flight, Messrs. Clayton and Ferguson, 513; Kew Experiments on Aneroid Barometers, Dr. Chree, F.R.S., 215; Weather Lore, Richard Inwards, 222; Remarkable Hailstones, Samuel N. Player, 223; the Weather of this Summer, Alex. B. MacDowall, 247; High (August) Shade Temperatures, 373; the Hot (August) Weather, 397; the Weather for last Week of August, 421; Meteorological Observations at Madrid, 1860-94, F. Cos, 230; the Climate of Cuba, Dr. Phillips, 256; the Weather of Manila, Prof. Hazen, 256; Summer and Winter in relation to the Sun-spot Cycle, 270; Curious Phenomena, N. W. Thomas, 294; the Ben Nevis Observatories, 298, 350; Variations of Air-Temperature in Cyclones, Rev. M. Dechevrens, 301; Cumulus Cloud-Formation over Fire, R. de C. Ward, 328; Mineral Hail in Russian Poland, M. Czernik, 352; Balloon-Shaped Cloud, F. F. Payne, 353; Dogmatism on the Moon and the Weather, 368; the "Cold Days" of May, Dr. R. Hennig, 374; Iridescent Clouds, E. Armitage, 390; Registering Solar Radiometer, G. S. Isham, 432; Aurora, C. E. Stromeyer, 460; the Aurora of September 9, 490; Hon. Rollo Russell, 496; Baron N. Kaulbars, 569; an Aurora Borealis, H. Deslandres, 516; the Altitude of the Aurora Borealis, Prof. C. Abbe, 603; Magnetic Storm, Dr. Charles Chree, F.R.S., 468; British Local Publications, 491; Disastrous Hurricane in Windward Islands, 512; Meteorological Statistics of, H. Powell, 551; Meteorological Observations at Rousden Observatory, Sir Cuthbert Peek, 514; Luminous Clouds, Arthur P. Jenkin, 521; Luminous Clouds or Aurora, J. Edmund Clark, 546; Report of U.S. Weather Bureau for 1896-7, 523; Meteorological Photography, Mr. Clayden, 534; the Green Ray at Sunrise, H. de Maubeuge, 564
- Meteorite, Fall of a, in Bosnia, 375
- Meteorites, a Fine Collection of, 232
- Meteorites: Northward over the "Great Ice," a Narrative of Life and Work along the Shores and upon the Interior Ice-Cap of Northern Greenland in the Years 1886 and 1891-1897, with a Description of the Little Tribe of Smith Sound Eskimos, the most Northerly Human Beings in the World, and an Account of the Discovery and bringing Home of the "Saviksue" or Great Cape York Meteorites, Robert E. Peary; Dr. Hugh Robert Mill, 589
- Meteors: the Meteor Shower of November 13, 1897, 210; August Meteors, 330, 490; the Recent Perseid Meteoric Shower, W. F. Denning, 371; Minor Meteoric Radiants, W. F. Denning, 424; the Dynamical Explanation of certain Observed Phenomena of Meteor Streams, Dr. Johnstone Stoney, 535; Large Meteors in 1897-1898, W. F. Denning, 583; Remarkable Meteor at Ontario, F. F. Payne, 604; Curious Meteor (?), 626
- Methylene Blue, on the Use of, as a Means of Investigating Respiration in Plants, Prof. J. B. Farmer, 185, 215
- Metric System; our Weights and Measures, a Practical Treatise on the Standard Weights and Measures in Use in the British Empire, with some Account of the, H. Chaney, 268
- Metzner (R.), Atomic Weight of Tellurium, 191; Use of Copper Selenate in Making Selenic Acid, 264

- Meunier (J.), Mixture of Marsh Gas and Air not Exploded by
Glowing Filament of Incandescent Lamp, 635
- Meyer (G.), New Method of Measuring Dip and Horizontal
Intensity, 117
- Meyer (Dr. H. W.) and Adenoid Growths, 625
- Meyer's (Max) Theory of Audition, 166
- Miall (Prof. L. C., F.R.S.), a Yorkshire Moor, 377, 401
- Mice, Epidemics among, W. F. Kirby, 223
- Michelson (Prof.), a New Form of Grating Spectroscope, 280
- Michelson (Prof. Albert A.), Fourier's Series, 544
- Micro-Biology as Applied to Hygiene, 15
- Micrometers, Interference Fringes applied to Study of, Maurice
Hamy, 216
- Micro-Organisms, the Utilisation of, in the Arts and Manu-
factures, Dr. Franz Lafar, 265
- Micro-Structure of Alloys, the Electrical Resistance and,
Saville Shaw, 356
- Microscopy: Organic Substances available for Mounting Speci-
mens, H. G. Madan, 94; Microscopical Society, 94, 188,
311; Two Old Microscopes, 311; a Modified Camera
Lucida, Frederick Ives, 311; a Monochromatic Green
Screen, Frederick Ives, 311; New Method of Preserving
Rotifers, C. F. Rousselet, 425; Microscopic Observations of
Coherers, L. Arons, 491
- Migula (Prof. W.), System der Bakterien, 97
- Mile, Roman, Precise Length of, Antonio Blasquez, 109
- Milk and Butter, the Adulteration of, R. H. Wallace, 133
- Milk, a Bacillus in, Dr. C. McClure, 254
- Milky Sea, a White or, Dan Pidgeon, 520
- Milky Way, Drawings of the, 490
- Mill (Dr. Hugh Robert), Five Years in Siam from 1891 to
1896, H. Warington Smyth, 322; the Geography of the
United States, Henry Gannett, 497; on the Prospects of
Antarctic Research, 587; Northward over the "Great Ice,"
Robert E. Peary, 589
- Miller (Dr. G. A.), the Hamilton Groups, 431
- Millet, Alimentary Value of, M. Ballard, 336
- Milne (Prof.), Seismology, 534; Earthquake recorded in Isle
of Wight, June 29, 1898, 228
- Milner (S. R.), On the Thermal Conductivity of Water, 532
- Milroy (Dr. T. H.), Modern Physiology from the Chemical
Standpoint, 73
- Milroy (Dr.), Metabolism of Nucleins, 239
- Mimicry and Warning Colours, F. Finn, 58, 279
- Mimicry, Protective, J. Castets, S.J., Prof. E. B. Poulton,
F.R.S., 223
- Minakata (Kumagusu), Notes on the Bugonia-Superstitions—
the Occurrence of *Eristalis tenax* in India, 101; the Centipede-
Whale, 570
- Minchin (E. A.), Position of Sponges in Animal Kingdom, 426
- Mineralogy: Prospecting for Minerals, S. Herbert Cox, 7;
Rhodolite, W. E. Hidden, 92; a New Dilatometer, A. E.
Tutton, 118, 311; a Description of Minerals of Commercial
Value, D. M. Barringer, 124; Introduzione allo Studio dei
Silicati, Dr. E. Ricci, 268; Analysis of Cornish Chalco-
pyllite, E. G. J. Hartley, 311; a Possible Dimorphous
Form of Laurionite, G. F. H. Smith, 311; Mineralogical
Society, 311; Origin of Corundum associated with Perido-
tites in North Carolina, J. H. Pratt, 335; Death of N. A.
Pomel, 396; Vanadium and Molybdenum in United States,
W. F. Hillebrand, 539; Death of Prof. Andrea Arzruni, 603
- Mining: Prospecting for Minerals, S. Herbert Cox, 7; the
Causes of the Snaefell Lead Mine Accident, Dr. Le Neve
Foster, F.R.S., 178; Mining Accidents in 1897, Dr. Le
N. Foster, 461
- Minor Planets, John K. Rees, 304
- Mirage on City Pavements, R. W. Wood, 596
- Mirages, Wall, C. T. Whitmell, 619
- Mirrors, Metal-backed Glass, of Antiquity, D. Berthelot, 359
- Mirrors, a Simple Method of Making Light, Prof. Charles B.
Thwing, 571
- Missouri Botanical Garden, Ninth Annual Report, 77
- Mivart (Dr. St. George, F.R.S.), Lories, 189; Moral Sense
and Ethic, 294
- Mixer (W. G.), Electrosynthesis, 539
- Mohegan Wreck, the, and a Suggested Possible Local Deviation
of Ship's Compass, Prof. A. W. Rücker, 629
- Moissan (Henri), the Preparation of Crystallised Calcium, 209;
Behaviour of Calcium heated in Hydrogen, 257; Analysis of
Commercial Calcium Carbide, 588; Calcium Nitride, 612
- Moki Indians, Aspects of Sun Worship among the, 295
- Mollusca: the Value of a Right-handed "Chank" Shell, Edgar
Thurston, 627
- Monachus tropicalis*, the West Indian Seal, 179
- Monaco (Albert, Prince of), some Results of my Researches on
Oceanography, 200
- Monium, Sir William Crookes, F.R.S., 438, 556
- Moniz (J. M.), Death of, 372
- Monochromatic Rainbow, a, A. J. K. Martyn, 224
- Montemartini (Dr. L.), Fisiologia Vegetale, 100
- Moody (G. T.), Preparation of Standard Acid Solution by
Direct Absorption of Hydrogen Chloride, 238
- Moon, the, and Auroræ, Prof. H. A. Hazen, 304
- Moon and the Weather, Dogmatism on the, 368
- Moon's Course, the, Sir Samuel Wilks, Bart., F.R.S., 496;
J. Hughes Hemming, 545; E. L. Garbett, 571
- Mooney (James), the Ghost-Dance Religion and the Sioux Out-
break of 1890, 125
- Moor, a Yorkshire, Prof. L. C. Miall, F.R.S., 377, 401
- Moore (J. E.), Electrical Discharge from Kinetic Point of View,
335
- Moore (J. E. S.), the Marine Fauna in Lake Tanganyika, and
the Advisability of Further Exploration in the Great African
Lakes, 404
- Moral Instinct, the Origin and Growth of the, Alexander
Sutherland, 241
- Moral Sense and Ethic, Dr. St. George Mivart, F.R.S., 294
- Morality Independent of Obligation or Sanction, M. Guyau, 567
- Morbology: the Sero-Diagnostic Test for Typhoid Fever, Dr.
McWeeney, 47; Immunity of Arabs against Typhoid Fever,
M. Vincent, 86; Effect of Polluted Soil on Vitality of
Typhoid Bacillus, Dr. Sidney Martin, 577; the Plague in
Calcutta and Dr. Haffkine's Method, 85; Formation in
Blood Serum, under Chemical Action, of Material coagu-
lating Bacilli of Tuberculosis, S. Arloing, 143; the Con-
tagious Character of Tuberculosis, 487; Leprosy in Russia,
M.M. Kirchner and Kübler, 158; Distribution of Leprosy in
the Far East, S. B. J. Skertchly, 514; the Etiology and
Prevention of Malarial Fever, Dr. E. Klein, F.R.S., 175; a
Plague Centre in German East Africa, Prof. Koch, 254; the
Hematozoa of Goitre, E. Grosset, 264; the Diseases of the
Lungs, James Kingston Fowler and Rickman J. Godlee, 291;
Rabies in Prussia, 300; Thermogenesis in Tetanus, M.M.
D'Arsonval and Charrin, 336; Clinical Varieties of Hepatic
Cirrhosis, Dr. Alexander James, 349; Influence of Micro-
Organisms on Diseases of Nervous System, Dr. Buzzard, 350;
the Tsetse Disease in Mammals, Prof. Kanthack and Mr.
Durham, 426; Rats and the Plague, Dr. F. G. Clemow,
551; the Mosquito the Host of Malaria Parasite, Surg. Maj-
Ronald Ross, 523
- Morel (Albert), Preparation of Mixed Carbonic Ethers, 240
- Moreland (Prof. Sidney T.), a High Rainbow, 151
- Morgan (Prof. C. Lloyd), Animal Intelligence: an Exper-
imental Study of the Associative Processes in Animals, Edward
L. Thorndike, 249, 390; on Animal Intelligence, 585
- Morgan (G. T.), Action of Formaldehyde on Naphthalene
Amines, I., 142
- Morize (H.), Duration of Emission of Röntgen Rays, 635
- Morphology: System der Bakterien, Prof. W. Migula,
Prof. A. A. Kanthack, 97; the Blood, how to Examine and
Diagnose its Diseases, Alfred C. Coles, 269; Morphology of
Vertebrates, Dr. Robert Wiedersheim, W. N. Parker, 409
- Morrell (Dr.), on the Oxidation of Glucose, 557
- Morris (Dr. D.), Sources of India-Rubber and Gutta-Percha, 514
- Moss: Prothallus of *Lycopodium clavatum* Discovered, Mr.
Lang, 633
- Moss (R. T.), Apparatus for Drying Bodies in Vacuo, 191
- Mosso (Prof.), Mountain Sickness, 481
- Mossman (R. C.), Non-instrumental Meteorological Phenomena
in London, 1763-1897, 190
- Mortillet (Gabriel de), Death of, 522; Obituary Notice of, 550
- Morton (G. H.), Carboniferous Limestone of Country round
Llandudno, 71
- Motion of Stars in the Line of Sight, M. Deslandres, 490
- Mott (Dr. F.W., F.R.S.), on the Influence of Cholin, Neurine,
and some Allied Substances upon the Arterial Blood-pressure,
483
- Mouneyrat (A.), Action of Aluminium Chloride and Chlorine
on Anhydrous Chloral, 120; Chlorination of Acetylene, 216;
Brominating Action of Aluminium Bromide in Fatty Series,
287; Action of Bromine on Normal Propyl Bromide in
Presence of Anhydrous Aluminium Bromide, 359

- Mount Kosciusko, Botanical Exploration of, J. H. Maiden, 551
 Mountain Sickness, Prof. Mosso, 481
 Mountaineering: Ascent of Yllimani, Sir W. M. Conway, 513;
 Attempts to Climb Mount Sorata, Sir Martin Conway, 626
 Mourelo (J. R.), Composition of Phosphorescent Sulphide of
 Strontium, 336, 432
 Moureu (Ch.), Hydrolysis of Ethane-dipyrocatechin, 359;
 Monopyrocatechin Glyoxal, 384
 Mourlot (A.), Anhydrous Crystallised Magnesium Sulphide,
 312; Crystallisation of Anhydrous Sulphides of Calcium
 and Strontium, 516
 Movement imparted by Tactile Impression, the Effect of, 588
 Mud Volcanoes, Petroliferous Sands and, in Burma, Dr. Fritz
 Noetting, 20
 Mushketoff (Prof.), Glaciers of Russia in 1896, 256
 Müller (Dr.), Death of, 625
 Müller (Herr), a New Long Period Variable, 60
 Müller (Prof. F.), Death of, 108
 Müller (J. A.), Synthetic Preparation of Potassium Carbonyl-
 Ferrocyanide, 96
 Munroe (John), a Trip to Venus, 366
 Munthe (H.), the Interglacial Submergence of Great Britain, 374
 Murani (Prof. O.), Stationary Hertzian Waves as studied with
 Use of Coherer, 552
 Murché (Vincent T.), Domestic Science Readers, 8
 Murray (George), the Phyto-Plankton of the Atlantic, 70
 Murray (Sir John), Plea for a British Antarctic Expedition, 604
 Museums Committee Report, 16
 Museums, Essays on, and other Subjects connected with
 Natural History, Sir William Henry Flower, K.C.B., Prof.
 R. Meldola, F.R.S., 217
 Museums, the Natural History, 247
 Mutilation of Animals, the Wanton, Dr. George Fleming, 605
 Mycology: Technical Mycology, Dr. Franz Laffar, 265;
 Mykologische Untersuchungen aus den Tropen (Mycological
 Researches in the Tropics), Dr. Carl Holtermann, G. Masseur,
 590
 Myers (Mr.), Psychological Side of Hypnotism, 350
 Mythology, the Crab in, Prof. D'Arcy Thompson, 143
 Naegamvala (Prof.), Photograph of the Chromosphere, 526
 Naples, the Disposal of the Town Refuse of, Prof. P. Boubée, 524
 Nasimi (Prof. R.), Solfatara Gases, 269
 National Museum of Natural History, the, 227
 National Physical Laboratory, the, 548, 565
 Natterer, (Dr. K.), on the Oceanographical Results of the
 Austro-Hungarian Deep-Sea Expeditions in the Eastern
 Mediterranean, Sea of Marmora, and Red Sea, 586
 Natural History: Hints on the Management of Hawks, J. E.
 Harting, 122; Wild Pigs and Python, Ernest Hose, 133;
 Essays on Museums and other Subjects connected with Nat-
 ural History, Sir William Henry Flower, K.C.B., Prof. R.
 Meldola, F.R.S., 217; the National Museum of Natural
 History, 227; the Natural History Museum, 247; the Mam-
 mals, Reptiles, and Fishes of Essex, H. Laver, 242; Memo-
 irs of Novorossian Society, 285; Death of Mr. Van Voorst,
 289; a Living Toad in a Snake, Colonel W. F. Major,
 344; Live Frog taken out of a Snake, Rose Haig Thomas,
 367; H. Ling Roth, 368; Death of J. M. Moniz, 372;
 Storia Naturale per la Gioventù Italiana, Dr. Achille Griffini,
 389; American Museum of Natural History, Glyptic and
 Graphic Art applied to Palæontology, 392; the Blue-Tongued
 Tasmanian Lizard as a Snake Destroyer, Stuart Dove, 422;
 the Memory of Fishes, Prof. W. C. McIntosh, 422; Memoirs
 of St. Petersburg Society of Naturalists, 491; Report on the
 Results of the Pamir Boundary Commission, A. W. Alcock,
 493; Deep-Sea Dredging, and the Phosphorescence of Living
 Creatures at great Sea Depths, E. L. J. Ridsdale, 497; a
 Hairless Rat, T. V. Hodgson, 546; a Fourth Specimen of
Notornis mantelli, Owen, Prof. W. Blaxland Benham, 547;
 a Living Representative of the Old Ground-Sloths, 547; the
 Centipede-Whale, Kumagusu Minakata, 570; the Develop-
 ment of the Tuatara Lizard, Prof. A. Dendy, 609; G. A.
 Boulenger, 619
 Natural Hygiene, H. Lahmann, 614
 Natural Phenomena, Sun-spot Periods and, M. Camille Flam-
 marion, 134
 Natural Selection, Prof. W. F. R. Weldon, F.R.S., 499;
 Organic Variations and their Interpretation, J. T. Cunn-
 ingham, 593; Rev. George Henslow, 594; Prof. W. F. R.
 Weldon, F.R.S., 595
 Nature, Problems of Researches and Discoveries of, Gustav
 Jaeger, 222
 Nature, a Student of, R. Menzies Fergusson, 543
 Nautical Astronomy, a Proposed Revolution in, 10
 Nautical Astronomy, Captain J. F. Ruthven, 151
 Navigation: Screw Propeller Cavitating Water, Hon. C. A.
 Parsons, 62; Navigation, Captain J. F. Ruthven, 104; Navi-
 gation and Cyclones, A. Ferion, 197; Illuminated Buoys, I.
 Pintsch, 489; the *Mohegan* Wreck and a suggested Possible
 Local Deviation of Ship's Compass, Prof. A. W. Rücker, 627
 Nebulæ, the Spectrum of Hydrogen in, Prof. Scheiner, 41
 Nebula of Andromeda, the, 515; M. Seraphimoff, 605
 Nebulæ, Catalogue of, Lewis Swift, 515
 Nebular Hypothesis, the, M. le Général Lafouge, 342
 Nebulosities of the Pleiades, the Exterior, 463
 Neely (S. T.), the Physics of Timber, 130
 Neolithics: Discovery of a Crannog on the Clyde, W. A. Don-
 nelly, 488; Crannoges in Estuaries, W. F. Sinclair, 521;
 R. J. Ussher, 571
 Neuhaus (R.), Proof of Existence of Thin Zenker's Plates in
 Colour Photographs by Lippmann's Method, 187
 Neurons of the Cortex Cerebri, on the Changes in the Form of
 the, under Various Conditions of Rest and Excitation, Dr. J.
 Demoor and Prof. Heger, 481
 New Physical Laboratory of Owens College, Manchester, 621
 New South Wales Linnean Society, 192, 240, 359, 492, 635
 New South Wales Royal Society, 312, 464
 New York Botanical Garden, 603
 New Zealand, the Echinoderm Fauna of, H. Farquhar, 636
 New Zealand Kea, the, Why it Attacks Sheep, F. R. Godfrey,
 110
 Newberry (John Strong), the Flora of the Amboy Clays, 81
 Newcomb (Prof. Simon), Reminiscences of an Astronomer, 376,
 583, 606
 Newlands (J. A. R.), Death of, 372; Obituary Notice of, 395
 Nicholson (Wm. Edward), Bacteria on an Ancient Bronze Im-
 plement, 32
 Nicoloux (Dr. Maurice), Carbon Monoxide in Blood, 120; Pro-
 duction of Carbon Monoxide in Organism, 143; Carbonic
 Oxide Production in Organism, 483
 Nijland (Dr.), the Variable α Ceti, 330
 Nippur, or Explorations and Adventures on the Euphrates, J.
 P. Peters, 243
 Nitro-Explosives, J. Daniel, 4
 Noetting (Dr. Fritz), Petroliferous Sands and Mud Volcanoes in
 Burma, 20; Palæontology of Baluchistan, 257
 Noll (Dr. Fritz), a Text-Book of Botany, 494
 Nomenclature and Notation in Calorimetry, J. Y. Buchanan,
 F.R.S., 30
 Nordenström (G.), Swedish Iron-Ore Mining, 430
 North America, Bird Studies, an Account of the Land Birds of
 Eastern, W. E. D. Scott, 541
 North American Birds, a Hundred and Fifty, Neltje Blanchan,
 388
 North Pole, Suggested "Ice-breaker" Expedition to, Admiral
 Makaroff, 353; Return of the Swedish Arctic Expedition,
 523
 Northern "Durchmusterung," the, 42
 Northern Highway of the Tsar, a, Aubyn Trevor-Battye, 75
 Northward over the "Great Ice," Robert E. Peary, Dr. Hugh
 Robert Mill, 589
 Notation in Calorimetry, Nomenclature and, J. Y. Buchanan,
 F.R.S., 30
 Notes from a Dairy, 1873-1881, Right Hon. Sir Mountstuart
 E. Grant Duff, 198
Notornis mantelli, Owen, a Fourth Specimen of, Prof. W.
 Blaxland Benham, 547
 Novorossian Society of Naturalists, Memoirs of, 285
 Obach (Dr. Eugene F. A.), Gutta-Percha, 136
 Observations, Notes on, Sydney Lupton, 7
 Observatories: Mr. Tebbutt's Observatory, 88; the Liverpool
 Observatory, 134; the Royal Observatory, Greenwich, Annual
 Report, 134; Oxford University Observatory, Prof. Turner,
 182; Destruction of the French Observatory in Madagascar,
 E. Colin, 259; the New Observatory at Heidelberg, 376;
 the Ben Nevis Observatories, 298, 350; the Paris Observ-
 atory, 356; New Teaching Observatory of the Californian
 University, 553; Annual Report of the Cambridge Observ-
 atory, 553; Annual Publication of the Observatory of Rio de
 Janeiro for 1898, 553; the Cape Observatory Report, 584

- Obsidian "Buttons" in Australia, 109
 Oceanography, some Results of my Researches on, Albert Prince of Monaco, 200
 O'Connor (D.), the Transport of Live Fish, 125
 O'Connor (Rev. J. F. X.), Facts about Book Worms, 435
 Œuvres complètes de Christiaan Huygens, Dr. J. L. E. Dreyer, 361
 Ogilby (Mrs.), *Æthopora perspicillata*, 192
 Ogilvie (Maria M.), die Korallen der Stramberger Schichten, 282
 Oldham (R. D.), the Indian Earthquake of August 9, 1895, 421; on the Great Indian Earthquake of June 12, 1897, 586
 Oliver (Dr. T.), French Match Manufactories, 327
 Ontario, Corundum in, 256
 Oolite, a Tooth of *Hybodius grossicornis* from the Inferior, Thos. Beacall, 390
 Opposition, Observations of Jupiter during the, 1898, Sir J. Comas Solá, 526
 Ophthalmology: Trachoma in Prussia, 254; Inflammatory Vegetable Application Used by Malingering Egyptian Soldiers, Kenneth Scott, 255
 Optics: Cloud-production by Ultra-Violet Light, C. T. R. Wilson, 62; New Instrument for Measuring Astigmatism, R. Straubel, 117; Optical Phenomena depending on Electric Charge and Mass of Ions, Part I., Prof. H. A. Lorenz, 48, 144; Röntgen Rays and Ordinary Light, C. Godfrey, 142; Possibility of Deducing Magneto-Optic Phenomena from Direct Modification of Electro-dynamic Energy Function, F. G. Leatham, 142; Visibility of Blind Spot in Retina, Aug. Charpentier, 168; Das Optische Drehungsvermögen Organischer Substanzen und dessen praktische anwendung, H. Landolt, Drs. O. Schönrock, P. Lindner, F. Schütt, L. Berndt, and T. Posner, 172; Flicker, T. C. Porter, 188; Interference Fringes applied to Study of Micrometers, Maurice Hamy, 216; Radiation of Incandescent Burners, H. Le Chatelier and O. Boudouard, 240; Maxima and Minima of Apparent Brightness due to Illusion, Prof. Haga, 288; a Modified Camera Lucida, Frederick Ives, 311; Recueil de Données Numériques Optique, H. Dufet, 344; a Simple Method of Making Light Mirrors, Prof. Charles B. Thwing, 571; New Action of Light traversing Metallic Vapours in Magnetic Field, D. Macaluso and O. M. Corbino, 635
 O'Reilly (Prof. J. P.), Astronomical Destination of Cromlechs near Dublin, 61; Rainfall and Earthquake Periods, 103
 Orchids of the Sikkim Himalaya, Sir George King and Robert Pantling, 465
 Ordinary Light, Röntgen Rays and, Prof. J. J. Thomson, F.R.S., 8
 Ores, Methods for the Analysis of Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149
 Organic Chemistry, Practical, George George, 245
 Organic Variations and their Interpretation, J. T. Cunningham, 593; Rev. George Henslow, 594; Prof. W. F. R. Weldon, F.R.S., 595; Walter Garstang, 619
 Organogeny: Biomechanik erschlossen aus dem Principe Organogenese, Dr. E. Mehnert, 591
 Organographie der Pflanzen, Dr. Goebel, 74
 Ornithology: Morphology of Owls, W. P. Pycraft, 46; Why the New Zealand Kea attacks Sheep, F. R. Godfrey, 110; Obituary Notice of Osbert Salvin, F.R.S., 128; Birds in London, W. H. Hudson, 172; Lories, Dr. St. G. Mivart, F.R.S., 189; the Fauna of British India, Birds, W. T. Blanford, 195; the Habits of Indian Birds, Frank Finn, 208; Anatomy of the Swallows, Dr. R. W. Shufeldt, 199; Wolmer Forest as a Sanctuary for Birds, 255; Ackworth Birds, being a List of Birds in the District of Ackworth, Yorkshire, Major Walter B. Arundel, 292; a Dictionary of Bird Notes, C. L. Hett, 366; Bird Neighbours: an Introductory Acquaintance with One Hundred and Fifty Birds commonly found in the Gardens, Meadows, and Woods about our Homes, Neltje Blanchan, 388; the Life Work of William Turner, Rev. H. A. Macpherson, 398; Social Instinct in Birds, B. B. Osmaston, 398; Bird Studies, an Account of the Land Birds of Eastern North America, W. E. D. Scott, 541
 Osborn (Prof.), *Pliohyrax fraasii*, 428
 Osgood (Prof.), Example of Single-valued Function with Natural Boundary, whose inverse is also Single-valued, 310
 Osmaston (B. B.), Social Instinct in Birds, 398
 Osmosis: the Theoretical Calculation of an Osmotic Optimum, Prof. Errera, 633
 Osteometric Index-Calculator, an, David Waterston, 597
 Ostrich, the Angora Goat and a Paper on the, S. C. Cronwright Scheiner, 314
 Ostrovomov (Herr), Flying Entomostraca, 513
 O'Toole (Rev. H.), a New Hydrometer, 191, 524
 Oudin (M.), Electric Resonators, 167
 Owens College, Manchester, New Physical Laboratory of, 621
 Owls, Morphology of, W. P. Pycraft, 46
 Oxford, Medical Missions in their Relation to, Sir Henry W. Acland, K.C.B., F.R.S., 222; Oxford University Observatory, Prof. Turner, 182
 Oyster, Modified Pedal Muscles in, Prof. Herdman, F.R.S., 216
 Ozone, the Production and Uses of, 416
 Pacific Coast, Earthquakes of, 1767-1897, Dr. E. S. Holden, 231
 Packard (Prof. Alpheus S.), a Text-Book of Entomology, including the Anatomy, Embryology and Metamorphoses of Insects, for Use in Agricultural and Technical Schools and Colleges, 244
 Paget (Stephen), Ambroise Paré and his Times, 1510-1590, 49
 Palaeontology, Prof. Whitney's "Calaveras Skull," 17; the Petrification of Fossil Bones, E. Goldsmith, 59; Skull of Amphictis, E. S. Riggs, 92; *Thylacoleo*, Dr. R. Broom, 192; Palaeontology of India, Dr. Fritz Noetling, 256; Dr. Carl Diener, 257; Die Korallen der Stramberger Schichten, Maria M. Ogilvie, Dr. J. W. Gregory, 282; Outlines of Vertebrate Palaeontology, A. Smith Woodward, 337; a Tooth of *Hybodius grossicornis* from the Inferior Oolite, Thos. Beacall, 390; Glyptic and Graphic Art applied to Palaeontology, 392; a Dragon of the Prime, 418; *Pliohyrax fraasii*, Prof. Osborn, 428; Prehistoric Fauna of Block Island, G. F. Eaton, 432; *Arhinolenur*, M. Ameghino, 492; Species of Ichthyodectes, O. P. Hay, 539
 Palazzo (Signor), on the Magnetic and Electrolytic Actions of Electric Railways, 533
 Pamir Boundary Commission, Report on the Natural History Results of the, A. W. Alcock, 493
 Pantling (Robert), Annals of the Royal Botanic Gardens, Calcutta, Vol. viii., the Orchids of the Sikkim Himalaya, 465
 Paper, the Deterioration of, Report of Society of Arts Committee, 85
 Paper, a New Photographic Printing, 213
 Papageria, W. J. McGee, 525
 Parallaxes and Masses of γ Virginis and γ Leonis, Dr. Belopolsky, 400
 Paré (Ambroise) and his Times 1510-1590, Stephen Paget, 49
 Paris Academy of Sciences, 23, 47, 71, 95, 119, 143, 167, 191, 216, 239, 264, 287, 311, 336, 359, 384, 408, 432, 464, 492, 516, 540, 564, 588, 612, 635
 Paris, Climate of, J. Jaubert, 22
 Paris Exhibition, the Great Telescope for the, 424
 Paris Observatory, the, 356
 Parker and Haswell's Text-book of Zoology, Prof. W. N. Parker, 200
 Parker (H.), the Abnormal Rainfall of December 1897 in Ceylon, 132
 Parker (Dr. J. Gordon), on Recent Advances in the Tanning Industry, 557
 Parker (Prof. T. Jeffery, F.R.S.), a Text-book of Zoology, 25
 Parker (Prof. W. N.), Parker and Haswell's Text-book of Zoology, 200; Elements of the Comparative Anatomy of Vertebrates, 409
 Parry (John), Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., 149
 Parsons (Hon. C. A.), Screw Propeller Cavitating Water, 62
 Pasteur Institut, Report of Anti-Rabic Inoculations in 1897, 59
 Pasteur, a Life of, Percy Frankland, F.R.S., and Mrs. Percy Frankland, 290
 Pathology: a Manual on General Pathology for Students and Practitioners, Dr. W. S. Lazarus Barlow, 244; Pasteur, Percy Frankland, F.R.S., and Mrs. Percy Frankland, 290; Opening of the Thompson-Yates Laboratories at University College, Liverpool, 575
 Paton (Dr. D. Noël), upon the Distribution of Nitrogen and of Sulphur in the Urine of the Dog, 486
 Payne (F. F.), Balloon-shaped Cloud, 353; Remarkable Meteor at Ontario, 604
 Pavements, Mirage on City, R. W. Wood, 596
 Peachey (S. J.), Resolution of Tetrahydropapaverine into its Optically Active Components, 94

- Pearson (Prof. Karl, F.R.S.), the Distribution of Prepotency, 292; Chance or Vitalism, 495; Reconstruction of Stature of Prehistoric Races, 286
- Pearson (Marchant), Notes on Volumetric Analysis, 269
- Peary (Robert E.), Northward over the "Great Ice," Dr. Hugh Robert Mill, 589
- Peat-Fibre Yarn, 178
- Pechuele (Herr), Comet Tempel 1866? 490
- Peddie (Dr. W.), Torsional Oscillations of Wires, 239
- Peck (Sir Cuthbert), Meteorological Observations at Rousden Observatory, 514
- Pierce (B. O.), Properties of Seasoned Magnets of Self-hardening Steel, 117
- Pekelharung (Prof.), Food-reception by Sponges, 47
- Pelabon (H.), Action of Hydrogen on Silver Sulphide and *vice versa*, 240
- Pell (A.), Focal Surfaces of Congruences of Tangents to given Surface, 22
- Pellat (H.), on Evaporation of Iron at Ordinary Temperature, 71; the Energy of a Magnetic Field, 612; Variation of Dielectric Constants with Temperature, 635
- Pendulum without Disturbance, Maintenance of Motion of, G. Lippmann, 264
- Pendulum, Mode of supporting Motion of, A. Guillet, 287
- Pendulum Oscillations in same Straight Line, Apparatus for representing Resultant of Two, Prof. A. Righi, 488
- Pentane Lamp, 10-candle, Vernon Harcourt, 557
- Pepper (Dr. William), Death of, 372; Obituary Notice of, 420
- Peptone Committee Experiments, the, 585
- Perfumes, the Chemical Manufacture of, 398
- Perigal (Henry), Death of, 131
- Peringuey (L.), South African Coleoptera, 423
- Perini (N.), Dante's Ten Heavens, Edmond G. Gardner, 362
- Periodic Comets, M. Schulhof, 526
- Peripatus nova-britanniae*, Development of, Dr. A. Willey, 142
- Perkin (A. G.), Yellow Colouring Matter of Leaves of *Arc-tostaphylos uva ursi*, 23; Azobenzene Derivative of Chrysin, 238; Constituents of "Waras," 238
- Perkin (W. H., jun.), Synthesis of Cis- and Trans-Caronic Acids, 23; Lauronic Acid, 23; Action of Bromacetal on Sodium Derivative of Ethylic Malonate, 23
- Perot (A.), Method of determining Order of Interference Fringe of High Order, 143
- Perrier (Prof. Ed.), Presidential Address to International Sea-Fisheries Congress at Dieppe, 511
- Perrine, Comet (March 19), 19, 42, 60; Dr. Berberich, 400
- Perrine, Comet (June 14), 232, 280
- Perrot (Louis), Thermo-Electric Electromotive Forces in Crystallised Bismuth, 23
- Perseid Meteoric Shower, the Recent, W. F. Denning, 371
- Perthshire, the Flora of, Dr. F. Buchanan White, 124
- Petavel (J. E.), Heat dissipated by Platinum Surface at High Temperatures, 237
- Peters (J. P.), Nippur; or, Explorations and Adventures on the Euphrates, 243
- Petrie (Prof. W. M. Flinders), Prehistoric Egypt, 31
- Petroliferous Sands and Mud Volcanoes in Burma, Dr. Fritz-Noetting, 20
- Pflanzen, Organographie der, Dr. Goebel, 74
- Pharmacology, its Aims and Methods, Dr. W. J. S. Jerome, 158
- Pharmacy: Death of Dr. J. E. de Vry, 352; the British Pharmaceutical Conference, Presidential Address of Dr. Charles Symes, 398; the Chemical Manufacture of Perfumes, 398
- Phillips (Dr.), the Climate of Cuba, 256
- Phillips (Prof.), Form of Protoplasmic Body in Florideæ, 633
- Philylogy: Origin of Phœnician Alphabet Characters, Prof. Crum Brown, 143
- Phisalix (Dr. C.), on the Existence of an Oxydase in the Skin of certain Batrachians, 485
- Phœnician Alphabet Characters, Origin of, Prof. Crum Brown, 143
- Phoroglucinol, Bone-Softening by, J. J. Andear, 47
- Phosphorescence, Herbert Jackson, 559; Deep-Sea Dredging and the Phosphorescence of Living Creatures at great Sea Depths, E. L. J. Ridsdale, 497
- Phosphorus in Lucifer Matches, 345
- Photography: at the Crystal Palace, 14; Submarine Photography, Prof. Louis Boutan, 18; Electrical Impressions on Photographic Plates, A. S. Bates, 32; Photographic Action of Printer's Ink, W. Trueman Tucker, 32; Printer's Ink and Photographic Plates, Rev. F. J. Jervis-Smith, F.R.S., 78; Phase Reversal and Silver Zone Plates, R. W. Wood, 61; Photography by the Aurora Borealis, J. E. Turner, 88; Improvement of Over-Exposed Negatives, M. Mercier, 120; Krömsköp Colour Photography, Frederick Ives, 124; Printed Matter and Photographic Plates, A. A. C. Swinton, 125; the Action of Electric Discharges on Photographic Plates, A. A. C. Swinton, 151; Figures produced on Photographic Plates by Electric Discharges, J. A. McClellan, 142; Action of Ammonium Persulphate on Silver in Negatives, MM. Lumière and Seyewetz, 168; Proof of Existence of Thin Zenker's Plates in Colour Photographs by Lippmann's Method, R. Neuhaus, 187; Reproduction by Photographic Processes, T. Bolas, 204; a New Photographic Printing Paper, 213; the Scientific Side of Photography, John Stuart, 254; Practicum der Wissenschaftlichen Photographie, Dr. Carl Kaiserling, 268; Comparison of Shadows of Röntgen Rays by Photography, Prof. Villari, 303; Photographische Bibliothek, Nos. 9 and 10, Das Fernobjektiv, Hans Schmidt, Der Gummidruck, J. Gaedicke, 343; Photography Annual: a Compendium of Photographic Information with a Record of Progress in Photography for the Past Year, 466; Meteorological Photography, Mr. Clayden, 534; Photograph of the Chromosphere, Prof. Naegamvala, 526; the Manufacture of Kinematograph Films, 552; Dr. W. J. Russell on the Action exerted by certain Metals and other Organic Substances on a Photographic Plate, 556; Mr. C. H. Bothamley on the Action of certain Substances on the Undeveloped Photographic Image, 557; Prof. Percy Frankland on an Additional Photographic Action—that of Bacteria, 557; Triplet Lightning Flash, C. E. Stromeyer, 570; Photographing Lightning by Day, F. H. Glew, 627; Mr. Francis Galton on Photographic Records of Pedigree Stock, 584
- Phylakopi, Melos, Excavations, the, Mr. Hogarth, 627
- Physics: Notes on Observations, Sydney Lupton, 7; Röntgen Rays and Ordinary Light, Prof. J. J. Thomson, F.R.S., 8; the New Physical Research Laboratory at the Sorbonne, 12; the Flow of Water, Prof. H. S. Hele-Shaw, 34, 520; Flow of Water shown by Colour Bands, Prof. Osborne Reynolds, F.R.S., 467; Prof. H. S. Hele-Shaw, 467; Collapse of Spherical Shell under Pressure, Prof. H. Schoentjes, 40; an Elementary Course of Physics, 51; on Evaporation of Iron at Ordinary Temperature, H. Pellat, 71; Liquefaction of Hydrogen, 55; Dr. W. Hampson, 77, 174, 246, 292; Prof. J. Dewar, F.R.S., 125, 199, 270, 319; Physical Society, 93, 119, 166, 215; Wiedemann's Annalen, 93, 117, 187, 335, 491; Die fundamentalen physikalischen Eigenschaften der Krystalle in elementarer Darstellung, Dr. Woldemar Voigt, W. H. and G. Chisholm Young, 99; Structures formed by Drying Fluid with Particles in Suspension, C. A. Raisin, 117; New Method of Measuring Dip and Horizontal Intensity, G. Meyer, 117; the Theory of Sound, J. W. Strutt, Baron Rayleigh, F.R.S., 121; the Rudiments of Physics and Chemistry, 123; on a New Constituent of Atmospheric Air, Prof. W. Ramsay, F.R.S., and Morris W. Travers, 127; the Physics of Timber, S. T. Neely, 130; Figures produced on Photographic Plates by Electric Discharges, J. A. McClellan, 142; on Laboratory Arts, Richard Threlfall, C. V. Boys, F.R.S., 145; Diffusive Convection, A. Griffiths, 167; Dendritic Patterns caused by Evaporation, Prof. G. H. Bryan, F.R.S., 174; Catherine A. Raisin, 224; Method of Measuring Surface Tension of Liquids, Dr. F. T. Trouton, F.R.S., 191; a New Hydrometer, Rev. H. O'Toole, 191, 524; Apparatus for Drying Bodies in Vacuo, R. J. Moss, 191; Liquid Air at One Operation, Lord Rayleigh, F.R.S., 199; the supposed Photographs of Currents from Human Body, Dr. A. Guébbard, 207; James Clerk Maxwell and Modern Physics, R. T. Glazebrook, F.R.S., Prof. A. Gray, F.R.S., 219; Torsional Oscillations of Wires, Dr. W. Peddie, 239; the Doctrine of Energy: a Theory of Reality, 269; a First Year's Course of Practical Physics, J. F. Tristram, 269; some Conditions affecting Geyser Eruptions, T. A. Jagger, jun., 261; Compressibility of Air as Gaseous Mixture, E. H. Amagat, 287; Recueil de Données Numériques Optique, H. Dufet, 344; Text-Book of Physical Chemistry, Clarence L. Speyers, 344; Local Variation in Intensity of Gravity near Mount Etna and in Eastern Sicily generally, A. Ricco, 354; Œuvres complètes de Christiaan Huygens, Dr. J. L. E. Dreyer, 361; Melting Points of Substances under High Pressure, E. Mack, 432; the Motion of Falling Spray, Arthur Jenkin, 460;

- Motion of Translation of Luminiferous Ether, W. Wien, 491; the National Physical Laboratory, 548, 565; Fourier's Series, Prof. Albert A. Michelson, 544; A. E. H. Love, F.R.S., 569; Lehrbuch der Experimental-Physik, Eduard Riecke, Prof. A. Gray, F.R.S., 566; Transference of Heat in Cooled Metal, Henry Bourget, 200, 521; Albert T. Bartlett, 411; John Stone Stone, 596; New Laboratory of Owens College, Manchester, 621; the Phenomenon of Equilibrium in Isomorphous Mixtures, Guseppe Bruni, 627; Mixture of Marsh Gas and Air not Exploded by Glowing Filament of Incandescent Lamp, H. Couriot and J. Meunier, 635
- Physiology: Sleep and the Theory of its Cause, 8; Thymus and Thyroid Glands in Marsupialia, J. Johnstone, 46; Text-book of Physiology, Dr. T. H. Milroy, 73; Action of Anæsthetics on Protoplasm, J. D. Farmer and A. D. Waller, F.R.S., 93; Carbon Monoxide in Blood, Maurice Nicloux, 120; Production of Carbon Monoxide in Organism, Maurice Nicloux, 143; Electro-physiology, W. Biedermann, 150; the Span of Gestation and the Cause of Birth, Dr. John Beard, Dr. Arthur Robinson, 173; Modified Pedal Muscles in Oyster, Prof. Herdman, F.R.S., 216; Metabolism of Nucleins, Drs. Milroy and Malcolm, 239; the Life-History of the Salmon, 280; Effect of Mixed Diet on Salivary Digestion, Dr. W. A. Robertson, 311; Artificial Food, Dr. Sidney Williamson, 368; Origin of Red Blood Corpuscles in *Tarsius*, Prof. Hubrecht, 428; Physiological Use of Salts, Léon Fredericq, 462; Effect of Bicycling on Lungs and Heart, A. Bianchi and F. Regnault, 464; Lilienfeld's Synthesis, Dr. John W. Pickering, 468; the Triennial International Congress of Physiologists, 481; Prof. Mosso on Mountain Sickness, 481; Prof. A. Kossel on Albumens, 481; Dr. J. De Moor and Prof. Heger on the Changes in the Form of the Neurons of the Cortex Cerebri under various Conditions of Rest and Excitation, 481; Prof. H. Hamburger on the Influence of Solutions of Inorganic Salts on the Volume of Animal Cells, 481; Prof. Kronecker and Mdlle. Devine on the Results of further Investigation of the Respiration of the Heart of the Tortoise, 481; Dr. L. Asher on the Theory of Lymph Production, 481; Dr. W. M. Bayliss on the Non-Antagonism of Visceral and Cutaneous Vascular Reflexes, 481; Mr. W. M. Fletcher on the Methods employed in his Investigation on the CO₂ Discharge of Excised Tissues, 481; Dr. Leonard Hill on the Influence of Gravity on the Circulation of the Blood, 481; Prof. Townsend Porter on the Mammalian Heart, 482; Prof. A. D. Waller, F.R.S., on the Influence of Salts upon the Electromobility of Medullated Nerve, 482; Dr. J. N. Langley, F.R.S. on the Discovery of the Possibility of obtaining an Experimental Union between the Nerve-Fibres of the Vagus Nerve and the Sympathetic Nerve-Cells of the Superior Cervical Ganglia, 482; Prof. Heymans upon Physiological and Artificial Disintoxication, 482; Prof. Sherrington, F.R.S., on his Discovery of Inhibition of the Tonus of a Skeletal Muscle by the Excitation, either Electrical or Mechanical, of the Antagonist Muscle, 482; Prof. Gotch, F.R.S., and Mr. G. J. Burch, Photographs of the Electrical Response of Nerve to Excitation, 483; Prof. A. B. Macallum on his Method for Detection and Localisation of Phosphorus in Animal and Vegetal Cells, &c., 483; Prof. Boruttan on Recent Advances in Electro physiology, 483; Dr. Theodore Beer on the Accommodation of the Eye in various Species of the Animal Kingdom, 483; Prof. Halliburton, F.R.S., and Dr. F. W. Mott, F.R.S., on the Influence of Cholin, Neurine, and some Allied Substances upon the Arterial Blood-Pressure, 483; Prof. E. Weymouth Reid, F.R.S., and Dr. J. S. Macdonald on the Electromotive Changes in the Phrenic Nerve, 483; Prof. Sherrington, F.R.S., and Dr. Hering, Demonstration in the Monkey (*Macacus*) of Inhibition of the Contraction of Voluntary Muscle evoked by Electrical Excitation of certain Points of the Cortex Cerebri, 483; Dr. Maurice Nicloux on Carbonic Oxide Production in Organism, 483; Prof. Waller, F.R.S., and Miss Sowton on the Action upon Isolated Nerve of Muscarine, Chlorine and Neurine, 484; Miss S. C. Sowton, Report of a Large Series of Galvanometric Records of the Decline of the Current of Injury in Medullated Nerve, and of the Changes in its Response to Periodic Stimulation, 484; Dr. Bayliss and Dr. E. Starling on an Influence of Blood Supply on Peristaltic Movement, 484; Prof. S. P. Budgett on Physical Absorption of Isotonic and Anisotonic Salt-Solutions, 484; Dr. F. S. Lee on the Fatigue of Muscle, 484; Prof. W. H. Thompson, Observations on the Diuretic Effects of Small Quantities of Normal Saline Solution, 484; Dr. Brunton Blaikie and Prof. Gottlieb, Examination of the Muscle of Dogs which had been Bled to Death, 484; Prof. Hagemann, Researches on the Actual Nutritional Value of the Feed of the Horse, 484; Drs. F. G. Hopkins and W. B. Hope on the Questions of the Nucleo-Proteids as Dietetic Precursors of Uric Acid, 484; Dr. Martin Hahn on the Chemical and Immunising Properties of Plasmines, 484; Prof. Livon, Observations on the Action of Extract of the Pituitary Body upon the Function of the Vagus Nerve, 484; Dr. Medwedew, Studies concerning the Oxidation of Salicyl Aldehyde in Tissue-Extracts, 484; Drs. Bedard and Mabile on the Action of Arsenic upon the Intoxication produced by Ingestion of the Thyroid Body, 484; Dr. de Saint Martin on the Absorbent Power of the Blood for Oxygen and for Carbonic Acid, 484; Dr. C. Phisalix on the Existence of an Oxydase in the Skin of certain Batrachians, 485; Prof. E. Schäfer, F.R.S., on the Alleged Sensory Functions of the Motor Cortex Cerebri, 485; Prof. A. Vitzon, Recovery of Sight in Monkeys, after Total Ablation of the Occipital Lobes, 485; Prof. Boyce and Dr. Warrington on the Physiological Structure of the Brain of the Fowl, 485; Prof. V. Frey on the Adequate Stimulation of Touch Nerves, 485; Profs. Langlois and Richet, Observations upon the Resistance of Diving Animals to Asphyxia, 485; Dr. R. Magnus on the Reaction of the Pupil of the Isolated Eel's Eye under Various Homogeneous Lights, 485; Prof. Delezenne, Is the Congestion of the Limbs and Skin produced in Asphyxia due to the Active Dilatation of the Blood-Vessels of those Parts, or Mechanical Dilatation by the Blood driven out of the Viscera by the Asphyxial Contraction of the Visceral Blood-Vessels? 486; Dr. D. Noël Paton upon the Distribution of Nitrogen and of Sulphur in the Urine of the Dog, 486; Dr. Arthur Biedl on the Blocking of the Thoracic Duct on the Removal of the Lymph from it by a Cannula producing a Glycosuria, 486; Prof. Denys, Experiments towards distinguishing Distinct Species among the Leucocytes of Mammals, 486; Prof. Graham Lusk on the Administration of Phlorizin to Starving Dogs, 486; Prof. G. Burch on Temporary Colour-Blindness, 486; Dr. F. H. Scott on some Points in the Micro-Chemistry of Nerve-Cells, 486; Opening of the Thompson-Yates Laboratories at University College, Liverpool, 575, 606; Increase of Weight of Body by Transformation of Fat into Glycogen, Ch. Bouchard, 588; Bouchard's Theory of the Transformation of Fat into Glycogen, Daniel Berthelot, 612; Air and Water as Factors in Food of Frogs, S. Jourdain, 612; Fat-Transformation by Direct Oxidation, M. Hanriot, 635; Plant Physiology: Fisiologia Vegetale, Dr. L. Montemartini, 100; Observations on Stomata, Francis Darwin, F.R.S., 212; Plant Life, considered with Special Reference to Form and Function, Charles Reid Barnes, 519; Practical Plant Physiology, Dr. W. Detmer, 592
- Phyto-Plankton of the Atlantic, the, George Murray, F.R.S., and V. H. Blackman, 70
- Pickering (Prof. E. C.), Variable Stars of Short Period, 181; Stars having Peculiar Spectra, 258
- Pickering (Dr. John W.), Lilienfeld's Synthesis, 468
- Picou (R. V.), Canalisations électriques, 519
- Pidgeon (Dan), a White or Milky Sea, 520
- Piepers (M. C.), Evolution of Colour in Lepidoptera, 425
- Pigs, Wild, and Python, Ernest Hose, 133
- Pile-Dwellings: Discovery of a Crannog on the Clyde, W. A. Donnelly, 488; Crannoges in Estuaries, W. F. Sinclair, 521; R. J. Ussher, 571
- Pintsch (J.), Illuminated Buoys, 489
- Pisciculture: Ten Pound Island (Massachusetts) Fish Hatchery, Sir D. Colnagh, 489; Death of Dr. Eugenio Bettoni, 626; Trout Acclimatisation in Cape Colony, J. D. F. Gilchrist, 628
- Pitchblende, a New Radio-Active Substance in, P. and S. Curie, 312
- Pitcher-Plant, Spider and, R. I. Pocock, 274
- Pithecanthropus erectus*, the Brain of, E. Dubois, 427
- Pittsburg, Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Regions about, John Parry, 149
- Plague, Inoculation against, 581
- Plague in Calcutta, Dr. Haffkine's Methods and the, 85
- Plague, Prof. Haffkine's Inoculation System as a Preventive of, 354

- Plague, the, a Centre in German East Africa, Prof. Koch, 254
 Plague, Rats and the, Dr. F. G. Clemow, 551
 Plague at Vienna, Deaths from, 625; Death of Dr. Müller, 625
 Planets: the Minor Planets, John K. Rees, 304; Mars in 1896-7, Prof. V. Cerulli, 304; Observations of Jupiter during the Opposition 1898, Sir J. Comas Solá, 526; the Planet between the Earth and Mars, Herr G. Witt, 526
 Plankton Studies on Lake Mendota, Dr. E. A. Birge, 259
 Plant Life, considered with Special Reference to Form and Function, Charles Reid Barnes, 519
 Plant Physiology: Fisiologia Vegetale, Dr. L. Montemartini, 100; Observations on Stomata, Francis Darwin, F.R.S., 212; Practical Plant Physiology, Dr. W. Detmer, 592
 Plants, on the Use of Methylene Blue as a Means of Investigating Respiration in, Prof. J. B. Farmer, 185, 215
 Play of Animals, the, a Study of Animal Life and Instinct, Karl Groos, 410
 Player (Samuel N.), Remarkable Hailstones, 223
 Playfair (Lord), Death of, 108; Obituary Notice of, 128
 Pleiades, the Exterior Nebulosity of, 463
 Pliny's Solpuga, the Nature and Habits of, 320; Prof. A. J. Cook, 247; R. I. Pocock, 294
 Po Delta, Progressive Increase of, Prof. Marinelli, 353
 Pocock (R. I.), Lion-Tiger Hybrid, 200; Spider and Pitcher-Plant, 274; the Nature and Habits of Pliny's Solpuga, 294; Spiders of Hungary, Cornelio Chyzer, Ladislao Kulczynski, 363
 Podmore (Frank), Studies in Psychical Research, 5
 Poincaré (M. H.), on the Stability of the Solar System, 183
 Poisonous Plants, Animals and, Alfred W. Bennett, 571; Edward M. Langley, 597
 Poisons, the Sale of, Sir J. C. Browne, 577
 Poisson's Integral, Prof. Bócher, 310
 Polar Axis, the Movement of the Earth's, 1890'0-1897'5, Prof. Albrecht, 42
 Poland, Russian, Mineral Hail in, M. Czernik, 352
 Polar Expedition, the German, 397
 Poles, the Secret of the, Henry Campion, 495
 Pollution, Distillery, C. A. Stevenson, 319
 Polonium, a New Radio-Active Substance, P. and S. Curie, 312
 Polyps, the *Xenida*, J. H. Ashworth, 335
 Pomel (M.), Death of, 373, 396
 Pope (F. G.), Condensation of Chloral Hydrates with Orcinol, 23
 Pope (W. J.), Separation of Optical Isomerides, 23; Resolution of Tetrahydropapaverine into its Optically Active Components, 94
 Porro (Dr. Francesco), Observations of Variable Stars, 60
 Porter (Prof. Townsend), on the Mammalian Heart, 482
 Porter (T. C.), Flicker, 188
 Portugal (Don F. C. de), Death of, 626
 Posner (T.), Das optische Drehungsvermögen organischer Substanzen und dessen praktische Anwendung, 172
 Potato-Disease, a New, Prof. Marshall Ward, 633
 Potential Matter—a Holiday Dream: Prof. Arthur Schuster, F.R.S., 367, 618
 Potentiometer, the, and its Adjuncts, W. Clark Fisher, Prof. A. Gray, F.R.S., 313
 Pottevin (H.), Saccharification of Starch by Malt, 24
 Poulton (Prof. E. B., F.R.S.), Protective Mimicry, 223; on the Struggle for Existence in certain Common Insects, 585
 Powell (H.), Meteorological Statistics of Windward Islands Hurricane, 551
 Praeger (R. Lloyd), Open-air Studies in Botany, 150
 Pratt (J. H.), Origin of Corundum Associated with Peridotites in North Carolina, 335
 Prediction, Weather, Prof. Dr. W. J. van Bebbber, 22
 Preece (W. H., F.R.S.), the Magnetic and Electrolytic Actions of Electric Railways, 533
 Prehistoric Egypt, Prof. W. M. Flinders Petrie, 31
 Prepotency, the Distribution of, Francis Galton, F.R.S., 246; Prof. Karl Pearson, F.R.S., 292
 Preston (Prof. T.), on Radiation in a Magnetic Field, 532
 Prevention of Malarial Fever, the Etiology and, Dr. E. Klein, F.R.S., 175
 Preventive Medicine, Annual Meeting of the British Institute of, 206; Transactions, 339
 Prime, a Dragon of the, 418
 Princeton University, the Mathematical Theory of the Top, Lectures delivered on the Occasion of the Sesquicentennial Celebration of, Prof. Felix Klein, 244
 Printed Matter and Photographic Plates, A. A. C. Swinton, 125
 Printer's Ink, Photographic Action of, W. Trueman Tucker, 32; Printer's Ink and Photographic Plates, Rev. F. J. Jarvis-Smith, F.R.S., 78
 Printing, Rules for Compositors and Readers, Montagu Browne, 368
 Problems of Nature, Researches and Discoveries of, Gustav Jaeger, 222
 Proctor (Mary), Stories of Star-Land, 519
 Protector, the U.S. Steamship, 488
 Procyon, the Companion to, Prof. Schaeberle, 134
 Prospecting for Minerals, S. Herbert Cox, 7
 Protective Mimicry, J. Castets, S.J., Prof. E. B. Poulton, F.R.S., 223
 Pruning-Book, the, L. H. Bailey, 290
 Prussia, Trachoma in, 254
 Prussia, Rabies in, 300
 Przibram (W.), Versuch einer Darstellung der Empfindungen, 316
 Psychology: Studies in Psychical Research, Frank Podmore, Dr. W. Leslie Mackenzie, 5; Animal Intelligence; an Experimental Study of the Associative Processes in Animals, Edward L. Thorndike, Prof. C. Lloyd Morgan, 249, 390; Psychologie als Erfahrungswissenschaft, H. Cornelius, Primer of Psychology, E. B. Titchener; Outlines of Descriptive Psychology, G. T. Ladd; Versuch einer Darstellung der Empfindungen, W. Przibram, A. E. Taylor, 316; Psychological Side of Hypnotism, Mr. Myers, 350
 Psychrometer applicable to Study of Plant-transpiration, R. G. Leavitt, 187
 Purple Patches, F. Southerden, 521
 Pycraft (W. P.), Morphology of Owls, 46
 Python, Wild Pigs and, Ernest Hose, 133
 Rabies: Report of Institut Pasteur of Anti-Rabic Inoculations in 1897, 59; Rabies in Prussia, 300; Egyptian Native Remedies for Rabies, 301
 Radiants, Minor Meteoric, W. F. Denning, 424
 Radiation of Incandescent Burners, H. Le Chatelier and O. Boudouard, 240
 Radiation in a Magnetic Field, Prof. T. Preston, 532
 Radiation, Solar, J. Evershed, 619
 Radiography: the Röntgen Rays, Prof. J. Trowbridge, 17; Prof. Röntgen, 17; Röntgen Rays as a Means of Certifying Death, 59; some New Studies in Kathode and Röntgen Radiations, Alan A. Campbell Swinton, 88; Action of Röntgen Rays on Opaque Tubes, Prof. Villari, 132; Infra-Electric Radiations, Prof. P. de Heen, 132; Röntgen Rays and Ordinary Light, C. Godfrey, 142; Causes of Imperfections in Radiographs from Use of Reinforcing Screens, A. Londe, 168; Thorium Rays, G. C. Schmidt, 187; Potential Gradients at Electrodes Discharged by X-Rays, C. D. Child, 187; the Becquerel Rays, O. M. Stewart, 230; Improvement in Tubes, L. Bonetti, 240; Source of Röntgen Rays in Focus Tubes, A. A. C. Swinton, 286; Radiography and the "X" Rays, S. R. Bottone, 292; the Röntgen Rays in Surgery, Prof. Küttner, 302; Comparison of Shadows of Röntgen Rays of Photography, Prof. Villari, 303; a New Radio-Active Substance in Pitchblende, P. and S. Curie, 312; Polarisation of Röntgen Rays, L. Graetz, 335; the Diffraction of X-Rays, Dr. C. H. Wind, 360; Duration of Emission of Röntgen Rays, H. Morize, 635
 Rails, Automobiles sur, G. Dumont, 495
 Railway, the Jungfrau Electric, 550
 Railways, State Purchase of, as a Means of Reducing Freight Charges, 608
 Rainbow, a High, Prof. Sidney T. Moreland, 151; Prof. F. J. Allen, 175
 Rainbow, a Monochromatic, A. J. K. Martyn, 224
 Rainfall: Future Rainfall, 30; Heavy Rainfalls, C. Driberg, 78; Rainfall and Earthquake Periods, Prof. J. P. O'Reilly, 103; Rainfall for United Kingdom, April-June, 1898, 353; Symons's British Rainfall, 1897, G. J. Symons, F.R.S., and H. Sowerby Wallis, 389
 Raisin (Catherine A.), Structures formed in the Drying of a Fluid with Particles in Suspension, 117; Dendritic Patterns caused by Evaporation, 224
 Ramsay (Prof. William, F.R.S.), on a New Constituent of Atmospheric Air, 127; Companions of Argon, 182; the Spectrum of Metargon, 245; Helium in the Atmosphere, 545; on the Extraction from Air of the Companions of Argon and on Neon, 556; "Xenon," 556

- Ransome (F. L.), Lava Flows of California, 117
 Raseri (Signor), the Time of Day of Death and Birth, 523
 Rat, a Hairless, T. V. Hodgson, 546
 Rats, New Microbe Pathogenic to, Dr. Issatschenko, 179
 Rats and the Plague, Dr. F. G. Clemow, 552
 Rawlinson (Sir Robert), Death of, 131
 Ray Society, a New Departure by the, 567
 Rayet (G.), Changes in Large Nebula in Belt of Andromeda, 564
 Rayleigh (Right Hon. Lord, F.R.S.), the Theory of Sound, 121; Experiments with the Telephone, 429; the Scientific Work of Lord Rayleigh, Prof. Oliver Lodge, 461
 Rays, Thorium, G. C. Schmidt, 47
 Reade (T. Mellard), Huge Gypsum Boulder, 132; Post-Glacial Beds exposed in Cutting of New Bruges Canal, 239; High Level Marine Drift at Colwyn Bay, 239
 Reale Accademia dei Lincei, Royal Prize Awards, 420
 Re-Blossoming of Horse-chestnut, 521
 Reclus (Prof.), on his Scheme for a Great Terrestrial Globe, 586
 Red Spot, Jupiter's, Dr. Lohse, 20
 Red Spot on Jupiter, the, and its Suspected Identity with Previous Markings, W. F. Denning, 331
 Rees (John R.), the Minor Planets, 304
 Refraction, Dispersion and Anomalous Dispersion, Lord Kelvin on the Dynamical Theory of, 546
 Refractor, the 40-inch Yerkes, Prof. Barnard, 181
 Refractors of the World, the Large, Prof. G. E. Hale, 160
 Regnault (F.), Effect of Bicycling on Lungs and Heart, 464
 Reid (Clement), Geological History of Recent British Flora, 278
 Reid (Prof. E. Weymouth, F.R.S.), on the Electromotive Changes in the Phrenic Nerve, 483
 Reid (John S.), a Course in Mechanical Drawing, 8
 Reliquary and Illustrated Archaeologist, the, 615
 Remarkable Hailstones, Samuel N. Player, 223
 Reptiles, Mammals, and Fishes of Essex, the, H. Laver, 242
 Reptilian Embryos, Hibernating, G. A. Boulenger, F.R.S., 619
 Reproduction by Photographic Processes, T. Bolas, 204
 Research, Fellowships for, Prof. A. Gray, 600
 Respiration in Plants, on the Use of Methylene Blue as a Means of Investigating, Prof. J. B. Farmer, 185, 215
- REVIEWS AND OUR BOOKSHELF:—
 Explosifs Nitrés, J. Daniel, 4
 Studies in Psychical Research, Frank Podmore, Dr. W. Leslie Mackenzie, 5
 Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, W. W. A. FitzGerald, 6
 Notes on Observations, Sydney Lupton, 7
 Prospecting for Minerals: a Practical Handbook for Prospectors, Explorers, Settlers, and all interested in the Opening-up and Development of New Lands, S. H. Cox, 7
 The Process of Creation Discovered, or the Self-evolution of the Earth and Universe by Natural Causes, James Dunbar, 8
 Domestic Science Readers, Vincent T. Murché, 8
 A Course in Mechanical Drawing, John S. Reid, 8
 Flower Favourites, their Legends, Symbolism, and Significance, Lizzie Deas, 8
 A Text-Book of Zoology, Prof. T. Jeffery Parker, F.R.S., Prof. William A. Haswell, F.R.S., and Prof. E. Ray Lankester, F.R.S., 25
 Traité de Zoologie Concrète, Yves Delage and E. Hérouard, Prof. E. Ray Lankester, 25
 Die Wettervorhersage, Prof. Dr. W. J. van Bebber, 28
 Maryland Geological Survey, 29
 Iowa Geological Survey: Report on Lead, Zinc, Artesian Wells, &c., 29
 Elementary Chemistry, Practical and Theoretical, T. A. Cheetham, 29
 Ambroise Paré and his Times, 1510-1590, Stephen Paget, 49
 The Collected Mathematical Papers of Arthur Cayley, F.R.S., 50
 An Elementary Course of Physics, 51
 L'Algérie: le Sol et les Habitants, &c., J. A. Battandier et L. Trabut, 51
 Text-Book of Physiology, E. A. Schäfer, F.R.S., Dr. T. H. Milroy, 73
 Organographie der Pflanzen, Dr. K. Goebel, 74
 A Northern Highway of the Tzar, Aubyn Trevor-Battye, 75
 Vorlesungen über Bacterien, Dr. Alfred Fischer, 76
 Lehrbuch der Entwicklungsgeschichte des Menschen, Dr. J. Kollmann, 77
 Missouri Botanical Garden, 77
 System der Bakterien, W. Migula, Prof. A. A. Kanthack, 97
 Die fundamentalen physikalischen Eigenschaften der Krystalle in Elementarer Darstellung, Dr. Woldemar Voigt, W. H. and G. Chisholm Young, 99
 The Arrangement of Atoms in Space, J. H. Van 't Hoff, 100
 The Linacre Reports, 100
 Anatomia Vegetale, Dr. F. Tognini, 100
 Fisiologia Vegetale; Dr. L. Montemartini, 100
 Glass Blowing and Working, Thomas Bolas, 101
 Experimental Mechanics, G. H. Wyatt, 101
 The Theory of Sound, J. W. Strutt, Baron Rayleigh, F.R.S., 121
 Hints on the Management of Hawks, J. E. Harting, 122
 General Elementary Science, 123
 Elementary General Science, A. T. Simmons and Lionel M. Jones, 123
 The Flora of Perthshire, F. Buchanan White, 124
 Manual Training: Woodwork, George Ricks, 124
 A Description of Minerals of Commercial Value, D. M. Barringer, 124
 Ludwig Otto Hesse's Gesammelte Werke, herausgegeben von der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften, 124
 Krömsköp Colour Photography, Frederic Ives, 124
 On Laboratory Arts, Richard Threlfall, C. V. Boys, F.R.S., 145
 A Student's Text-Book of Zoology, Adam Sedgwick, F.R.S., Prof. Ray Lankester, F.R.S., 147
 Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149
 Electro-physiology, W. Biederman, 150
 Open-air Studies in Botany: Sketches of British Wild-flowers in their Homes, R. Lloyd Praeger, 150
 The Journal of the Iron and Steel Institute, 150
 A Simplified Euclid, W. W. Cheriton, 150
 Theoretical Mechanics: an Introductory Treatise on the Principles of Dynamics, with Applications and numerous Examples, A. E. H. Love, F.R.S., Prof. A. G. Greenhill, F.R.S., 169
 Birds in London, W. H. Hudson, 172
 Das optische Drehungsvermögen organischer Substanzen und dessen praktische Anwendung, H. Landolt, 172
 The Span of Gestation and the Cause of Birth, John Beard, Dr. Arthur Robinson, 173
 A New Astronomy, Prof. David P. Todd, 173
 Lessons in Domestic Science, Ethel R. Lush, 173
 Observations on the Coloration of Insects, Brunner von Wattenwyl, 193
 The Fauna of British India: Birds, W. T. Blanford, 195
 Méthode pour abréger les traversées en utilisant les perturbations de l'atmosphère, M. A. Fieron, 197
 Notes from a Diary, 1873-1881, Right Hon. Sir Mountstuart E. Grant Duff, 198
 Elements of Descriptive Astronomy, Herbert Howe, 198
 South American Sketches, Robert Crawford, 198
 The Making of a Daisy; "Wheat out of Lilies"; and other Studies in Plant-Life and Evolution, Eleanor Hughes-Gibb, 198
 Essays on Museums and other Subjects connected with Natural History, Sir William Henry Flower, K.C.B., Prof. R. Meldola, F.R.S., 217
 James Clerk Maxwell and Modern Physics, R. T. Glazebrook, F.R.S., Prof. A. Gray, F.R.S., 219
 The Atoll of Funafuti, Ellice Group: its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley, of the Australian Museum, Sydney, N.S.W., 221
 Weather Lore, Richard Inwards, 222
 First Stage Magnetism and Electricity, R. H. Jude, 222
 Problems of Nature. Researches and Discoveries of Gustav Jaeger, 222
 Medical Missions in their Relation to Oxford, Sir Henry W. Acland, Bart., K.C.B., F.R.S., 222
 The Origin and Growth of the Moral Instinct, Alexander Sutherland, 241
 The Mammals, Reptiles, and Fishes of Essex, H. Laver, 242
 Nippur; or Explorations and Adventures on the Euphrates, J. P. Peters, 243

- A Manual on General Pathology for Students and Practitioners, W. S. Lazarus Barlow, 244
- A Text-book of Entomology, including the Anatomy, Embryology, and Metamorphoses of Insects, for Use in Agricultural and Technical Schools and Colleges, Prof. Alpheus S. Packard, 244
- The Mathematical Theory of the Top, Felix Klein, 244
- William Stokes, his Life and Work (1804-1878), Sir William Stokes, 245
- Practical Organic Chemistry, George George, 245
- Food Supply, Robert Bruce, 245
- Royal Gardens, Kew: Bulletin of Miscellaneous Information, 1897, 245
- The Utilisation of Micro-organisms in the Arts and Manufactures: a Practical Handbook on Fermentation and Fermentative Processes, Dr. Franz Lafar, 265
- Leçons sur l'intégration des équations aux dérivées partielles du second ordre à deux variables indépendantes, E. Goursat, 266
- Our Weights and Measures, H. J. Chaney, 268
- Practicum der Wissenschaftlichen Photographie, Dr. Carl Kaiserling, 268
- Principles of Mechanism, S. W. Robinson, 268
- Introduzione allo Studio dei Silicati, Dr. E. Ricci, 268
- The Blood; how to Examine and Diagnose its Diseases, A. C. Coles, 269
- Notes on Volumetric Analysis, Arthur Thornton and Marchant Pearson, 269
- A First Year's Course of Practical Physics, adapted for Beginners and Junior Students, J. F. Tristram, 269
- The Doctrine of Energy a Theory of Reality, 269
- Submarine Telegraphs, Charles Bright, 289
- Pasteur, Percy Frankland and Mrs. Percy Frankland, 290
- Garden-Making, L. H. Bailey, 290
- The Pruning-Book, L. H. Bailey, 290
- The Diseases of the Lungs, James Kingston Fowler and Rickman J. Godlee, 291
- An Elementary Course of Infinitesimal Calculus, Horace Lamb, F.R.S., 292
- Radiography and the "X" Rays, S. R. Bottone, 292
- Ackworth Birds, being a list of Birds in the district of Ackworth, Yorkshire, Major Walter B. Arundel, 292
- Angling Days and an Angler's Books, Jonathan Dale, 292
- The Potentiometer and its Adjuncts, W. Clark Fisher, Prof. A. Gray, F.R.S., 313
- The Principles of Alternate Current Working, Alfred Hay, Prof. A. Gray, F.R.S., 313
- Electric Wiring for the Use of Architects, Underwriters, and the Owners of Buildings, Russell Robb, Prof. A. Gray, 313
- The Angora Goat; and a Paper on the Ostrich, S. C. Cronwright Schreiner, 314
- Creation Records discovered in Egypt, G. St. Clair, 315
- Psychologie als Erfahrungswissenschaft, H. Cornelius, A. E. Taylor, 316
- Primer of Psychology, E. B. Titchener, A. E. Taylor, 316
- Outlines of Descriptive Psychology, G. T. Ladd, A. E. Taylor, 316
- Versuch einer Darstellung der Empfindungen, W. Przibram, A. E. Taylor, 316
- Elementary Practical Zoology, Frank E. Beddard, 318
- Elementary Conics, W. H. Besant, F.R.S., 318
- Examples in Analytical Conics for Beginners, W. M. Baker, 318
- Dobbie's Horticultural Handbooks: Pansies, Violas, and Violets, Charles Jordan, John Ballantyne, Jessie M. Burnie, William Cuthbertson, 318
- The Mechanical Engineer's Handy Office Companion, Robert Edwards, 318
- Outlines of Vertebrate Palæontology, A. Smith Woodward, 337
- Transactions of the British Institute of Preventive Medicine, 339
- Introduction to Algebra, for the Use of Secondary Schools and Technical Colleges, G. Chrystal, 340
- First Steps in Assyrian, L. W. King, 341
- Essai synthétique sur la formation du Système Solaire; première partie: formation du système, M. Le Général Lafouge, 342
- Photographische Bibliothek. Das Fernobjektiv, Hans Schmidt. Der Gummidruck, J. Gaedicke, 343
- Text-book of Physical Chemistry, Clarence L. Speyers, 344
- Recueil de Données Numériques Optique, H. Dufet, 344
- Euvres complètes de Christiaan Huygens publiées par la Société Hollandaise des Sciences, Dr. J. L. E. Dreyer, 361
- Dante's Ten Heavens, Edmond G. Gardner, N. Perini, 362
- A Maori English Lexicon, Rev. W. Colenso, 364
- Aranee hungaricæ . . . conscriptæ a Cornelio Chyzer et Ladislao Kulczynski, R. I. Pocock, 365
- Electrodynamics: the Direct Current Motor, C. A. Carus-Wilson, 366
- A Trip to Venus, John Munro, 366
- A Dictionary of Bird Notes, C. L. Hett, 366
- Chemical Analysis, Qualitative and Quantitative, W. Briggs and R. W. Stewart, 366
- A Treatise on Universal Algebra, with Applications, Alfred North Whitehead, 385
- The First Philosophers of Greece, Arthur Fairbanks, 386
- Bird Neighbours, Neltje Blanchan, 388
- Symons's British Rainfall, 1897, G. J. Symons, F.R.S., H. Sowerby Wallis, 389
- Storia Naturale, per la gioventù Italiana, Achille Griffini, 389
- Iowa Geographical Survey, 389
- Elements of the Comparative Anatomy of Vertebrates, W. N. Parker, 409
- The Play of Animals; a Study of Animal Life and Instinct, Karl Groos, 410
- The Study of Man, Alfred C. Haddon, 410
- A School Geography, George Bird, 411
- The Art of Taxidermy, John Rowley, 433
- Handbuch der Blütenbiologie unter zugrundelegung von Hermann Müller's werk: "Die Befruchtung der Blumen durch Insekten," Dr. Paul Knuth, Francis Darwin, F.R.S., 434
- Annals of the Royal Botanic Garden, Calcutta; the Orchids of the Sikkim Himalaya, Sir George King and Robert Pantling, 465
- Essai sur la Théorie des Machines électriques à Influence, V. Schaffers, 466
- An Introductory Course of Practical Magnetism and Electricity, J. Reginald Ashworth, 466
- Photography Annual, 466
- Botanisches Bilderbuch für Jung und Alt, Franz Bley, 466
- Report on the Natural History Results of the Pamir Boundary Commission, A. W. Alcock, 493
- Outlines of Sociology, Lester F. Ward, A. E. Taylor, 494
- A Text-book of Botany, Dr. E. Strasburger, Dr. Fritz Noll, Dr. H. Schenck, Dr. A. F. W. Schimper, 494
- Automobiles sur Rails, G. Dumont, 495
- Régularisation du Mouvement dans les Machines, L. Lecornu, 495
- A Pocket Dictionary of Hygiene, C. T. Kingzett, D. Homfray, 495
- The Secret of the Poles, Henry Campion, 495
- Wireless Telegraphy, popularly explained, Richard Kerr, 495
- The Metaphysic of Experience, Shadworth H. Hodgson, 517
- Geology for Beginners, W. W. Watts, 518
- Plant Life, considered with special Reference to Form and Function, Charles Reid Barnes, 519
- Stories of Star-Land, Mary Proctor, 519
- Canalisations électriques, R. V. Picou, 519
- Contributions a l'Étude de l'Hérédité et des Principes de la Formation des Races, J. M. Harracu, 519
- Bird Studies, an Account of the Land Birds of Eastern North America, W. E. D. Scott, 541
- A Century of Vaccination, and what it teaches, W. Scott Tebb, 542
- The Heat Efficiency of Steam Boilers: Land, Marine, and Locomotive, Bryan Donkin, 543
- A Text-book of Geodetic Astronomy, John F. Hayford, 543
- Machine Drawing, Thomas Jones and T. Gilbert Jones, 543
- A Student of Nature, R. Menzies Fergusson, 543
- Lehrbuch der Experimental-Physik, Eduard Riecke, Prof. A. Gray, F.R.S., 566
- Tailless Batrachians of Europe, G. A. Boulenger, F.R.S., 567
- Morality independent of Obligation or Sanction, M. Guyau, 567
- Th. Thoroddsen, Geschichte der Isländischen Geographie. Vorstellungen von Island und seines Natur, und Untersuchungen darüber in alter und neuer Zeit, August Gebhardt, 568
- The Telephone: Outlines of the Development of Transmitters and Receivers, Prof. William J. Hopkins, 568

- Mathematical Examination Papers for Use in Navy Classes in Schools, Rev. J. L. Robinson, 568
- Northward over the "Great Ice"; a Narrative of Life and Work along the Shores and upon the Interior Ice-cap of Northern Greenland in the Years 1886 and 1891-1897. With a Description of the Little Tribe of Smith Sound Esquimos, the most Northerly Human Beings in the World, and an Account of the Discovery and Bringing Home of the "Saviksue" or Great Cape York Meteorites, Robert E. Peary, Dr. Hugh Robert Mill, 589
- Mykologische Untersuchungen aus den Tropen (Mycological Researches in the Tropics), Dr. Carl Holtermann, G. Masee, 590
- Applied Magnetism: an Introduction to the Design of Electro-Magnetic Apparatus, J. A. Kingdon, 591
- Biomechanik erschlossen aus dem Principe der Organogenese, Dr. E. Mehnert, 591
- Practical Plant Physiology, Dr. W. Detmer, 592
- A Chemical Laboratory Course, A. F. Hogg, 592
- The Scientific Memoirs of Thomas Henry Huxley, W. T. Thiselton-Dyer, F.R.S., 613
- Magnets and Electric Currents, Prof. J. A. Fleming, 614
- Natural Hygiene, Dr. H. Lahmann, 614
- Applied Geology, J. V. Elsdon, 615
- Flora of County Donegal, Henry Chichester Hart, 615
- The Reliquary and Illustrated Archaeologist, 615
- Reynolds (Prof. Emerson), on the Position of Helium, Argon, Krypton, and Neon in his Diagrammatic Representation of the Relations of the Elements, 556; Experiment illustrating the Effect on the Acetylene Flame of Varying Proportions of Carbon-dioxide in the Gas, 557
- Reynolds (Prof. Osborne, F.R.S.), Flow of Water shown by Colour Bands, 467
- Rhodolite, W. E. Hidden, 92
- Rhone Glacier, Water Circulation in, F. A. Forel, 635
- Ricci (Dr. E.), *Introduzione allo Studio dei Silicati*, 268
- Ricco (A.), Local Variations in Intensity of Gravity near Mount Etna and in Eastern Sicily generally, 354
- Richards (Prof. T. W.), Redetermination of Atomic Weights of Nickel and Cobalt, 87; Transition Temperature of Sodid Sulphate, 539
- Richet (Prof.), Observations upon the Resistance of Diving Animals to Asphyxia, 485
- Ricks (Geo.), *Manual Training: Woodwork, a Handbook for Teachers*, 124
- Ridsdale (E. L. J.), Capture of Curious Crustaceans, 597; Deep-Sea Dredging and the Phosphorescence of Living Creatures at Great Sea Depths, 497
- Riecke (Eduard), *Lehrbuch der Experimental-Physik*, 566
- Riggs (E. S.), Skull of *Amphictis*, 92
- Righi (Prof. A.), Apparatus for representing the Resultant of two Pendulum Oscillations in the same Straight Line, 488
- Rigid Earth, Latitude Variation in a, Prof. Henry Crew, 232
- Rio de Janeiro, Annual Publication of the Observatory of, for 1898, 553
- River Channels, Sub-Oceanic Terraces and, off the Coast of Spain and Portugal, Dr. Edward Hull, F.R.S., 51
- Rivers, German: the Wupper, Dr. C. Dammann, 109
- Rob (Russell), Electric Wiring for the Use of Architects, Underwriters, and the Owners of Buildings, 313
- Roberts-Austen (Prof. W. C., F.R.S.), Apparatus illustrating Berthelot's Interference Method of Measuring High Temperatures, 62; Treatment of the Surface of Medals, 236; Surfusion of Metals and Alloys, 619
- Robertson (Dr. W. A.), Effect of Mixed Diet on Salivary Digestion, 311
- Robinson (Dr. Arthur), the Span of Gestation and the Cause of Birth, Dr. John Beard, 173
- Robinson (Rev. J. L.), Mathematical Examination Papers for Use in Navy Classes in Schools, 568
- Robinson (S. W.), Principles of Mechanism: a Treatise on the Modification of Motion by means of the Elementary Combinations of Mechanism, or the Parts of Machines for Use in College Classes by Mechanical Engineers, &c., 268
- Rocques (X.), Volumetric Estimation of Acetaldehyde, 612
- Roger (M.), Artichokes as Culture-Medium for Bacteria, 354
- Roman Mile, Precise Length of, Antonio Blasquez, 109
- Romburgh (Dr. P. van), Cinnamic Methyl Ether in *Alpinia Malaccensis*, 143
- Röntgen (Prof.), Interesting Properties of Röntgen Rays, 17
- Röntgen Radiations, some New Studies in Kathode and, Alan A. Campbell Swinton, 88
- Röntgen Rays: Röntgen Rays and Ordinary Light, Prof. J. J. Thomson, F.R.S., 8; C. Godfrey, 142; Röntgen Rays, Prof. J. Trowbridge, 17; Prof. Röntgen, 17; Röntgen Rays as a Means of Certifying Death, 59; Action on Opaque Tubes of Röntgen Rays, Prof. Villari, 132; Causes of Imperfections in Radiographs from Use of Reinforcing Screens, A. Londe, 168; Potential Gradients at Electrodes discharged by Röntgen Rays, C. D. Child, 187; Source in Focus Tubes of Röntgen Rays, A. A. C. Swinton, 286; Radiography and the X-Rays, S. R. Bottone, 292; Röntgen Rays in Surgery, Prof. Kättner, 302; Comparison by Photography of Shadows of Röntgen Rays, Prof. Villari, 303; Polarisation of Röntgen Rays, L. Graetz, 335; the Diffraction of, Dr. C. H. Wind, 360; Duration of Emission of Röntgen Rays, H. Morize, 635
- Rosa (Prof.), Does the Law of Conservation of Energy hold good for the Vital Processes going on in the Human Body? 532
- Rose-Innes (John), Concerning the Thermodynamic Correction for an Air-Thermometer, 77
- Ross (Surgeon-Major Ronald), the Mosquito the Host of Malaria Parasite, 523
- Rotch (A. L.), Free Air Exploration by Kites, 190
- Roth (H. Ling), Live Frog taken out of a Snake, 367
- Rotifers in Lake Bassenthwaite, Prof. Sydney J. Hickson, F.R.S., 200; W. T. Calman, 271
- Rousselet (C. F.), New Method of Preserving Rotifers, 425
- Rowley (John), the Art of Taxidermy, 433
- Royal Society, 22, 61, 70, 93, 117, 166, 188, 214, 237, 286, 335, 383; Selected Candidates, 32; Royal Society's Conversatione, 61
- Rubens (H.), Absorption and Emission of Steam and Carbonic Acid in Infra-Red Spectrum, 93; Transparency of some Liquids for Rays of Great Wave-Length, 93
- Rubens (Prof. H.), Improvements on Melloni Thermopile, 39
- Rubber Plant at Kew, the Ceara, 40
- Rubber: New Machine for Extraction of Rubber, 58; Gutta-Percha and India-Rubber, 236; Fiji Rubber, 302; Artificial Rubber, 302; Sources of India-Rubber and Gutta-Percha, Dr. D. Morris, 514; the Supply of Amazonian Rubber, W. A. Churchill, 603
- Rubénovitch (E.), Action of Pure Hydrogen Phosphide on Cupric Sulphate, 359
- Rücker (Prof. A. W., Sec. R.S.), Opening Address at the International Conference of Terrestrial Magnetism and Atmospheric Electricity, 473; on the Magnetic and Electrolytic Actions of Electric Railways, 533; the *Mohegan* Wreck and a suggested possible Local Deviation of Ship's Compass, 627
- Rudski (P.), the Mathematical Theory of Earthquakes, 40
- Russell (Hon. Rollo), the Aurora of September 9, 496
- Russell (Dr. W. J.), on the Action exerted by certain Metals and other Organic Substances on a Photographic Plate, 556
- Russia, Leprosy in, M.M. Kirchner and Kübler, 158; Glaciers of Russia in 1896, Prof. Mushketoff, 256; Memoirs of Caucasian Branch of Russian Geographical Society, 539
- Ruthven (Captain J. F.), Navigation, 104; Nautical Astronomy, 151
- Rydberg (J. R.), Metargon and the Interplanetary Medium, 319
- Sacerdote (P.), Variation of Dielectric Constants with Temperature, 635
- Sachs (Edwin O.), Science in the Theatre, 162
- St. Clair (G.), Creation Records discovered in Egypt, 315
- St. Lawrence, Character and Progress of the Tides in the Gulf and River, as ascertained by Simultaneous Observations with Self-registering Tide-Gauges, W. Bell Dawson, 260
- St. Louis Academy of Sciences, 72
- Saint-Martin (Dr. de), on the Absorbent Power of the Blood for Oxygen and for Carbonic Acid, 484
- St. Petersburg Society of Naturalists, Memoirs of, 491
- St. Pétersbourg, Bulletin de l'Académie des Sciences de, 492
- Salmon, the Life-History of the, 280
- Salt, the Physiological Use of, Léon Fredericq, 462
- Salvadori (R.), Solfataras Gases, 269
- Salvin (Osbert, F.R.S.), Obituary Notice of, 129
- Sam (T. B. F.), the Auriferous Conglomerates of Gold Coast Colony, 46
- Sanarelli (Dr.), Yellow Fever and Anti-toxic Serum, 158

- Sandbanks, Sea-Beaches and, Vaughan Cornish, 42
 Sandberger (Dr. K. L. F. von), Death of, 16
 Sanders (Miss C. B.), on the Struggle for Existence in certain Common Insects, 585
 Sanitary Institute, Congress of, 522
 Satellite, the First, of Jupiter, A. E. Douglass, 210
 Scenery and Literature, Sir Archibald Geikie, 179
 Schaeberle (Prof.), the Companion to Procyon, 134: Blurring Aberration in the Telescope, 88
 Schäfer (Prof. E., F.R.S.), on the Alleged Sensory Functions of the Motor Cortex Cerebri, 485
 Schaffers (V.), *Essai sur la Théorie des Machines Electriques à Influence*, 466
 Schaw (Major-General), Australasian Weather Charts and New Zealand Storms, 582
 Scheiner (Prof.), the Spectrum of Hydrogen in Nebulae, 41
 Scheiner (S. C. Cronwright), the Angora Goat, and a Paper on the Ostrich, 314
 Schenk (Dr. H.), a Text-book of Botany, 494
 Schimper (Dr. A. F. W.), a Text-book of Botany, 494
 Schlechert (F.), the Temperature of Tree-Stems, 629
 Schloesing (Th., Fils), Study of Phosphoric Acid Dissolved by the Water of the Soil, 384
 Schmidt (Dr. G. C.), Thorium Rays, 47; Fluorescence and Actino-Electricity, 117; Electric Properties of Gases, 180
 Schmidt (Hans), *Das Fernobjektiv*, 343
 Schoentjes (Prof. H.), Collapse of Spherical Shell under Pressure, 40
 Schönrock (Dr. O.), *Das Optische Drehungsvermögen Organischer Substanzen und dessen Praktische Anwendung*, 172
 School Geography, a, George Bird, 411
 Schools, Technical High, Comparison, Sir Philip Magnus, 52
 Schott (Dr.), on the Magnetic and Electrolytic Actions of Electric Railways, 533
 Schulhof (M.), Periodic Comets, 526
 Schuster (Prof. Arthur, F.R.S.), the Origin of the Aurora Spectrum, 151; the Spectrum of Metargon, 199, 269; Potential Matter: a Holiday Dream, 367, 618
 Schütt (F.), *Das Optische Drehungsvermögen Organischer Substanzen und dessen Praktische Anwendung*, 172
 Schuyten (C.), Double Salicylates of Metals and Antipyrin, 583
 Science: Scientific Worthies, Albert von Kölliker, Prof. W. F. R. Weldon, F.R.S., 1; Domestic Science Readers, Vincent T. Murché, 8; Science Buildings at South Kensington, 54, 155, 176, 294; General Elementary Science, 123; Elementary General Science, A. T. Simmons and Lionel M. Jones, 123; Science in the Theatre, Edwin O. Sachs, 162; Lessons in Domestic Science, Ethel R. Lush, 173; Science and Art Department Examinations, 435, 625; Forthcoming Books of Science, 535; Recent Advances in Science, and their Bearing on Medicine and Surgery, Prof. R. Virchow, For. Member R.S., 554; a Short History of Scientific Instruction, Sir Norman Lockyer, K.C.B., F.R.S., 572, 597; Conference on the International Catalogue of Scientific Literature, 578; Science in Relation to Trade, 609; the Science of Applied Electricity, Magnets and Electric Currents, Prof. J. A. Fleming, 614; Report of International Conference on Scientific Literature, 623
 Scott (Dr.), Anatomy of Coal-Measure Plants, 633
 Scott (Dr. F. H.), on some Points in the Micro-Chemistry of Nerve Cells, 486
 Scott (Kenneth), Vegetable Application used to Inflammation of Eye by Malingering Egyptian Soldiers, 255
 Scott (R. H., F.R.S.), Frequency of Rainy Days in British Islands, 95
 Scott (W. E. D.), Bird Studies: an Account of the Land Birds of Eastern North America, 541
 Screw Propeller cavitating Water, Hon. C. A. Parsons, 62
 Sea: Deep-Sea Dredging and the Phosphorescence of Living Creatures at great Sea Depths, E. L. J. Ridsdale, 497
 Sea, a White, James W. Barrett, 496, 619
 Sea, a White or Milky, Dan Pigeon, 520
 Sea-Beaches and Sandbanks, Vaughan Cornish, 42
 Sea Fisheries Congress at Dieppe, International, 461, 511
 Seal, the West Indian, *Monachus tropicalis*, 179
 Sedgwick (Adam, F.R.S.), a Student's Text-Book of Zoology, 147
 See (Dr. T. J. J.), Double and Multiple Southern Stars, 134
 Seismology: Bollettino della Società Italiana, 22, 359; the Mathematical Theory of Earthquakes, P. Rudski, 40; Mean Surface-Velocity of Pulsations from Calcutta Earthquake of June 12, 1897, Dr. Agamennone, 109; the Indian Earthquake of June 12, 1897, R. D. Oldham, 421; Dr. Cancani's Horizontal Pendulums at Rocca di Papa, 158; Earthquake recorded in Isle of Wight, June 29, 1898, John Milne, 228; Earthquakes of Pacific Coast, 1767-1897, Dr. E. S. Holden, 231; Calabro-Messinese Earthquakes, Prof. G. Mercalli, 329; Attempt to Calculate Velocity of Aidin Earthquake of August 9, 1895, Dr. G. Agamennone, 421; Prof. Milne on Seismological Laboratories, 534
 Self-Registering Tide-Gauges, Character and Progress of the Tides in the Gulf and River St. Lawrence as ascertained by Simultaneous Observations with, W. Bell Dawson, 260
 Semmola (Prof.), Volcanic Flames, 303
 Septic Treatment of Sewage, 229
 Seraphimoff (M.), the Andromeda Nebula, 605
 Serotherapy: Influence of Place and Mode of Introduction on Development of Immunising Effects of Anti-diphtheritic Serum, S. Arloing, 23; Report of Institut Pasteur of Anti-Rabic Inoculations, 1897, 59; Dr. Haffkine's Methods and the Plague in Calcutta, 85; Prof. Haffkine's Inoculation System as a Plague Preventive, 354; Inoculation against Plague, 581; Yellow Fever and Anti-Toxic Serum, Dr. Sanarelli, 158; Experiments with Anti-streptococcal Serum, M. Courmont, 278; the Toxicity of Eel Serum, and Further Studies on Immunity, Mrs. Percy Frankland, 369; the Nature of the Antagonism between Toxins and Antitoxins, 323
 Sewage: the Septic Treatment of Sewage, 229; Bacteriology of London Sewage, 374; the Bacterial Process of Sewage Purification, Rudolph Hering, 628; the Disposal of the Town Refuse of Naples, Prof. P. Boubée, 524
 Seward (A. C.), the Malayan Fern *Matonia*, 633
 Seyewetz (M.), Action of Ammonium Persulphate on Silver in Photographic Negatives, 168
 Sharp (Dr. David), the Classification of Insects, 425
 Shashih, Chinese Antiquities at, 133
 Shaw (Saville), the Electrical Resistance and Micro-Structure of Alloys, 356
 Shaw (W. N.), on Dalton's Law, 532: a Pneumatic Analogue of the Potentiometer, 534
 Sheep's Horns, Maggots in, W. H. McCorquodale, 546
 Sherrington (Prof., F.R.S.), on his Discovery of Inhibition of the Tonus of a Skeletal Muscle by the Excitation, either Electrical or Mechanical, of the Antagonist Muscle, 482; Demonstration in the Monkey (*Macacus*) of Inhibition of the Contraction of Voluntary Muscle evoked by Electrical Excitation of certain Points of the Cortex Cerebri, 483
 Shipworms, Australian, C. Hedley, 240
 Shrubsole (O. A.), High Level Gravels in Berkshire and Oxfordshire, 190
 Shufeldt (Dr. R. W.), Anatomy of the Swallows, 199
 Siam, Five Years in, from 1891 to 1896, H. Warrington Smyth, Dr. Hugh Robert Mill, 322
 Siemens (A.), on the Application of the Electric Motor to the Engineering Workshop, 608
 Sikkim Himalaya, Orchids of the, Sir George King and Robert Pantling, 465
 Silicati, *Introduzione allo Studio dei*, Dr. E. Ricci, 268
 Silphium among the Ancient Greeks, Dr. Kronfeld, 628
 Silver Medals, Treatment of the Surface of, Prof. Roberts-Austen, F.R.S., 236
 Simmons (A. T.), Elementary General Science, 123
 Simplified Euclid, a, W. W. Cheriton, 150
 Sinclair (W. F.), Ebbing and Flowing Wells, 52; Crannoges in Estuaries, 521
 Sioux Outbreak of 1890, the Ghost-Dance Religion and the, James Mooney, 125
 Skertchly (S. B. J.), Distribution of Leprosy in Far East, 514
 Skinner (S.), Affinity-constants of Dihydroxymaleic, Dihydroxy-fumaric, Dihydroxytartaric and Tartronic Acids, 94: on the Carbon-consuming Cell of Jaques, 533
 Skull, Calaveras, Prof. Whitney's, 17
 Sleep, and the Theory of its Cause, 8
 Slime-Flux Disease of Fruit Trees, the, George Massee, 133
 Smith (C.), Carbohydrates of Barley-straw, 23; Action of Hydrogen Peroxide on Carbohydrates in presence of Iron, 94
 Smith (G. F. H.), a Possible Dimorphous Form of Laurionite, 311
 Smith (H. G.), Essential Oil of Eucalyptus Genus, 464
 Smithsonian Institution, the Story of the, 271

- Smyth (H. Warington), Five Years in Siam, from 1891 to 1896, 322
- Snaefell Lead Mine Accident, the Causes of the, Dr. Le Neve Foster, F.R.S., 178
- Snake, a Living Toad in a, Colonel F. W. Major, 344
- Snake, Live Frog taken out of a, Rose Haig Thomas, 367; H. Ling Roth, 368
- Snake-Destroyer, the Blue-tongued Tasmanian Lizard as a, Stuart Dove, 422
- Snake! Venom, Bile of Venomous Serpents most Powerful Antidote against, Prof. F. R. Fraser, 461
- Social Instinct in Birds, B. B. Osmaston, 398
- Sociology, Outlines of, Lester F. Ward, A. E. Taylor, 494
- Solá (Sir J. Comas), Observations of Jupiter during the Opposition 1898, 526
- Solaire, Essai synthétique sur la formation du Système, M. le General Lafouge, 342
- Solar Halo of July 3, Catharine O. Stevens, 224
- Solar Halos, W. Larden, 344
- Solar Radiation, J. Evershed, 619
- Solar Radiometer, Registering, G. S. Isham, 432
- Solar System, on the Stability of the, M. H. Poincaré, 183
- Solfatara Gases, Prof. R. Nasini, F. Anderlini and R. Salvadori, 269
- Solpuga, the Nature and Habits of Pliny's, 320; Prof. A. J. Cook, 247; R. I. Pocock, 294
- Somervail (A.), on the Age and Origin of the Granite of Dartmoor, 558
- Sorbonne, the New Physical Research Laboratory at the, 12
- Souillart (Prof.), Obituary Notice of, M. Callandreau, 112
- Sound, the Theory of, J. W. Strutt, Baron Rayleigh, F.R.S., 121
- South American Sketches, Robert Crawford, 198
- South Kensington, the Science and Art Buildings at, 54, 155, 176, 294
- Southerden (F.), "Purple Patches," 521
- Southern Stars, Double and Multiple, Dr. T. J. J. See, 134
- Sowton (Miss), on the Action upon Isolated Nerve of Muscarine, Chlorine, and Neurine, 484
- Sowton (Miss S. C.), Report of a Large Series of Galvanometric Records of the Decline of the Current of Injury in Medullated Nerve, and of the Changes in its Response to Periodic Stimulation, 484
- Space, the Arrangement of Atoms in, J. H. Van 't Hoff, 100
- Spain and Portugal, Sub-Oceanic Terraces and River Channels off the Coast of, Dr. Edward Hull, F.R.S., 51
- Span of Gestation, the, and the Cause of Birth, Dr. John Beard, Dr. Arthur Robinson, 173
- Spectrum Analysis: Kirchhoff's Spectroscope, Prof. H. C. Vogel, 19; the Spectrum of Hydrogen in Nebulae, Prof. Scheiner, 41; Apparatus exhibiting Peculiarities of Interference Fringes formed between Silvered Surfaces, Edwin Edser, 62; Simple Interference Method of Calibrating Spectrometer, Edwin Edser and C. P. Butler, 62; Absorption and Emission of Steam and Carbonic Acid in Infra-red Spectrum, H. Rubens and E. Aschkinass, 93; Transparency of some Liquids for Rays of Great Wave-lengths, H. Rubens and E. Aschkinass, 93; Simple Method of reducing Prismatic Spectra, Edwin Edser and C. P. Butler, 119; on a New Constituent of Atmospheric Air, Prof. W. Ramsay, F.R.S., and Morris W. Travers, 127; Method of determining Order of Fringe of High Order, C. Fabry and A. Perot, 143; the Origin of the Aurora Spectrum, Prof. Arthur Schuster, F.R.S., 151; "Flicker," T. C. Porter, 188; the Spectrum of Metargon, Prof. Arthur Schuster, F.R.S., 199, 269; Prof. W. Ramsay, F.R.S., M. W. Travers and Edward C. Cyril Baly, 245; Metargon, Prof. James Dewar, F.R.S., 319; Metargon and the Interplanetary Medium, J. R. Rydberg, 319; Stars having Peculiar Spectra, Prof. Pickering, Mrs. Fleming, Miss Cannon, 258; New Observations on Zeeman Phenomenon, Henri Becquerel and H. Deslandres, 264; Solfatara Gases, Prof. R. Nasini, F. Anderlini and R. Salvadori, 269; a New Form of Grating Spectroscope, Prof. Michelson, 280; Structure of the H and K Lines, Mr. Jewell, 280; New Action of Light Traversing Metallic Vapours in Magnetic Field, Dr. Macaluso and O. M. Corbino, 635
- Spelterini (Captain), Attempted Balloon Passage of Alps, 549
- Spencer (Herbert), Stereo-Chemistry and Vitalism, 592
- Spencer (Percival), Experiments in Aerial Research, 327
- Spencer (Stanley), Remarkable Balloon Ascent, 513
- Speyers (Clarence L.), Text-book of Physical Chemistry, 344
- Spherical Shell, Collapse under Pressure of, Prof. H. Schoentjes, 40
- Spider and Pitcher-Plant, R. I. Pocock, 274
- Spiders of Hungary, Cornelio Chyzer, Ladislao Kulczynski, R. I. Pocock, 365
- Spines, the Origin and Significance of, C. E. Beecher, 335, 539, 635
- Spivey (W. T. N.), Cannabinol, 238
- Sponges, Food-reception by, Dr. Vosmaer and Prof. Pekelharing, 47
- Sprankling (C. H. G.), Action of Bromoacetal on Sodium Derivative of Ethylic Malanate, 23
- Spray, the Motion of Falling, Arthur Jenkin, 460
- Spring (W.), Influence of Electricity on Sedimentation of Turbulent Liquids, 422
- Spring (Prof. Walthere), Colours of Natural Waters, 580
- Squirer (Lieut. G. O.), High Speed Telegraph Transmission by Means of Alternators, 211
- Stability of the Solar System, on the, M. H. Poincaré, 183
- Stage Mechanism, Edwin O. Sachs, 162
- Staigmüller (H.), Theoretical Derivation of the Constant of Dulong and Petit's Law, 491
- Stansfield (A.), Method of Demonstrating Allotropic Change in Iron, 62
- Stapf (Dr. Otto), Obituary Notice of Dr. Anton Kerner von Marilaun, 251
- Stark (J.), the Leiden Frost Drop, 335
- Starling (Dr. E.), on an Influence of Blood-supply on Peristaltic Movement, 484
- Stars: Stellar Radiations, Prof. Ayrton, 112; Double and Multiple Southern Stars, Dr. T. J. J. See, 134; Constant of Aberration and Stellar Magnitudes, Prof. Doberck, 258; Stars having Peculiar Spectra, Prof. Pickering, Mrs. Fleming, Miss Cannon, 258; a Catalogue of Fourth-Type Stars, Rev. T. E. Espin, 401; Planet 1898 DQ, Jean Mascart, 432; Motion of Stars in the Line of Sight, M. Deslandres, 490; Observations of Variable Stars, Dr. Francesco Porro, 60; a New Long Period Variable, Herren Müller and Kempf, 60; Variable Stars of Short Period, Prof. E. C. Pickering, 181; the Supposed Variable Y Aquile, 182; the Variable α Ceti, Herr W. Stratonoff, 330; Dr. Nijland, 330; a New Variable Star, Madame Ceraski, 424; Variable Stars in Clusters, Prof. Bailey, 583; Atlas of Variable Stars, Dr. J. G. Hagen, 606; Stories of Star-Land, Mary Proctor, 519
- Statistics: the Time of Day, of Death, and Birth, Signor Raseri, 523
- Steam Boilers, Heat Efficiency of, Land, Marine, and Locomotive, Bryan Donkin, 543
- Steam Engine, the Oldest Known, 255
- Steel: Methods for the Analysis of Ores, Iron and Steel, in Use at the Laboratories of Iron and Steel Works in the Region about Pittsburg, Pa., John Parry, 149
- Stellar Magnitudes, Constant of Aberration and, Prof. Doberck, 258
- Stellar Radiations, Prof. Ayrton, 112
- Stereo-Chemistry: the Arrangement of Atoms in Space, J. H. Van 't Hoff, 100; Stereo-Chemistry and Vitalism, Prof. F. R. Japp, F.R.S., 452, 616; Prof. F. J. Allen, 520; Herbert Spencer, 592; Chance or Vitalism, Prof. Karl Pearson, F.R.S., 495
- Steiner's Surfaces, Prof. Brambilla, 627
- Stevens (Catharine O.), Solar Halo of July 3, 224
- Stevenson (C. A.), Distillery Pollution, 319
- Stewart (O. M.), the Becquerel Rays, 230
- Stewart (R. W.), Chemical Analysis, Qualitative and Quantitative, 366
- Stieltje's Polynomials, Prof. van Vleck, 310
- Stings, the Injection of Cocaine as a Remedy for, 497
- Stings, Wasp and Bee, Sir J. F. D. Donnelly, 435
- Stockholm Meeting of the Iron and Steel Institute, the, 430
- Stokes (Sir George), on the Motion of a Viscous Fluid between Two Parallel Plates, 535
- Stokes (Prof. G. J.), on the Imaginary of Logic, 535
- Stokes (Sir William), William Stokes, his Life and Work, 1804-1878, 245
- Stokes (William), his Life and Work, 1804-1878, Sir W. Stokes, 245
- Stoklasa (Jules), Physiological Function of Iron in Vegetable Organism, 359
- Stomata, Observations on, Francis Darwin, F.R.S., 212

- Stone (John Stone), Transference of Heat in Cooled Metal, 596
- Stoney (Dr. Johnstone), the Dynamical Explanation of certain Observed Phenomena of Meteor Streams, 555
- Storia Naturale, per la gioventù Italiana, Dr. Achille Griffini, 389
- Storm, Magnetic, Dr. Charles Chree, F.R.S., 468
- Strachan (Dr. Henry), Larvæ in Antelope Horns, 468
- Strait of Bab-el-Mandeb, Undercurrents in the, Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., 544
- Stramberg Corals, the, Maria M. Ogilvie, Dr. J. W. Gregory, 282
- Straneo (Paolo), Variation of Thermic Conductivity with Temperature, 329
- Strange (Mr.), on the Results obtained in studying the Cooling Curves of Fatty Acids, 557
- Strangling of an Elephant, the, 115
- Strasburger (Dr. E.), a Text-book of Botany, 494
- Stratonoff (Herr W.), the Variable α Ceti, 330
- Stromeyer (C. E.), Aurora, 460; Triple Lightning Flash, 570
- Strong (W. M.), Is Continuity of Space necessary to Euclid's Geometry, 310
- Stuart (John), the Scientific Side of Photography, 284
- Student of Nature, a, R. Menzies Fergusson, 543
- Submarine Photography, Prof. Louis Boutan, 18
- Submarine Telegraphs, Charles Bright, 289
- Sub-Oceanic Terraces and River Channels of the Coast of Spain and Portugal, Dr. Edward Hull, F.R.S., 51
- Sugar, Luminosity produced by Striking, J. Burke, 533
- Summer, the Weather of this, Alex. B. MacDowall, 247
- Summer and Winter in relation to the Sun-spot Cycle, 270
- Sun, the Eclipsed and Un-Eclipsed, M. Deslandres, 258
- Sun Worship, Aspects of, among the Moki Indians, 295; Sun Worship by Tusayan Indians, Dr. J. Fewkes, 111
- Sun-spots: Sun-spot Period, W. Ellis, F.R.S., 61; Magnetism and Sun-spots, William Ellis, F.R.S., 78; Sun-spot Periods and Natural Phenomena, M. Camille Flammarion, 134; Summer and Winter in relation to the Sun-spot Cycle, 270; a Large Sun-spot, 463, 553, 630
- Superstitions, Notes on the Bugonia, the Occurrence of *Eristalis tenax* in India, Kumagusu Minakata, 101
- Surf, Iridescent, at Cromer, Constance F. Gordon Cumming, 174
- Surface of Medals, Treatment of the, Prof. Roberts-Austen, F.R.S., 236
- Surfusion in Metals and Alloys, Prof. W. C. Roberts-Austen, F.R.S., 619
- Surgery: Ambroise Paré and his Times, 1510-1590, 49; the Röntgen Rays in Surgery, Prof. Küttner, 302; Death of Dr. J. E. T. Aitchison, F.R.S., 550; Recent Advances in Science and their Bearing on Medicine and Surgery, Prof. R. Virchow, For. Member R.S., 554; Interscapulo-Thoracic Amputation in Malignant Tumours of Humerus, Paul Berger, 588
- Suringar (Prof.), Death of, 299
- Sutherland (Alexander), the Origin and Growth of the Moral Instinct, 241
- Swallows, Anatomy of the, Dr. R. W. Shufeldt, 199
- Sweden: the Swedish Iron Industry, R. Akerman, 430; Swedish Iron Ore Mining, G. Nordenström, 430; the Iron Ore Deposits of Swedish Lapland, H. Lundbohm, 430
- Swedish Arctic Expedition, Return of the, 523
- Swift (Lewis), Catalogue of Nebulæ, 515
- Swinton (A. A. C.), Circulation of Residual Gaseous Matter in Crookes' Tubes, 61; Kathode Ray Lamps, 61; some New Studies in Kathode and Röntgen Radiations, 88; Circulation of Residual Gaseous Matter in Crookes' Tubes, 119; Printed Matter and Photographic Plates, 125; the Action of Electric Discharges on Photographic Plates, 151; Source of Röntgen Rays in Focus Tubes, 286; Circulation of Residual Gas in Crookes' Tubes, 627
- Switzerland, Electric Transmission of Water Power in, 328
- Symes (Dr. Charles), Presidential Address to British Pharmaceutical Conference, 398
- Symons's British Rainfall, 1897, G. J. Symons, F.R.S., and H. Sowerby Wallis, 389
- Symons's Monthly Meteorological Magazine, 22, 117, 237, 310, 491, 539
- Synthesis of Albuminous Substances, Dr. Leo Lilienfeld, 351
- Synthesis, Lilienfeld's, Dr. John W. Pickering, 468
- Tactile Impression, the Effect of Movement imparted by, 588
- Tailless Batrachians of Europe, the, G. A. Boulenger, F.R.S., 567
- Tanater (M.), Sodium Perborate, 279
- Taxidermy, the Art of, John Rowley, 433
- Taylor (A. E.), Psychologie als Erfahrungswissenschaft, H. Cornelius, 316; Primer of Psychology, E. B. Titchener, 316; Outlines of Descriptive Psychology, G. T. Ladd, 316; Versuch einer Darstellung der Empfindungen, W. Przibram, 316; Outlines of Sociology, Lester F. Ward, 494
- Taylor (W. W.), Freezing Point of Aqueous Solution of Sodium Mellitate, 335
- Tea Cultivation in India, 423
- Tebb (W. Scott), a Century of Vaccination and what it Teaches, 542
- Tebbutt's Observatory, 88
- Technical High Schools—a Comparison, Sir Philip Magnus, 52
- Technical Mycology, Dr. Franz Lafar, 265
- Telegraphy: Hertzian Receiver for Telegraphy without Wires, E. Ducretet, 47; Wireless Telegraphy and Collisions at Sea, E. Branly, 312; Experiments in Wireless Telegraphy, 398; Wireless Telegraphy, Richard Kerr, 495; Submarine Telegraphs, Charles Bright, 289; Improvements in Magnetic Space-Telegraphy, Prof. O. Lodge, F.R.S., 62; High Speed Telegraph Transmission by Means of Alternators, Prof. A. C. Crehore, Lieut. G. O. Squier, 211; Death of Mr. E. E. Glanville, 421; Telegraphic Instruments actuated at a Distance by Ultra-Violet Light, Prof. Zickler, 524
- Telephony: Automatic Exchange System, 39; Electric Light Wires as Telephonic Circuits, Rev. F. J. Jervis-Smith, F.R.S., 51; Experiments with the Telephone, Right Hon. Lord Rayleigh, F.R.S., 429; Telephonic Communication between Australian Farms, 524; New Magnifying Telephone, Prof. Lodge, 533; the Telephone: Outlines of the Development of Transmitters and Receivers, Prof. William J. Hopkins, 568
- Telescopes: Blurring Aberration in the Telescope, Prof. Schaeberle, 88; J. R. Collins, 88, 280; the Large Refractors of the World, Prof. G. E. Hale, 160; the 40-inch Yerkes Refractor, Prof. Barnard, 181; the Great Telescope for the Paris Exhibition, 424
- Tempel's Comet (1867 II.), M. Gautier, 19
- Tempel's Comet? (1886), 515, Herr Pechuele, 490
- Ten Heavens, Dante's, Edmond G. Gardner, N. Perini, 362
- Ten-Pound Island (Massachusetts) Fish Hatchery, Sir D. Colnaghi, 489
- Terrestrial Magnetism and Atmospheric Electricity, International Conference of, Opening Address by Prof. A. W. Rücker, Sec. R.S., President of the Conference, 473
- Tetanus, Thermogenesis in, MM. D'Arsonval and Charrin, 336
- Textiles, Absorption of Liquids by, Leo Vignon, 264
- Textiles, the Attempts to fit China-Grass and Ramie for Manufacturing Purposes, 523
- Theatre, Science in the, Edwin O. Sachs, 162
- Therapeutics, Egyptian Native Remedies for Rabies, 301
- Thermodynamics: concerning the Thermodynamic Correction for an Air Thermometer, John Rose-Innes, 77
- Thermometry: concerning the Thermodynamic Correction for an Air Thermometer, John Rose-Innes, 77; Recent Work in Thermometry, Dr. C. Chree, F.R.S., 304; Transition Temperature of Sodid Sulphate, T. W. Richards, 539
- Thermophones, F. Braun, 335
- Thevenet (Dr. A.), Climate of Algeria, 117
- Thielsen-Dyer (W. T., F.R.S.), the First Volume of Huxley's Memoirs, 613
- Thomas (N. W.), Curious Phenomenon, 294
- Thomas (Rose Haig), Live Frog taken out of a Snake, 367
- Thomas (V.), Chlorinating Action of Ferric Chloride in Aromatic Series, 24; some Halogen Salts of Lead, 71
- Thompson (Prof. D'Arcy), the Crab in Mythology, 143
- Thompson (Dr. S. P.), Max Meyer's Theory of Audition, 166; on the Magnetic and Electrolytic Actions of Electric Railways, 533; on an Experiment by Righti on the Production of the Zeeman Phenomenon by Absorption, 533
- Thompson (Prof. Silvanus), on Electric Traction by Surface Contacts, 608
- Thompson (Prof. W. H.), Observations on the Diuretic Effects of Small Quantities of Normal Saline Solution, 484
- Thompson-Yates Laboratories at University College, Liverpool, Opening of the, 575, 606

- Thomson (Prof. J. J., F.R.S.), Röntgen Rays and Ordinary Light, 8
- Thorium Rays, G. C. Schmidt, 47
- Thorndike (Edward L.), Animal Intelligence: an Experimental Study of the Associative Processes in Animals, 249, 390
- Thornton (Arthur), Notes on Volumetric Analysis, 269
- Thoroddsen (Dr. Th.), Geschichte der Isländischen Geographie, Vorstellung von Island und seines Natur und Untersuchungen darüber in Alter und neuer Zeit, 568
- Thorpe (J. F.), Synthesis of Cis- and Trans-Caronic Acids, 23
- Threlfall (Richard), on Laboratory Arts, 145
- Thunderstorms, Distant, affecting Flowers, Rosemary Crawshay, 390
- Thurston (Edgar), Anthropology in Madras, 82; the Value of a Right-handed "Chank" Shell, 627
- Thwing (Prof. Charles B.), a Simple Method of making Light Mirrors, 571
- Tibet, through Unknown, Captain M. S. Wellby, 347
- Tides in the Gulf and River St. Lawrence, Character and Progress of the, as ascertained by Simultaneous Observations with Self-registering Tide-Gauges, W. Bell Dawson, 260
- Tiger, Lion-, Hybrid, R. I. Pocock, 200
- Tilden (Prof. W. A., F.R.S.), Recent Experiments on certain of the Chemical Elements in relation to Heat, 160
- Timber, the Physics of, S. T. Neely, 130
- Time, International, France and, 60
- Titchener (E. B.), Primer of Psychology, 316
- Toad, a Living, in a Snake, Colonel F. W. Major, 344
- Todd (Prof. David P.), a New Astronomy, 173
- Tognini (Dr. F.), Anatomia Vegetale, 100
- Tokyo, the Variation of Latitude at, H. Kimura, 490
- Toole (Rev. H. O'), Improved Hydrometer, 191, 524
- Tooth of *Hybodus grossicornis* from the Inferior Oolite, a, Thos. Beacall, 390
- Top, the Mathematical Theory of the, Prof. Felix Klein, 244
- Torell (Prof. O. M.), the Work of, 603
- Tortoise, on the Results of Further Investigation of the Respiration of the Heart of the, Prof. Kronecker and Mdle. Devine, 481
- Tortoises, Galapagos, in Zoological Gardens, 326
- Totemism, Prof. E. B. Tylor, F.R.S., 189
- Toxicity of Eel-Serum, and Further Studies on Immunity, Mrs. Percy Frankland, 369
- Toxicology: the Immunity of Bee-keepers from Bee-poison, Dr. Langer, 18; Reciprocal Action of Animal Toxins, A. Costa, 302; Bile of Venomous Serpents most Powerful Antidote against Snake-Venom, Prof. F. R. Fraser, 461; the Sale of Poisons, Sir J. C. Browne, 577
- Toxins and Antitoxins, the Nature of the Antagonism between, 323
- Trabut (L.), L'Algérie, le Sol et les Habitants, 51
- Trachoma in Prussia, 254
- Trade, Science in Relation to, 609
- Traherne (Captain G. G., R.A.), Horn-Feeding Larvæ, 521
- Transport of Live Fish, the, D. O'Connor, 125
- Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba, W. W. A. FitzGerald, 6
- Travers (Dr. Morris W.), on a New Constituent of Atmospheric Air, 127; Companions of Argon, 182; on the Extraction from Air of the Companions of Argon and on Neon, 556; Xenon, 556; the Spectrum of Metargon, 245; Helium in the Atmosphere, 545
- Tree-Stems, the Temperature of, F. Schlechert, 629
- Trevor-Battye (Aubyn), a Northern Highway of the Tzar, 75
- Trillat (A.), Estimation of Methyl Alcohol in Ethyl Alcohol, 336
- Trimble (Dr. H.), Death of, 513
- Tringali (Dr.), Catania Soil-Temperature Observations, 40
- Trip to Venus, a, John Munroe, 366
- Triplet Lightning Flash, C. E. Stromeyer, 570
- Tristram (J. F.), a First Year's Course of Practical Physics, 269
- Troost (L.), Boiling Point of Liquid Ozone, 216
- Tropics, Mycological Researches in the, Dr. Carl Holtermann, G. Masee, 590
- Trout Acclimatisation in Cape Colony, J. D. F. Gilchrist, 628
- Trouton (Dr. F. T., F.R.S.), Method of Measuring Surface Tension of Liquids, 191
- Trowbridge (Prof. J.), Experiments on Röntgen Rays, 17; Nature of Electrical Discharges in Air and Gases, 604
- Truffaut (G.), Use of Manures in Horticulture, 216
- Tsetse Disease in Mammals, Prof. Kanthack and Mr. Durham, 426
- Tuatara Lizard, the Development of the, Prof. A. Dendy, 609
- Tuberculosis: Formation in Blood Serum, under Chemical Action, of Material coagulating Bacilli of, S. Arloing, 143; the Contagious Character of Tuberculosis, 487; Clinical Value of Agglutination of Koch's Bacillus by Human Serum, S. Arloing and Paul Courmont, 540
- Tubes, Luminosities of Gases in Vacuum, 463
- Tucker (W. Trueman), Photographic Action of Printer's Ink, 32
- Tunncliffe (F. W.), the Opening Addresses at the Medical Schools, 576
- Turner (I. E.), Photography by the Aurora Borealis, 88
- Turner (William), the Life-Work of, Rev. H. A. Macpherson, 398
- Turner (Mr.), the Present Position of the Medical Profession, 577
- Turner (Prof.), Oxford University Observatory, 182; on the Recent Solar Eclipse Expeditions, 533
- Turpan (Albert), Comparison of Hertzian Field in Air and Oil, 167
- Tusayan Indians, Sun Worship by, Dr. J. Walter Fewkes, 111
- Tusayan Kacinas, J. W. Fewkes, 126
- Tusayan Snake Ceremonies, J. W. Fewkes, 127
- Tutt (J. W.), Drinking Habits of Butterflies and Moths, 110
- Tutton (A. E.), a Compensated Interference Dilatometer, 118; a New Dilatometer, 311
- Tylor (Prof. E. B., F.R.S.), Totemism, 189
- Typhoid Fever, Immunity of Arabs against, M. Vincent, 86
- Typhoid Fever, the Sero-Diagnostic Test for, Dr. McWeeney, 477
- Tyrell (J. B.), Glaciation of North Central Canada, 399
- Tzar, a Northern Highway of the, Aubyn Trevor-Battye, 75
- Umbgrove (Dr.), Action of Sulphuric Acid of 35-40 per cent. on Acid Aliphatic and Neutral Nitramines and their Isomers, 47
- Undercurrents in the Strait of Bab-el-Mandeb, Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., 544
- United States: Monographs of the United States Geological Survey, 81; the Glacial Lake Agassiz, Warren Upham, 81; the Flora of the Amboy Clays, John Strong Newberry, 81; Geology of the Denver Basin in Colorado, S. F. Emmons, Whitman Cross, and G. H. Eldridge, 82; the Marquette Iron-Bearing District of Michigan, C. R. van Hise and W. S. Bayley, 82; the Destruction of the Birds and Mammals of the United States, William T. Hornaday, 308; the Geography of the United States, Henry Gannett, Dr. Hugh Robert Mill, 497; Report of United States Weather Bureau for 1896-7, 523
- University Intelligence, 22, 45, 69, 92, 116, 141, 165, 186, 214, 237, 263, 285, 309, 334, 358, 382, 408, 431, 463, 491, 515, 538, 563, 587, 610, 634
- Universities: the University of London Commission Bill, 154, 176; the Proposed University for Birmingham, 226; the Duke of Devonshire on University Extension, 260; University Education, Dr. Michael Foster, Sec. R.S., 283
- Unknown Tibet, through, Captain M. S. Wellby, 347
- Upham (Warren), the Glacial Lake Agassiz, 81
- Urumiah, Lake, the Medusa of, Dr. Albert Günther, 319
- Urumiah, Lake, the Jelly-Fish of, R. T. Günther, 435
- Ussher (R. J.), Crannoges in Estuaries, 571
- Vaccination: the Bacterial Character of Calf Lymph, Mrs. Percy Frankland, 44; British Medical Association, Report on Vaccination Bill, 58; the Future of Vaccination, 469; the Vaccination Bill, 320; a Century of Vaccination, and what it teaches, W. Scott Tebb, 542
- Vacuum Tubes, Luminosities of Gases in, 463
- Vailati (Dr. G.), an Obsolete Book of Euclid on Balances and the Lever, 207
- Vaillant (Léon), Eel in Open Sea, 96
- Vadivvia, German Deep-Sea Expedition in the Steamship, 346
- Valeur (A.), the Quinoneoximes, 23
- Van Hise (C. R.), the Marquette Iron-Bearing District of Michigan, 82
- Van't Hoff (J. H.), the Arrangement of Atoms in Space, 100
- Variable Stars: Observations of Variable Stars, Dr. Francesco Porro, 60; a New Long Period Variable, Herren Müller and Kempf, 60; Variable Stars of Short Period, Prof. E. C. Pickering, 181; the Supposed Variable *V* Aquile, 182; the Variable *o* Ceti, Herr W. Stratonoff, 330, Dr. Nijland, 330; a New Variable Star, Madame Ceraski, 424; Variable Stars

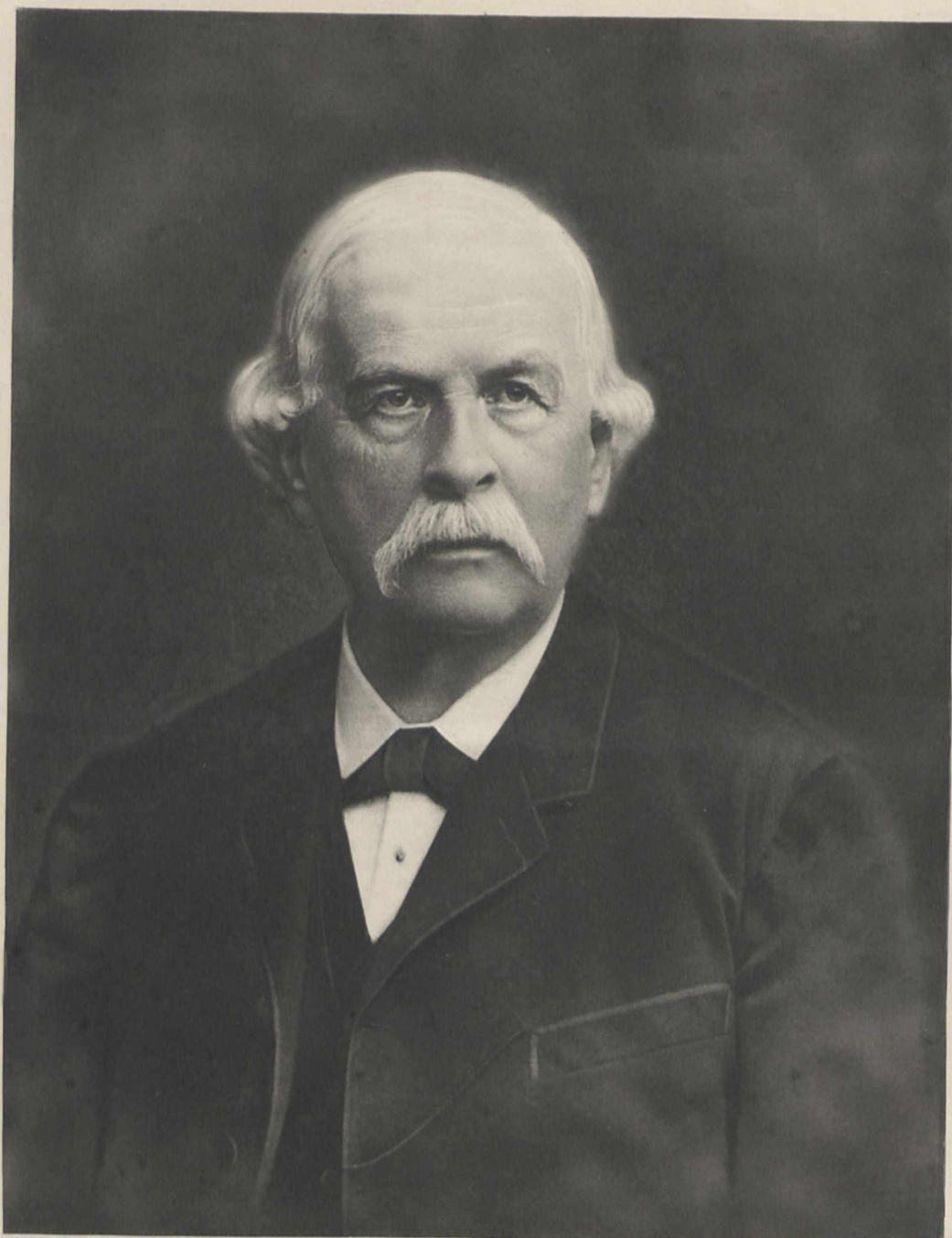
- in Clusters, Prof. Bailey, 583; Atlas of Variable Stars, Dr. J. G. Hagen, 606
- Variation, Latitude, in a Rigid Earth, Prof. Henry Crew, 232
- Variation of Latitude at Tokyo, the, H. Kimura, 490
- Variations, Organic, and their Interpretation, J. T. Cunningham, 593; Rev. George Henslow, 594; Prof. W. F. R. Weldon, F.R.S., 595; Walter Garstang, 619
- Vasco da Gama, Sir Clements R. Markham, F.R.S., 67
- Vegetable Anatomy: Anatomia Vegetale, Dr. F. Tognini, 100
- Vegetable Organography, Dr. K. Goebel, 74
- "Velox," a New Photographic Printing Paper, 213
- Venus, a Trip to, John Munroe, 366
- Verneuil (A.), Commercial Extraction of Thorium, 516
- Vernon (H. M.), Relations between Hybrid and Parent Forms of Echinoid Larvæ, 118; on the Relations between Marine Animal and Vegetable Life in Aquaria, 584
- Vertebrate Palæontology, Outlines of, A. Smith Woodward, 337
- Vertebrates, Elements of the Comparative Anatomy of, Dr. Robert Wiedershein, W. N. Parker, 409
- Vesuvius, Eruption of, 396, 513
- Vézès (M.), Atomic Weight of Nitrogen, 191
- Vienna, Deaths from Plague at, 625
- Vignon (Leo), Absorption of Liquids by Textiles, 264; the Estimation of Tannin, 432
- Vigouroux (E.), a Silicide of Tungsten, 492
- Villard (P.), a Crookes' Tube revivable by Osmosis, 96; a Property of Fluorescent Screens, 96; the Kathode Rays, 143
- Villari (Prof.), Action of Röntgen Rays on Opaque Tubes, 132; Comparison of Shadows of Röntgen Rays by Photography, 393
- Vincent (M.), Immunity of Arabs against Typhoid Fever, 86
- Virchow (Prof. R., For. Member R.S.), the Second Huxley Lecture, 554; Dinner to, 581
- γ Virginis and γ Leonis, Parallaxes and Masses of, Dr. Belopolsky, 400
- Viticulture: the Adherence of Copper Washes against Vine-Parasites, M.M. Guiland and Gourand, 336
- Vitalism, Stereo-Chemistry and, Prof. F. R. Japp, F.R.S., 452; Prof. F. J. Allen, 520; Herbert Spencer, 592
- Vitalism, Chance or, Prof. Karl Pearson, F.R.S., 495; Prof. Geo. Fras. FitzGerald, F.R.S., 545; Clement O. Bartrum, 545; Asymmetry and Vitalism, Prof. G. Errera, 616; Prof. F. R. Japp, F.R.S., 616
- Vitzou (Prof. A.), Recovery of Sight in Monkeys after Total Ablation of the Occipital Lobes, 485
- Vleck (Prof. van), Stieltjes' Polynomials, 310
- Vogel (Prof. H. C.), Kirchhoff's Spectroscope, 19
- Voigt (Dr. Woldemar), Die fundamentalen physikalischen Eigenschaften der Krystalle in Elementarer Darstellung, W. H. and G. Chisholm Young, 99
- Volcanoes: Petroliferous Sands and Mud Volcanoes in Burma, Dr. Fritz Noetling, 20; Volcanic Flames, Prof. Semmola, 303; Prof. Matteucci, 303; Local Variations in Intensity of Gravity near Mount Etna, A. Ricco, 354; Eruption of Vesuvius, 396, 513
- Volumetric Analysis, Notes on, Arthur Thornton and Marchant Pearson, 269
- Voorst (Mr. van), Death of, 299
- Vosmaer (Dr.), Food-reception by Sponges, 47
- Vry (Dr. J. E. de), Death of, 352
- Wade (E. B. II.), Method of Facilitating Measurement of Temperature by Platinum Thermometry, 142
- Wager (Harold), Structure of Yeast Cell, 633
- Wales, the Astronomical Society of, 42
- Walker (J.), Preparation of Solid Ammonium Cyanate, 23
- Solubility of Isomeric Substances, 238
- Walker (Mr.), on Electric Traction by Surface Contacts, 608
- Wall Mirages, C. T. Whitmell, 619
- Waller (Prof. A. D., F.R.S.), Action of Anæsthetics on Protoplasm, 93; on the Influence of Salts upon the Electromobility of Medullated Nerve, 482; on the Action upon Isolated Nerve of Muscarine, Chlorine and Neurine, 484
- Wallich (Major G. C.), Linnean Society's Annual Gold Medal awarded to, 107
- Wallis (H. Sowerby), Symons's British Rainfall, 1897, 389
- Walpi, the Winter Solstice Ceremony at, 295
- Wanton Mutilation of Animals, the, Dr. George Fleming, 605
- Ward (Lester F.), Outlines of Sociology, 494
- Ward (Prof. Marshall), a New Potato Disease, 633
- Ward (R. de C.), Cumulus Cloud Formation over Fire, 328
- Warning Colours, Mimicry and, Frank Finn, 58, 279
- Warrington (A. W.), on Hydrometers of Total Immersion, 534
- Warrington (Dr.), on the Physiological Structure of the Brain of the Fowl, 485
- Wasp and Bee Stings, Sir J. F. D. Donnelly, 435
- Water Circulation in Rhone Glacier, F. A. Forel, 635
- Water, the Flow of, Prof. H. S. Hele-Shaw, 34, 467, 520
- Water, Flow of, shown by Colour Bands, Prof. Osborne Reynolds, F.R.S., 467; Prof. H. S. Hele-Shaw, 467
- Water-Flow in Uniform Pipes and Channels, G. H. Knibbs, 354
- Water Gas, Opinion of Public Control Committee of London County Council, 276
- Water Power in Switzerland, Electric Transmission of, 328
- Waters, Natural Colours of, Prof. W. Spring, 580
- Waterston (David), an Osteometric Index-Calculator, 597
- Wattenwyl (Brunner von), Observations on the Colorations of Insects, 193
- Watts (W. W.), Geology for Beginners, 518
- Wave-power, the Utilisation of, Experiments at Los Angeles, 207
- Weather, Dogmatism on the Moon and the, 368
- Weather-Lore, Richard Inwards, 222
- Weather Prediction, Prof. Dr. W. J. van Bebbler, 28
- Weather of this Summer, the, Alex. B. MacDowall, 247
- Wedd (C. B.), Corallian Rocks of Upware, 239
- Wehnelt (A.), Light Nodes in Kathode Ray Bundle under Influence of Magnetic Field, 93; the Dark Kathode Space, 491
- Weights and Measures, Our, a Practical Treatise on the Standard Weights and Measures in Use in the British Empire, with some Account of the Metric System, H. J. Chaney, 268
- Weldon (Prof. W. F. R., F.R.S.), Scientific Worthies, Albert von Kölliker, 1; Opening Address in Section D of the British Association, 499; Organic Variations and their Interpretations, 595
- Wellby (Captain M. S.), through Unknown Tibet, 347
- Wells, Ebbing and Flowing, W. F. Sinclair, 52; F. R. Mallet, 104
- West Indies, Economic Botany in the, J. H. Hart, 87
- Wethered (E.), on the Building of the Clifton Rocks, 558; on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 559
- Wettervorhersage, Die, Prof. Dr. W. J. van Bebbler, 28
- Whale, the Centipede, Kumagusu Minakata, 570
- Wharton (Rear-Admiral, Sir W. J. L., K.C.B., F.R.S.), Undercurrents in the Strait of Bab-el-Mandeb, 544
- Wheeler (W. H.), on the Action of Waves and Tides on the Movement of Material on the Sea-coast, 559
- Whittaker (W.), on the Relation and Extension of the Franco-Belgian Coal-field to that of Kent and Somerset, 558
- White (Dr. Buchanan), the Flora of Perthshire, 124
- White (Sir W. H.), on Engineering Education, 634
- White Sea, a, James W. Barrett, 496, 619
- White or Milky Sea, a, Dan Pidgeon, 520
- Whitehead (Alfred North), a Treatise on Universal Algebra, with Applications, 385
- Whitmell (C. T.), Wall Mirages, 619
- Whitney's (Prof.) Calaveras Skull, 17
- Whittaker (E. T.), Connection of Algebraic with Automorphic Functions, 93; the Recent History of the Theory of the Functions used in Analysis, 535
- Wiedemann (Prof. E.), Light Nodes in Kathode Ray Bundle under Influence of Magnetic Field, 93; Electric Properties of Gases, 180; Wiedemann's Annalen, 93, 117, 187, 335, 491
- Wiedershein (Dr. Robert), Elements of the Comparative Anatomy of Vertebrates, 409
- Wien (W.), Electric Discharge in Rarefied Gases, 335; Motion of Translation of Luminiferous Ether, 491
- Wilcox (E. M.), Winter Condition of Reserve Food in *Liriodendron* Stems, 335
- Wilks (Sir Samuel, Bart., F.R.S.), the Moon's Course, 496
- Willey (Dr. A.), Development of *Peripatus nova-britannicæ*, 142; What is Anlage?, 390; on the Phylogeny of the Arthropod Anion, 584
- Williams (Lloyd), the Reproduction of *Dictyota dichotoma*, 632
- Williams (Percy), a New Carbide of Tungsten, 191; a Double Carbide of Iron and Tungsten, 516; Double Carbides of Iron and Chromium and Iron and Tungsten, 588

- Williamson (Dr. Sidney), Artificial Food, 368
 Willis (J. C.), Report of Royal Botanic Gardens, Ceylon, 329
 Willows, Changes in Sex of, Mr. Burkill, 633
 Wilson (Prof. Carus), Action of Two Electro-Motors Coupled so as to Rotate at Different Speeds, 215
 Wilson (C. T. R.), Cloud-Production by Ultra-Violet Light, 62
 Wilson (Edward), Death of, 85
 Wilson (Ernest), Aluminium as Electrodes, 188
 Wilson (J.), Action of Light on Acetylene, 238
 Wind (Dr. C. H.), the Diffraction of X-Rays, 360
 Wind-Power, the Utilisation of, Prof. la Cour, 300
 Windt (Mr. de), Death of, 513
 Windward Islands Hurricane, 512; Meteorological Statistics of, H. Powell, 551
 Winter, Summer and, in Relation to the Sun-spot Cycle, 270
 Winternitz (Dr. M.), Folk-Medicine in Ancient India, 233
 Winton (W. E. de), *Aethurus glirinus*, a New Rodent, 95
 Wireless Telegraphy, Experiments in, 398
 Wireless Telegraphy, Richard Kerr, 495
 Wires, Torsional Oscillations of, Dr. W. Peddie, 239
 Wolf's Comet, 330, 356, 375
 Wolmer Forest as a Sanctuary for Birds, 255
 Wood (J. K.), Preparation of Solid Ammonium Cyanate, 23; Solubility of Isomeric Substances, 238
 Wood (R. W.), Phase Reversal and Silver Zone Plates, 61; Mirage on City Pavements, 596
 Wood (T. B.), Cannabinol, 238
 Wood Incombustible, Process of Making, 328
 Woodward (A. Smith), Outlines of Vertebrate Paleontology, 337
 Woodwork, Manual Training: a Handbook for Teachers, Geo. Ricks, 124
 Wupper, the River, Dr. C. Dammann, 109
 Wyatt (G. H.), Experimental Mechanics, 101
 Wyronhoff (M.), Commercial Extraction of Thorium, 516

Xeniide, the, J. H. Ashworth, 335
 Xenon, Prof. Ramsay and Dr. Travers, 556

 Yarn, Peat-Fibre, 178
 Yeast Cell, Structure of, Prof. Errera, 633; Harold Wager, 633; Enzyme of Yeast Plant, Prof. Reynolds Green, 633
 Yellow Fever and Anti-Toxin Serum, Dr. Sanarelli, 158
 Yerkes Refractor, the 40-inch, Prof. Barnard, 181
 Yllimani, Ascent of, Sir W. M. Conway, 513
 Yorkshire Moor, a, Prof. L. C. Miall, F.R.S., 377, 401
 Young (Prof. Sydney), on the Thermal Properties of Gases and Liquids, 556
 Young (W. H. and G. Chisholm), Die Fundamentalen Physikalischen Eigenschaften der Krystalle in Elementarer Darstellung, Dr. Woldemar Voigt, 99

 Zaharia (A.), Solubility of Camphor, 635
 Zeeman Phenomenon, New Observations on, Henri Becquerel and H. Deslandres, 264
 Zeeman's Phenomena, Prof. S. P. Thompson, 533
 Zickler (Prof.), Telegraphic Instruments actuated at a Distance by Ultra-Violet Light, 524
 Zoology: Additions to Zoological Gardens, 19, 41, 60, 88, 111, 134, 159, 181, 209, 232, 258, 277, 279, 303, 326, 330, 355, 375, 400, 424, 462, 490, 515, 526, 553, 583, 605, 629; Zoological Society, 23, 70, 95, 190, 238; Anniversary Meeting, 17; *Traité de Zoologie Concrète*, Prof. Yves Delages and E. Hérouard, Prof. E. Ray Lankester, F.R.S., 25; a Text-book of Zoology, Prof. T. Jeffery Parker, F.R.S., and Prof. W. A. Haswell, F.R.S., Prof. E. Ray Lankester, F.R.S., 25; Prof. W. N. Parker, 200; Death of Prof. D. S. Kellicott, 39; the Present Position of some Cell Problems, Prof. J. B. Farmer, 63; *Aethurus glirinus*, a New Rodent, W. E. de Winton, 95; the Linacre Reports, 100; Climbing Habits in Frogs, 111; the Strangling of an Elephant, 115; Relations between Hybrid and Parent Forms of Echinoid Larvæ, H. M. Vernon, 118; Development of *Peripatus nova-britannicæ*, Dr. A. Willey, 142; a Student's Text-Book of Zoology, Adam Sedgwick, F.R.S., Prof. E. Ray Lankester, F.R.S., 147; the West Indian Seal, *Monachus tropicalis*, 179; Lion-Tiger Hybrid, R. I. Pocock, 200; the Atoll of Funafuti, Ellice Group, its Zoology, Botany, Ethnology, and General Structure, based on Collections made by Mr. Charles Hedley of the Australian Museum, Sydney, N.S.W., 221; Zoology as a Higher Study, Prof. William A. Haswell, F.R.S., 247; the Senegal Giraffe at the Zoological Gardens, 277; Death of the Senegal Giraffe, 373; the Destruction of the Birds and Mammals of the United States, William T. Hornaday, 308; the Angora Goat, and a Paper on the Ostrich, S. C. Cronwright Schreiner, 314; Elementary Practical Zoology, Frank E. Beddard, 318; Galapagos Tortoises in Zoological Gardens, 326; the International Congress of Zoologists, 376, 424; International Congress of Zoology, 390; Address by the President, Sir John Lubbock, 391; the Life Work of William Turner, Rev. H. A. Macpherson, 398; the Marine Fauna in Lake Tanganyika, and the Advisability of Further Exploration in the Great African Lakes, J. E. S. Moore, 404; the Building of Atolls, Stanley Gardiner, 425; New Method of Preserving Rotifers, C. F. Rousselet, 425; Classification of Insects, Dr. David Sharp, 425; Colour Evolution of Lepidoptera, M. Bordage, 425; Relation of Colour of Lepidoptera Chrysalids to Colour of Environment, M. Bordage, 425; Position of Sponges in Animal Kingdom, Prof. Yves Delages, 425; E. A. Minchin, 426; Saville Kent, 426; the Tsetse Disease in Mammals, Prof. Kanthack and Mr. Durham, 426; Traces of Six Primitive Segments in Insects' Heads, Ch. Janet, 426; Origin of Mammals, Prof. Seeley, 426; Prof. Osborn, 426; Prof. Marsh, 427; A. Sedgwick, 427; Prof. Hubrecht, 427; the Descent of Man, Prof. Haeckel, 427; the Brain of *Pithecanthropus erectus*, E. Dubois, 427; Origin of Echinoderms, Prof. MacBride, 427; Origin of Red Blood Corpuscles in Placenta of *Tarsius*, Prof. Hubrecht, 428; *Pliohyrax fraasii*, Prof. Osborn, 428; the Medusa of Lake Urumiah, Dr. Albert Günther, 319; the "Jelly-Fish" of Lake Urumiah, R. T. Günther, 435; a Request for Zoological Literature, Prof. Blaxland Benham, 520; the Tailless Batrachians of Europe, G. A. Boulenger, F.R.S., 567; Organic Variations and their Interpretations, J. T. Cunningham, 593; Rev. George Henslow, 594; Prof. W. F. R. Weldon, F.R.S., 595; Walter Garstang, 619; Air and Water as Factors in Food of Frogs, H. Pellat, 612; the Echinoderm Fauna of New Zealand, H. Farquhar, 636



Alfred Naumeni Photo

Walker & Dowell, Ph. Sc.

A. Koelliker



A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

“To the solid ground
Of Nature trusts the mind which builds for aye.”—WORDSWORTH.

THURSDAY, MAY 5, 1898.

SCIENTIFIC WORTHIES.

XXXI.—ALBERT VON KÖLLIKER.

ALBERT VON KÖLLIKER was born at Zürich on July 6, 1817; he therefore is the eldest of the illustrious teachers who have brought down to the present day the tradition of that active spirit of biological inquiry which had its most complete expression, during the first part of the century, in the life and work of Johannes Müller.

After visiting several universities, and so hearing the lectures of many eminent biologists (among whom Johannes Müller himself may be specially mentioned), Kölliker took the degree of M.D. in Heidelberg in 1842; and in 1843 he commenced his teaching career as Prosector to Henle in Zürich. In 1846 he became Professor extraordinarius in Zürich, and in the autumn of 1847 he was called to Würzburg as Professor of Human Anatomy. This chair he has continuously occupied ever since. The remarkable Festschrift, recently published in his honour, contains a long list of names of men who are proud to call themselves his pupils; and the scientific position which so many of these men have won is evidence of the way in which he has fulfilled the highest function of a teacher, imparting to his hearers not only a great store of knowledge, but a just perception of the point where knowledge ends, and something of his own determination and energy in the acquisition of new scientific truth.

It is impossible to give anything like a detailed account of Prof. von Kölliker's scientific work, the results of which are embodied in some couple of hundred memoirs (written with apparently equal facility in any one of four languages) and in a series of text-books. All that can be attempted is an outline of its most important features.

The publication, in 1838, of Schwann's great work drew attention to a number of problems; and Kölliker was one of the first to realise that the complete justification of the cell-theory must be accomplished by a

study of the whole history of animal tissues, from the fertilised egg onwards. The first results of this conviction are seen in his monograph of the development of Cephalopods (1844), and in a series of papers on the development of Amphibia (1846-1847). These memoirs are of great importance in the history of embryology, because they definitely bring the phenomena of the segmentation of fertilised ova into the category of normal cell divisions, and lay the foundation of the modern doctrine that an ovum is to be regarded as a single cell. Speaking in 1860 of his work on the Cephalopoda, Prof. von Kölliker points out, with justifiable pride, that he had already in 1844 asserted

“Dass in der ganze Reihe der Entwicklung der thierischen Gewebe, ebensowie bei den Pflanzen, keine Zellenbildung ausserhalb der schon vorhandenen sich finde, vielmehr alle Erscheinungen als die ununterbrochene Folge von Veränderungen ursprünglich gleichbedeutender und alle von Einem ersten abstammender Elementarorgane aufzufassen seien.”—

the process of derivation being always a cell-division comparable with the division of cells in a later embryo, or in the adult body (cf. *Entwicklungsgeschichte*, ed. 1861). But besides this important general proposition, the memoir contains a detailed account of Cephalopod development, so far as it could be studied by the methods available at the time, which is of great and permanent value to students of molluscan embryology. The papers on the development of Amphibia describe in outline the process by which the cells of cartilage and blood, the walls of blood-vessels and the elements of embryonic muscle are derived from blastomeres, and therefore have an important bearing on the fundamental problems of histogenesis.

A second series of early papers (1841-1847) was of great assistance, although in a different way, to the study of animal development. The acceptance of Caspar Wolff's doctrine of epigenesis, while it led to a right understanding of the structure of the ovum, was accompanied for a time by a curious belief concerning spermatozoa. After the discovery of these bodies in Leeuwenhoek's laboratory (1677) they were held by many supporters of the hypothesis of “evolution” to contain the whole preformed germ of the future animal,

which unfolded and grew after entering the egg. This view never obtained universal acceptance, and it was abandoned by every one at the close of the eighteenth century, as Wolff's view of development became fashionable; but the belief which then grew up was further from the truth than that previously held, for it was maintained that spermatozoa were parasites of extraneous origin, which played no part whatever in the process of fertilisation. This belief was finally destroyed by the researches of Kölliker, who showed conclusively that spermatozoa arise from the tissues of the male gonad, and said in 1847: "Ich betrachte sie als befruchtende Princip und glaube, dass sie durch Berührung der Eier in denselben ein neues Leben erwecken"—thus leading the way directly to modern views. These papers again, besides establishing an important general proposition, contain statements of value on many points of detail, among which the descriptions of the large non-motile male elements of the higher Crustacea may be mentioned.

The two series of memoirs referred to contain perhaps the most fundamental results achieved before going to Würzburg in 1847; but they give no idea of the amount of work actually done before that date. In the field of pure histology must be mentioned the memoir on the Pacinian bodies, written in conjunction with Henle (1844); the important demonstration of the whole course of the connection between a medullated nerve fibre and a nerve cell (1845); a memoir on the spleen, and another on the synovial membranes (1847); also a preliminary account of the researches on the structure of smooth muscle, which were fully described later. Of more purely zoological interest are the papers on the hectocotylus of Cephalopods, in which the trematode hypothesis is shown to be untenable; the paper on the marginal bodies of *Medusæ* (1843), which contains the earliest recognition of the nature of the ootocysts in these animals; the description of the remarkable *Rhodope Varanii* (1847), discovered by v. Kölliker; and two papers, written in conjunction with Löwe, on the presence of cellulose in the test of Tunicata (1846).

On going to Würzburg, Prof. v. Kölliker's activity was if anything increased. He almost immediately joined von Siebold in founding the *Zeitschrift für wissenschaftliche Zoologie*; and it is not the least of his claims to the gratitude of biologists that he has continued for half a century to edit this valuable journal. The first numbers contain a series of papers written by himself, of which the following are the most important.

The essay on *Actinophrys* recognises the rhizopod nature of this animal, and contains a remarkable discussion of the manner in which rhizopods generally ingest their food. The suggestion is clearly made that the contractile substance of *Actinophrys* and *Amæba* is identical in nature with that of *Hydra* and of the higher animals; so that this paper, and Ecker's paper on the contractile substance of *Hydra* which is printed immediately after it, mark an important step in the general conception of what is now called protoplasm.

The monograph of the *Gregarinidæ*, also in the first volume, clearly recognises the unicellular nature of an adult *Gregarina*, and in it the *pseudonavicelle* are stated to represent stages in the life-history of the *Gregarina*. Many species of Gregarines are described.

[The description of *Dicyema* (1849) may be most conveniently referred to here, although it was not published in the *Zeitschr. f. w. Zoologie*.]

Of papers relating to vertebrate histology, published in the early numbers of the *Zeitschrift*, the most important are the memoirs on smooth muscle, and on the skin. In the first the result of the work already referred to is more fully described. This memoir contains a description of the cellular elements of smooth muscular tissue, and a detailed account of its occurrence in the vertebrate body, including a final demonstration of its presence in the walls of the blood-vessels, which was doubted by several anatomists at the time. In the second memoir, the development of the epidermis is described, and a full account of the development of sweat-glands, hairs, and sebaceous glands is also given.

A paper on nerve-cells, and a note upon the distinction between the two classes of cranial bones, according to their method of ossification, must also be mentioned.

The first published volume of the "Mikroskopische Anatomie," the first of the series of text-books which Prof. von Kölliker has produced, appeared in 1850. This volume was the second of the projected work, and contained a systematic account of the various organs, illustrated by a large series of original figures, many of which have been copied by subsequent writers continuously until the present day. Within two years this was followed by the celebrated "Handbuch der Gewebelehre des Menschen," translated into English, soon after its appearance, by Busk and Huxley, and again (from a subsequent edition) by Bowman.

These masterly works are remarkable not only for their complete treatment of adult histology, but for the way in which the development of each tissue is described, whenever such description is possible, as a means of elucidating its adult structure. The necessity for such a study of the whole history of a tissue, from the egg upwards, is emphatically dwelt upon in the introduction to the "Gewebelehre." Among points of interest in special sections must be mentioned the whole treatment of the derivatives of the ectoderm (other than the central nervous system), including the development of the sweat-glands, the sebaceous and the mammary glands, and a description of the structure, development and succession of hair, which seems, if an English reader may presume to judge, clearer in some respects than the description given in the *Zeitschr. f. w. Zoologie*. The relation between striped muscles and their tendons is described so as to confirm, by independent evidence, many of the statements of Bowman; and a special point of interest in the account of muscular tissues is the description of the branched muscle-plates of the heart and certain other organs, which had been described by Leeuwenhoek, although the description seems to have been forgotten until the rediscovery of the structures by Prof. Kölliker. The chapters on the bones and on the process of ossification describe the mode of addition to bone beneath the periosteum, and include a detailed description of the growth of bone, together with the ossification of membrane bones. These chapters, in which the results of Prof. von Kölliker's researches were shown to be in complete agreement with those conducted in this country by Sharpey, had an important influence upon scientific

opinion. The formation of "membrane bones" had been asserted by Nesbitt in 1736, and since his time by Rathke, Jacobson, and others; but the researches of Sharpey in this country, and von Kölliker in Germany, gave the first intelligible account of the process from a histological point of view. The chapters dealing with the spleen, and with the organs of reproduction, must be mentioned; and the account of the ear is especially interesting, from the remarks upon the work of Corti, which had recently been carried out in Würzburg itself, and described in the third volume of the *Zeitschr. f. w. Zoologie*. It is characteristic of Prof. von Kölliker's scrupulous care that, although this work had been done so lately in his own University, he investigated the whole matter again for himself before writing the chapters dealing with it.

During the next ten years many important papers were published. In 1853 Kölliker paid a visit to Messina in the company of H. Müller; and after their arrival the two naturalists were joined by Gegenbaur. The visit has become celebrated among zoologists because of the investigations which were then begun. An account of the work done by each of the three naturalists is given in a joint paper (*Zeitschr. f. w. Zoologie*, Bd. iv.). Prof. Kölliker occupied himself chiefly with observations on the structure and development of hydrozoa; a sketch of his observations is given in the paper referred to, and his fuller quarto work on the Siphonophora was published in the following year, while a paper on the development of Pneumodermon, by Profs. Gegenbaur and Kölliker together, appeared in the *Zeitschr. f. w. Zoologie* for 1853.

Between this time and 1861 appeared a series of papers on the vertebrate notochord, in its relation to the adult vertebral column and to the skull. The investigations recorded in these papers constitute an important step in the detailed knowledge of the cranial notochord of the lower Fishes; while the description of the post-cephalic notochord leads to a classification of vertebral columns generally, based upon the degree to which the chordal sheath persists, and the share taken by this structure and by the "skeletogenous layer" of tissue outside it, in the formation of vertebral centra. The classification suggested was not accepted for many years; but it has lately been justified, and has formed the starting-point for important recent work. Of great value are the papers on the minute structure of the bony skeleton of adult fishes, published during the same period.

In 1861 the first edition of the "Entwicklungsgeschichte des Menschen u. d. höheren Thieren" was published. This edition is of interest not only from its scientific value, but because of its form. It is printed, after some revision, from the shorthand notes of a course of lectures delivered in Würzburg in 1860; and one can, therefore, gather from it some faint idea of the author's method and style of exposition. As usual, the book contains the result of several original investigations. Especially interesting are the lectures on the nature of meroblastic ova, and on segmentation of ova generally, and those relating to the development of the nervous system and the organs of special sense.

In the meantime the "Handbuch der Gewebelehre"

had passed through three editions, and had been again translated into English. In 1863 the fourth edition appeared.

In 1864 Prof. v. Kölliker made his first statement of opinion upon questions raised by the publication of the "Origin of Species." While he accepted a doctrine of descent with modification as a statement of the way in which species had appeared upon the earth, he refused to admit that Natural Selection had been the agency by which the modification had been produced, and he argued against the assumption that "utility" in the Darwinian sense had determined the survival of varieties. He also urged the possibility that variations of considerable magnitude might suddenly appear and survive. In his subsequent writings he has maintained essentially the same position, postulating an *allgemeine Entwicklungsgesetz*, working independently of any utilitarian effect, which determines the evolution of living things. His conception of the process of evolution is, therefore, allied to that of Nägeli and his school rather than to that of Darwin himself.

From 1865-1875 appeared a series of papers dealing with the anatomy of Coelenterates, and including the celebrated memoirs on the Alcyonaria (on *Renilla*, 1871; on the *Pennatulida*, 1872; on *Umbellula*, 1875). These papers, with their account of the remarkable dimorphism of the pennatulid zooids, and the mass of anatomical information they contain, are of fundamental importance to the student of the Alcyonaria. In 1879 the report on the *Pennatulida* collected during the voyage of H.M.S. *Challenger* was written.

A fifth edition of the "Gewebelehre" appeared in 1867.

Other work during these years deals with the development and resorption of bone, and with various points in the development of Vertebrates, especially of Mammals.

In 1876 the second edition of the "Entwicklungsgeschichte des Menschen u. d. höheren Thiere" was published. This edition is much larger than the first, and contains what Balfour, in his notice of the book calls "the most complete description which has yet been given of the early development of the Bird and Mammal" (*Journ. Anat. Physiol.*, 1876). Especially interesting are the account of the development of the Fowl during the first three days of incubation; the statements concerning the origin of the heart and the Wolffian bodies; and the whole account of the early development of the Rabbit. The great number of original figures shows how largely the whole work is based on personal observation.

The considerable series of embryological and other papers published since that time cannot here be noticed. The little space remaining must be given to a mention of the last edition of the "Handbuch der Gewebelehre," of which the first volume was published in 1889. This is, as the author declares in the preface, rather an altogether new treatise than a new edition of an old one; and as usual every page shows how largely it is based on Prof. von Kölliker's own observations, whether original or in confirmation of results obtained by others. The first volume deals with the simple tissues, with the skin and its derivatives, with bone and with muscle. The second volume, which deals with the nervous system, appeared in parts from 1893 onwards.

The advance in knowledge since the fifth edition of the "Gewebelehre" is nowhere so striking as in the case of the central nervous system. The extended study of degeneration following upon injury, and the histological methods introduced by Erlich, Golgi, and others, have led to a rapid increase in knowledge concerning the distribution of nerve fibres both within the central nervous system and outside its limits; while an altogether new conception of the anatomical relations of ganglion cells has been established. Prof. von Kölliker was one of the first to recognise the importance of Golgi's work; and after visiting him in Padua in 1887, he adopted the new method in a series of investigations, some of which are described in seven papers published between 1889 and 1891 (cf. especially *Zeitschr. f. w. Zoologie*, vols. xlix. and li.), while the results of others appear for the first time in the second volume of the "Gewebelehre." This volume, of nearly 900 closely-printed pages, illustrated by 840 figures, most of which are as usual original, attempts nothing less than an outline of the comparative histology of the central nervous system in Vertebrata generally. The value of this enormous work arises not only from the new statements of fact which it contains, but from the systematic treatment of the mass of detail, constituting almost a new science, by a man who knows every fact referred to from his own observation.

This is not the place in which to speak of the numerous and well-merited honours conferred upon Prof. von Kölliker by the Government of his own country and by scientific societies and academies in almost every land. It is hoped that the foregoing imperfect outline of his work may give some idea of his position as one of the founders of modern systematic histology, and of his valuable services to embryology and comparative anatomy. Those who are best able to judge the imperfections of this sketch will be best able to understand the magnitude of the attempted task.

W. F. R. WELDON.

NITRO-EXPLOSIVES.

Explosifs Nitrés. By J. Daniel. Pp. viii + 235. (Paris: Gauthier-Villars et Fils.)

BY far the greater portion of this book is a fairly literal translation of Mr. Sanford's work on nitro-explosives, published in 1894. It suffers therefore, in many respects, from the same defects, though in others it is a decided improvement. Like the original it gives, for example, a description of all the gelatinised nitroglycerine preparations before giving the manufacture of the various nitro-cottons used in gelatinising them, which is, in several respects, an inconvenient arrangement. Like Sanford's work, it describes the manufacture of nitroglycerine and nitrocellulose in greater detail than is necessary for the use of a general chemist, and yet insufficiently so to serve as a complete guide to the manufacturer. The description of nitroglycerine is, however, a marked improvement on the original, and does not, for example, leave the reader in doubt as to whether nitroglycerine should be regarded as a nitric ether or not. It is, therefore, all the more surprising to find that M. Daniel, like Mr. Sanford, has apparently

failed to grasp the great importance, from a theoretical as well as a practical point of view, of the fundamental difference between a nitric ether, on the one hand, and a true nitro-compound on the other. The former, although, when pure, perfectly stable at ordinary temperatures, decompose readily at, comparatively speaking, low temperature, and are one and all unstable at ordinary temperature in the presence of even minute traces of strong mineral acids as well as in the presence of many organic acids. Hence, in order to ensure the stability of a powder containing a nitric ether, it is absolutely essential not only to exclude all free acids, but also all compounds likely to become acid. Hence ammonium salts, like nitrate of ammonium, for example, may be used with perfect safety in admixture with a nitro-compound, such as dinitrobenzole in the manufacture of bellite, roburite, securite, &c., whereas the presence of this salt would be fatal in an explosive containing a nitric ether such as guncotton or nitroglycerine.

The preparation of the various nitro-celluloses, soluble and insoluble, is given very fully—too fully for the general chemist; but the author, in following too closely his original, fails to point out that the question of solubility or non-solubility of nitro-cotton is, in great measure, at least, one of method of manufacture and not one of degree of nitration, and also depends, in a measure, on the temperature of the ether alcohol mixture. This is very remarkable, seeing that the Cordite trial, during the progress of which this question of soluble and insoluble guncotton was very fully discussed, is several times alluded to in the work. The statement, found in both works, that the sulphuric acid in the manufacture of guncotton does not take part in the reaction, is, at least, open to doubt. The manufacture of celluloid, to which eight pages are devoted, however interesting in itself, should scarcely occupy so much space in a work of only 271 pages devoted to nitro-explosives.

A very useful addition of M. Daniel consists in a description of the physiological effects of nitroglycerine and dinitrobenzole. The baneful effects of this latter compound on the health of the workpeople employed in the manufacture of explosives containing it, was first clearly established by a small Departmental Committee of the Home Office, and it is curious to find it taken up by a Frenchman and omitted from the work of an Englishman.

Most of the more commonly used explosives are shortly, but sufficiently described; but the mistakes found in the original unfortunately reappear in the translation. Thus roburite never was a mixture of ammonium nitrate and chlorodinitrobenzole, but one of the former salt with chlorinated dinitrobenzole containing, at most, 2 per cent. of chlorine, a very different thing. This original roburite is no longer manufactured in England. M. Daniel also, like Mr. Sanford, gives what may be called the ideal composition of dynamite (25 per cent. kieselguhr and 75 per cent. nitroglycerine) as the ordinary one, whereas, as a matter of fact, commercial dynamite practically never contains 75 per cent. nitroglycerine, and almost always contains mineral matters besides kieselguhr.

As a further interesting addition by the translator may be mentioned the statement regarding the curious difference in the behaviour of frozen gelatine dynamite and

blasting gelatine respectively, to shock or percussion, gelatine dynamite, when frozen, being, if anything, rather more sensitive to percussion than when unfrozen, while with blasting gelatine the reverse is the case. This is a point of some importance when these two explosives have to be dealt with in winter, and it is curious to note that this fact, like the baneful effects of dinitrobenzole, although first established in England, is not found in the English work, but appears in the French translation.

We must also raise our protest against the statement, repeated in the translation, that blasting gelatine, when ignited in the open, burns but does not explode; this is true only when the blasting gelatine is in relatively small quantities, or in an unfrozen condition. The burning of large quantities of blasting gelatine frequently ends in a violent explosion, and the burning of even a pound or two of the frozen material nearly always leads to explosion. This is one of those careless statements which, unfortunately, frequently lead to accidents.

As regards this portion of the work we should have been grateful to the author if he had given us a little more information as to the various explosives, propulsive as well as disruptive, used in the French army. We in England, foolishly perhaps, have few or no secrets in such matters; it is, in fact, one of the most difficult things imaginable to keep anything secret. In France they manage these things better, or at least differently, and we are still, many years after their introduction, ignorant of the exact nature of the powder and other explosives used by the French army. Any information on these points from M. Daniel would have met with our warmest appreciation.

The chapters on the analysis of explosives are practically a simple translation of Mr. Sanford on the same subject, and suffer from the same defects, and have the same excellencies as the original. Here we can only point out one more instance of want of care in the translator. M. Daniel, like Mr. Sanford, dries moist guncotton at 100° C. to estimate the proportion of water, a proceeding which every one who has tried it must know to be impossible.

One of the greatest, if not the greatest, advances made in the production of smokeless powder, consisting in their complete gelatinisation, whereby they are converted into hard non-porous masses which burn only on the surface, is scarcely hinted at in this work.

Lastly, the list of explosives given at the end of the work suffers from the same defect as did the similar list in Mr. Sanford's book, and several explosives are given, which from the nature of their constituents must be unstable, and therefore dangerous to keep, without a word of warning being added; such as, for example, ammonia dynamite (amidogene) and poudre au nitrate d'ammoniac, which latter contains two salts incompatible with each other, viz. nitrate of ammonium and chlorate of potassium.

In conclusion we welcome this book as a useful addition to our library, but cannot refrain from expressing a hope that Mr. Sanford may soon have an opportunity of giving us a second edition of his work, free from the mistakes and shortcomings of his own first edition as well as those in the French translation of the same.

A. D.

PSYCHICAL RESEARCH.

Studies in Psychical Research. By Frank Podmore, M.A., author of "Apparitions and Thought-Transference." Pp. xi + 458. (London: Kegan Paul, Trench, Trübner, and Co., 1897.)

MR. FRANK PODMORE'S "Studies in Psychical Research" is at once a critically sifted account of facts and the story of a movement. The facts, or alleged facts, concern spiritualism, poltergeists, thought-transference, telepathic hallucinations, ghosts, haunted houses, premonitions, previsions, secondary consciousness, impersonation, obsession, clairvoyance. The movement is the persistent transfer of the facts from the region of myth to the region of verified science. This movement is typified by the work of the Psychical Research Society, which, as Mr. Podmore in his opening chapter shows, was founded by competent persons for the special purpose of ascertaining whether the popular belief in certain phenomena had any basis in scientific evidence. Some ten years ago "Phantasms of the Living" set men thinking on these topics. The theories, as much as the facts there adduced, have stimulated reflection at every hand. Mr. Podmore now aims at placing in a simple form the critical result of twenty years' labour. He is lucid, exact and critical. He pushes no hypothesis except so far as the evidence seems to justify it. Even his favourite "telepathy" is offered as a "working hypothesis" chiefly because it is the smallest "draught upon the unknown."

In Chapter ii., Mr. Podmore gives an account of "spiritualism as a popular movement." The testimony is, he finds, more "copious than cogent." The high-water mark in the scientific observation of spiritualism was Mr. Crookes' experiments with Home and others. The facts narrated in this chapter are subjected to a thorough criticism in Chapter iii. The two chapters are in admirable contrast—the facts of the one melting away under the scrutiny of the other. "Perhaps they heard Dr. Hodgson and the new generation knocking at the door" (p. 81). As the scientific search-light grows stronger, the marvels grow smaller and less numerous. Yet, negative conclusions notwithstanding, the year 1894 witnessed the performances of Eusapia Palladino. In regard to Mr. Crookes and his experiments, Mr. Podmore is becomingly respectful; but the best critical faculty may be taken in by trickery (*e.g.*, p. 111, "Miss Cook, Miss Fay, and other mediums with whom Mr. Crookes experimented"). Mr. Podmore concludes: "Unless and until some feat is performed which fraud cannot explain, the presumption that fraud is the all-sufficient cause remains unshaken" (p. 124). The "unless" and "until" rest with spiritualism, and were it for this result alone, the S.P.R. has not worked in vain. The poltergeists (Chapter v.) are, in brief, demonstrated trickery. In Chapter vi., Madame Blavatsky and her theosophy are, after a narrative that leaves no doubt, dismissed with a *decipiantur*. The grosser theosophy, like the grosser spiritualism, now receives its "unless" and "until." In Chapter vii. ("experimental thought-transference"), however, we are on more solid ground. Much of the material reminds one of Mr. Podmore's former book. He states the cases, and lets the reader "judge for

himself" (p. 199). But this assumes that all the necessary data are supplied—a large assumption. Fraud, at least conscious fraud, may be held as excluded by the conditions, which have all the seeming of true scientific methods. Agent and percipient are strictly watched and guarded. The most obvious sources of error are forestalled. Silent choosing of cards, and the like, obviate any risk of suggestion by normal channels—the purpose being to isolate the fact of the actuality of transference. How difficult it is so to isolate the fact may be guessed from the somewhat extraordinary results of Hansen and Lehman with "involuntary whispering." Their results, as even Parish ("Hallucinations and Illusions," p. 320) allows, are not necessarily conclusive against any experiments recorded by the Society, but they show how extremely difficult it is to establish, in this kind, the ordinary conditions of strict physiological experiment. But apart from these possible errors, the accounts seem somewhat wanting everywhere in psychological "context." This is specially true of the telepathic hallucinations (Chapter viii.), where, once more, the "method of agreement" predominates. A detached mental fact, when once it is subjectively assigned to so simple a cause as telepathic agency, is apt to escape from its mental current. The immediate association may be forgotten instantaneously, or pass utterly unrecognised. It is a more distinguished and impressive thing to have thoughts inspired by an outside source than following in the orthodox way of contiguous or similar association. This defect is very obvious in many of the cases (*e.g.*, p. 245). Several of the recorders of hallucinations state that this is their only experience of the kind. This seems to be a fairly complete proof of bad self-observation. It is true that a well-defined hallucination is, in the ordinary acceptance, a relatively uncommon experience; but Mr. Podmore admits (p. 244) that dreams and waking hallucinations differ, not in essence, but in the accident of sleeping or waking. Obviously, the recorders of those isolated experiences do not take hallucinations in this wide sense. Consequently, a doubt arises as to their competence to record the psychological context. Further, if dream and hallucination are thus to play into each other, the long arm of coincidence is made yet longer, and telepathy, while the marvel of it is none the less, becomes all the more difficult to establish. Mr. Podmore's exposition is so persuasive, and he obviously holds in reserve so much more information, that one hesitates to express doubts crudely. Yet he seems to allow too little for the "submerged dream," for the coincidences that (in excess of chance) must result from the general similarity of mental venue of friends or relatives or acquaintances. He seems to accept too easily the "veridicality" (Parish) of the alleged coincidence, for in some of his instances the precise nature of the fact is just what escapes. Thus the "come to me" of case iv., p. 245, and of her telepathic correlate, may have been, in each case, the end of a normal associational sequence. But the data are not enough to settle the point. The same difficulty in fixing evanescent processes of association has been pointed out by Prof. W. James (*Psych.*, ii. 83), and by Miss Helen Dendy (*Mind*, N.S., 7, 370), in connection with subconscious processes. Many disputes might be

raised on the time that hallucinations take to emerge after the alleged telepathic message has been sent, and the suggestions to meet the difficulty are sometimes more "copious than cogent."

Ghosts (Chapter ix.) and haunted houses (Chapter x.) are investigated only to be discredited, and Mr. Podmore then concentrates himself on a very important subject, "secondary consciousness," which, in its turn, is found not proven as a coherent system of ideas. That is, he does not regard as sufficient the argument that contends for separate subconscious personality acting in a hidden way alongside of the normal supraliminal consciousness. The ordinary doctrine of subconscious storage of memories in the nerve centres is considered enough. These subconscious personalities are "manufactured articles," and indicate rather the possible education of special centres for special ends than any fresh revelation of "transcending" consciousness. Once or twice in this book we seem to catch a tendency to meet popular explanations half-way (*e.g.*, p. 378), but there is proof enough that Mr. Podmore has a firm hold of positive psychology, and his fair-minded restatements of somewhat inflated doctrines are excellent instances of an investigator's patience. Although he seems to give too little to "veridicality" of coincidence, too little to mental venue, the submerged dream, the psychological context, dissociation of consciousness, the state of health and the "pathologic" element generally, yet he presents a residuum that will compel explanation, and that is at once the final justification of the Society he represents and of his elegantly narrated studies.

W. LESLIE MACKENZIE.

BRITISH EAST AFRICA.

Travels in the Coastlands of British East Africa and the Islands of Zanzibar and Pemba. By W. W. A. FitzGerald. Pp. xxiv + 774. Maps and illustrations. (London: Chapman and Hall, 1898.)

THIS handsome volume deals with a part of East Africa which, in spite of its apparent accessibility, has down to the present day remained surprisingly little known to the world at large. In the general rush to explore the more remote recesses of the African continent, many of the immediate coastlands have been left comparatively unheeded, and nowhere, perhaps, has this been more the case than in the northern districts of the British sphere along the East African coast. The present book, therefore, fills a decided blank in the literature of the continent.

Commissioned in 1891 by the late British East Africa Company to study the agricultural capabilities of the coastal zone falling within its sphere of operations, Mr. FitzGerald during the space of two years traversed that region in all directions, from Mombasa in the south to Port Durnford in the north, besides extending his inquiries to the two largest islands lying off the coast. He was thus able to gain an intimate acquaintance with the country, and the record of his experiences possesses a solid value, which fully atones for the slight delay noticeable in its presentation to the public. With the aid of the numerous illustrations, all of them reproductions of photographs, we gain a vivid idea of the characteristic

features of the East African coastlands—their labyrinth of creeks and backwaters, their miles of waterless scrub, or groves of *Hyphæne* palms, perhaps the most typical tree of a large part of their area. In the more northern districts traversed, on the borders of the Galla territories south of the Jub River, Mr. FitzGerald was actually breaking new ground, and the result of his journeys has been to modify considerably our ideas of the general character of the country, by showing that the vegetation is in parts of the interior much more luxuriant than has been generally supposed. Throughout his residence in the country he was in close touch with the native inhabitants, for whom he shows a genuine liking, and of whose life and customs many interesting details are given.

It is, however, in the treatment of the agricultural capabilities of the country that the chief value of the book will be found to exist. During the whole of his travels, the author devoted his constant attention to this subject, so that the information collected was unusually varied and complete, and the picture presented of the various aspects of life in the African "shambas" (plantations) is full of interest. The general reader may, perhaps, find the mass of details on agricultural subjects hardly to his taste; but to all who require a trustworthy guide to the capabilities of British East Africa in such matters, the book will prove of sterling value. A special weight attaches to Mr. FitzGerald's views from his wide experience of agriculture as carried out in Southern India, and he has done good service in calling attention to what he considers the great possibilities which lie before British enterprise in this direction in the East African coastlands. Much of the country is, in his opinion, eminently adapted for the growth of cotton and coco-nuts, while other products, such as fibre-plants and india-rubber, would also repay attention. Much apposite information regarding all these, drawn from sources not widely accessible, is printed in the form of appendices.

In the second part of the book, Mr. FitzGerald enlarges upon his report, made to the Directors of the East Africa Company in 1892, on the agricultural capabilities of Zanzibar and Pemba Islands. He treats exhaustively of the clove cultivation there carried on, describing minutely the requirements of the clove tree, the present methods employed in its culture, and various improvements which should be introduced. He also treats of other products to which attention should be paid, in order that the prosperity of the islands may not depend, as it does at present, on one crop alone. In the case of Zanzibar the ground has, it is true, been already covered to some extent by Dr. Baumann's useful monograph, but it is valuable to have also a professed agriculturist's views on the subject, which the German traveller approached rather from the standpoint of a scientific geographer. A point of special interest at the present time, when the slavery question seems to await its final solution, is the discussion of the sources of labour supply, into which Mr. FitzGerald enters fully. He holds that the introduction of Indian coolies will afford the best hope of a satisfactory solution of the problem.

A useful feature in the book is the lavish supply of maps (compiled by Mr. Reeves, of the Royal Geographical Society), in which the whole of the author's routes can

be followed, and which contain material not hitherto published. The index—also a point of special importance in a work intended, like the present, to be used for reference—is particularly full and well arranged.

OUR BOOK SHELF.

Notes on Observations. By Sydney Lupton, M.A. Pp. ix + 124. (London: Macmillan and Co., 1898.)

THE sub-title of this book describes the contents as "an outline of the methods used for determining the meaning and value of quantitative observations and experiments in physics and chemistry, and for reducing the results obtained." It is very important that students of science should be logical in their arguments and sound in their conclusions; and Mr. Lupton's concise description of the methods which must be followed before a scientific law or any general proposition can be established conduce to this end. The opening chapters of the book remind us of Huxley's inspiring little "Introductory" Science Primer. After these more or less metaphysical, but distinctly serviceable, statements as to ideas, premisses, and laws, come short chapters on units, averages, interpolation, the law of error, the method of least squares, the expression of results by graphical and by empirical methods, and many other subjects of interest to all who are engaged in quantitative physical and chemical experimentation. The treatment is but brief in most cases, and questions involving higher mathematics are not introduced. Sufficient is said, however, to show students how to apply to his own results the methods described; and for those who desire to go into the subjects more thoroughly, a list of references to standard works is appended to each chapter.

The book should find a place in the library of every physical and chemical laboratory, and all students of the laws and phenomena of nature should make themselves familiar with the principles described; for they will thereby learn the methods of sound reasoning, and be instructed in the art of computation for the purposes of science.

Prospecting for Minerals: a Practical Handbook for Prospectors, Explorers, Settlers, and all interested in the Opening-up and Development of New Lands. By S. Herbert Cox. Pp. xi + 239. With illustrations. (London: Charles Griffin and Co., Ltd., 1898.)

THIS little work forms the first volume of a new series of handbooks to be edited by Prof. Grenville Cole, and issued under the title of "The New Land Series." Although it can hardly be said that the title of the series is very happily chosen, it will be immediately admitted that the object of the series is distinctly good. The explorer or the settler in any new country needs, in most cases, some instruction as to the best means of discovering and developing its resources. Of all pioneers of civilisation, the mineral prospector is the most likely nowadays to lead the way; and the first volume of the series is, therefore, appropriately devoted to the subject of prospecting. The preparation of the work has been entrusted to Mr. Herbert Cox, a well-known mining engineer in London, who has in his day travelled widely and seen much of mines and minerals. Those who know the character of his professional work will feel no doubt as to his ability to lead the prospector in the way he should go; and an examination of the volume shows that its value is beyond dispute. Mr. Cox has furnished the prospector with a portable guide, which, while essentially practical, contains sufficient geology and mineralogy to explain the scientific principles on which the search for minerals should be based. The rough-and-ready prospector may probably think that the science is too much in evidence, and may grow impatient as he turns over pages about such things as "anhydrous silicates of lime

and alumina and their crystallographic allies." But the explorer should clearly understand that, notwithstanding occasional accidents, the most trustworthy results in the search for minerals will, in the long run, be reached by that man who brings to bear upon his work the widest range of scientific knowledge.

The Process of Creation Discovered; or, the Self-evolution of the Earth and Universe by Natural Causes. By James Dufbar. Pp. viii + 290. (London: Watts and Co., 1898.)

To review this book would be to give prominence to a volume every page of which exemplifies the dangerous character of a little knowledge. We will merely remark that the author finds himself at variance with very many physical facts and theories, disbelieves the results of spectroscopic analysis applied to celestial bodies, and regards the solar photosphere as a deep ocean of water. According to his theory of inorganic evolution, "the only elements employed or necessary in the formation of the sun, solar system, and universe are those composing atmospheric air and water." Students of science may be left to form their own opinion upon a book containing an assertion of this kind.

Domestic Science Readers. Book vii. By Vincent T. Murché. Pp. 298. (London: Macmillan and Co., 1898.)

THE subject of domestic economy is taught in the various standards of our elementary schools; and this book is adapted to supply girls in the highest standards with the information which the Education Department expects them to possess. The laws of health, infant management, common ailments and their remedies, common accidents, infectious diseases, and management of the sick-room are the subjects dealt with in the six parts of the book, and they are treated in a very clear and instructive manner. Mr. Murché knows how to interest the young readers for whom he writes, and this little school book will doubtless be as successful as the others of which he is the author. Moreover, the pupils who read the book will receive a large amount of sensible advice which will give them a sound understanding of the laws of health, and thus be of service to them and to future generations.

A Course in Mechanical Drawing. By John S. Reid. Pp. 128. (New York: John Wiley and Sons. London: Chapman and Hall, 1898.)

TEACHERS of the elements of mechanical drawing to students in marine, electrical, railway, and mechanical engineering will find that this book contains a concise statement of the essential principles of the subject. In the five chapters, the author deals with drawing instruments, geometrical drawing, or the use of the instruments, conventional methods of drawing used by draughtsmen, lettering and figuring, and orthographic projection. The author is instructor in mechanical drawing and designing in Sibley College, Cornell University, and his experience has enabled him to produce a useful work.

Flower Favourites, their Legends, Symbolism and Significance. By Lizzie Deas. Pp. viii + 229. (London: George Allen, 1898.)

MANY pretty stories concerning common flowers have been collected from folk-lore and classic myths by the author, and are presented here in an attractive setting. The nursery traditions and love legends referring to flowers and flower-names are numerous and interesting enough, but very little attention is devoted to the subject of "plants and flowers in their widest relationships" referred to in the preface.

LETTER 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.]

Röntgen Rays and Ordinary Light.

I QUITE agree with the physical principles in Lord Rayleigh's article on "Röntgen Rays and Ordinary Light" in NATURE of April 28, and think that the difference between us is one of terminology. I am accustomed to restrict the word wave to disturbances in which the harmonic character is well developed, and not to use it in physics in the sense in which it is used in the phrase "a wave of enthusiasm." It would never have occurred to me to speak of a disturbance localised in a thin shell as a wave of short wave-length. I should speak of it as a pulse, and though such pulses can of course be resolved by Fourier's theorem into trains of waves, yet it seems to me that when a simple pulse is so resolved (except for some special purpose), there is a loss of clearness both in expression and conception analogous to that which would occur if we regarded a straight line as an aggregate of harmonic curves.

The term pulse has the advantage that it suggests the fundamental property of the Röntgen rays, that their action on matter in their path is an *impulsive* action, *i.e.* that the time constant of the disturbance (the time taken by the pulse to pass over a point) is small compared with the time constant of the system in their path (the time of vibration of the molecules).

I am not aware that I have ever regarded these pulses as possessing any physical property which would be inconsistent with the physical properties of the constituents into which they can be resolved by Fourier's theorem. Personally I should expect that if a train of waves of wave-length λ were refracted, a pulse of thickness λ would be refracted too, and if the thickness of these pulses were of the order of the wave-length of ordinary light, that the Röntgen rays would be like ordinary light.

I believe the Röntgen rays to be pulses rather than waves of small wave-length, not because I think the properties of the latter would be different from those of Röntgen rays as far as we know them, but because electromagnetic theory shows that pulses, and not short waves, are produced by the impact of kathode rays.

J. J. THOMSON.

Cambridge, April 30.

SLEEP, AND THE THEORIES OF ITS CAUSE.

THE theory of the origin of sleep which has gained the widest credence is the one that attributes it to anæmia of the brain. It has been shown by Mosso, and many others, that in men with defects of the cranial wall the volume of the brain decreases during sleep. At the same time, the volume of any limb increases as the peripheral parts of the body become turgid with blood. In dogs, the brain has been exposed, and the cortex of that organ has been observed to become anæmic during sleep. It is a matter of ordinary observation that in infants, during sleep, the volume of the brain becomes less, since the fontanelle is found to sink in. It has been supposed, but without sufficient evidence to justify the supposition, that this anæmia of the brain is the cause and not the sequence of sleep. The idea behind this supposition has been that, as the day draws to an end, the circulatory mechanism becomes fatigued, the vasomotor centre exhausted, the tone of the blood vessels deficient, and the energy of the heart diminished, and thus is the circulation to the cerebral arteries lessened. By means of a simple and accurate instrument (the Hill-Barnard sphygmometer), with which the pressure in the arteries of man can be easily reckoned, it has been recently determined that the arterial pressure falls just as greatly during bodily rest as during sleep. The ordinary pressure of the blood in the arteries of young and healthy men averages 110-120 mm. of mercury. In sleep, the pressure may sink to 95-100

mm.; but if the pressure be taken of the same subject lying in bed, and quietly engaged on mental work, it will be found to be no higher. By mental strain or muscular effort, the pressure is, however, immediately raised, and may then reach 130-140 mm. of mercury. It can be seen from considering these facts that the fall of pressure is concomitant with rest, rather than with sleep. As, moreover, it has been determined on strong evidence that the cerebral vessels are not supplied with vasomotor nerves, and that the cerebral circulation passively follows every change in the arterial pressure, it becomes evident that sleep cannot be occasioned by any active change in the cerebral vessels. This conclusion is borne out by the fact that to produce in the dog a condition of coma like to sleep, it is necessary to reduce, by a very great amount, the cerebral circulation. Thus, both carotids and both vertebral arteries can be frequently tied at one and the same time without either producing coma or any very marked symptoms. The circulation is, in such a case, maintained through other channels, such as branches from the superior intercostal arteries which enter the anterior spinal artery. While total anæmia of the brain instantaneously abolishes consciousness, partial anæmia is found to raise the excitability of the cortex cerebri. By estimation of the exchange of gases in the blood which enters and leaves the brain, it has been shown that the consumption of oxygen and the production of carbonic acid in that organ is not large. Further, it may be noted that the condition of anæsthesia is not in all cases associated with cerebral anæmia. Thus, while during chloroform anæsthesia the arterial pressure markedly falls. Such is not the case during anæsthesia produced by ether or a mixture of nitrous oxide and oxygen.

The arterial pressure of man is not lowered by the ordinary fatigue of daily life. It is only in extreme states of exhaustion that the pressure may be found decreased when the subject is in the standing position. The fall of pressure which does occur during rest or sleep is mainly occasioned by the diminished rate of the heart. The increase in the volume of the limbs is to be ascribed to the cessation of muscular movement, and to the diminution in the amplitude of respiration. The duty of the heart is to deliver the blood to the capillaries. From the veins the blood is, for the most part, returned to the heart by the compressive action of the muscles, the constant change of posture and by the respiration acting both as a force and suction pump. All of these factors are at their maximum during bodily activity, and at their minimum during rest. On exciting a sleeper by calling his name, or in any way disturbing him, the limbs, it has been recorded, decrease in volume while the brain expands. This is so because the respiration changes in depth, the heart quickens, the muscles alter in tone, as the subject stirs in his sleep in reflex response to external stimuli. Considering all these facts, we must regard the fall of arterial pressure, the depression of the fontanelle, and the turgescence of the vessels of the limbs as phenomena concomitant with bodily rest and warmth, and we have no more right to assign the causation of sleep to cerebral anæmia than to any other alteration in the functions of the body, such as occur during sleep.

We may well here summarise these other changes in function.

- (1) The respiratory movement becomes shallow and thoracic in type.
- (2) The volume of the air inspired per minute is lessened by one-half to two-thirds.
- (3) The output of carbonic acid is diminished by the same amount.
- (4) The bodily temperature falls.
- (5) The acidity of the cortex of the brain disappears.
- (6) Reflex action persists; the knee jerk is diminished,

pointing to relaxation in tone of the muscles; consciousness is suspended.

Analysing more closely the conditions of the central nervous system, it becomes evident that, in sleep, consciousness alone is in abeyance. The nerves and the special senses continue to transmit impulses, and to produce reflex movements. If a blanket, sufficiently heavy to impede respiration, be placed upon the face of a sleeping person, we know that it will be immediately pushed away. More than this, complicated movements can be carried out: the postillion can sleep on horse-back; the punkah-wallah may work his punkah, and at the same time enjoy a slumber; a weary mother may sleep, and yet automatically rock her infant's cradle. Turning to the histories of sleep-walkers, we find it recorded that, during sleep, they perform such feats as climbing slanting roofs, or walking across dangerous narrow ledges and bridges. The writer knew of the case of a lad, who, when locked into his room at night to prevent his wandering in his sleep, climbed a partition eight to ten feet in height which separated his sleeping compartment from the next, and this without waking.

The brain can carry out not only such complicated acts as these, but it has been found to maintain during sleep its normal inhibitory control over the lower reflex centres in the spinal cord.

Thus, in sleeping dogs, after the spinal cord has been divided in the dorsal region, reflexes can be more easily evoked from the lumbar than from the cervical cord, because the former is freed from the inhibitory control of the brain.

The strength of stimulus necessary to pass the threshold of consciousness, and to produce an awakening, has been measured in various ways. It has been determined that it takes a louder and louder sound, or a stronger and stronger electric shock to arouse a sleeper during the first two or three hours of slumber; after that period, the sleep becomes lighter, and the required stimulus need be much less.

The alternative theories, which have been suggested to account for the onset of sleep, may be classed as chemical and histological.

In relation to the first, it has been suggested that if consciousness be regarded as dependent upon a certain rate of atomic vibration, it is possible that this rate depends on a store of intramolecular oxygen, which, owing to fatigue, may become exhausted; or it may be supposed that alkaloidal substances may collect as fatigue products within the brain, and choke the activity of that organ. Against this theory may be submitted the facts that monotony of stimulus will produce sleep in an unfatigued person, that over-fatigue, either mental or bodily, will hinder the onset of sleep, that the cessation of external stimuli by itself produces sleep. As an example of this last, may be quoted the case recorded by Strumpel of a patient who was completely anæsthetic save for one eye and one ear, and who fell asleep when these were closed. Moreover, many men possess the power, by an effort of will, of withdrawing from objective or subjective stimuli, and of thus inducing sleep.

The histological theories of sleep are founded on recent extraordinary advances in the knowledge of the minute anatomy of the central nervous system, a knowledge founded on the Golgi and methylene-blue methods of staining. It is held possible that the dendrites or branching processes of nerve cells are contractile, and that they, by pulling themselves apart, break the association pathways which are formed by the interlacing or synapses of the dendrites in the brain. Ramon y Cajal, on the other hand, believes that the neuroglia cells are contractile, and may expand so as to interpose their branches as insulating material between the synapses formed by the dendrites of the nerve cells. The difficulty of accepting these theories is that nobody can locate consciousness

to any particular group of nerve-cells. Moreover, the anatomical evidence of such changes taking place is at present of the flimsiest character.

If these theories be true, what, it may be asked, is the agency that causes the dendrites to contract or the neuroglia cells to expand? Is there really a soul sitting aloof in the pineal gland, as Descartes held? When a man like Lord Brougham can at any moment shut himself away from the outer world and fall asleep, does his soul break the dendritic contacts between cell and cell; and when he awakes, does it make contacts and switch the impulses evoked by sense stimuli on to one or other tract of the axons, or axis cylinder processes, which form the association pathways? Such an hypothesis is no explanation: it simply puts back the whole question a step further, and leaves it wrapped in mystery. It cannot be fatigue that produces the hypothetical interruptions of the dendritic synapses and then induces sleep, for sleep can follow after fatigue of a very limited kind. A man may sleep equally well after a day spent in scientific research, as after one spent in mountain-climbing, or after another passed in idling by the seashore. He may spend a whole day engaged in mathematical calculation, or in painting a landscape. He fatigues—if we admit the localisation of function to definite parts of the brain—but one set of association tracts, but one group of cells, and yet, when he falls asleep, consciousness is not partially, but totally suspended.

We must admit that the withdrawal of stimuli, or their monotonous repetition, are factors which do undoubtedly stand out as primary causes of sleep. We may suppose, if we like, that consciousness depends upon a certain rate of vibration which takes place in the brain structure. This vibration is maintained by the stimuli of the present, which awaken memories of former stimuli, and are themselves at the same time modified by these. By each impulse streaming into the brain from the sense organs, we can imagine the structure of the cerebral cortex to be more or less permanently altered. The impulses of the present, as they sweep through the association pathways, arouse memories of the past; but in what way this is brought about is outside the range of explanation. Perhaps an impulse vibrating at a certain rate may arouse cells or fibrils tuned by past stimuli to respond to this particular rate of vibration. Thus may be evoked a chain of memories, while by an impulse of a different rate, quite another set of memories may be started. Tracts of association are probably formed in definite lines through the nervous system, as during the life of a child repeated waves of sense-impulses beat against and overcome resistances, and make smooth pathways here and there through the brain structure. Thus may be produced growth of axons in certain directions, and synapses of this cell with that. If the same stimulus be often repeated, the synapses between groups of cells may become permanent. A memory, a definite line of action which is manifested by a certain muscular response, may thus become structurally fixed. If the stimulus be not repeated, the synapses may be but temporary, and the memory fade as the group of cells is occupied by a new memory of some more potent sense stimulus. Many association tracts and synapses are laid down in the central nervous system when the child is born. These are the fruits of inheritance, and by their means, we may suppose, instinctive reflex actions are carried out.

So long as the present stimuli are controlled by past memories and are active in recalling them, so long does consciousness exist, and the higher will be the consciousness the greater the number and the more intense the character of the memories aroused. We may suppose that when all external stimuli are withdrawn, or the brain soothed by monotony of gentle repetition, and when the

body is placed at rest, and the viscera are normal and give rise to no disturbing sensations, consciousness is then suspended, and natural sleep ensues. Either local fatigue of the muscles, or of the heart, or ennui, or exhaustion of some brain centre usually leads us to seek those conditions in which sleep comes. The whole organism may sleep for the sake of the part. To avoid sleeplessness, we seek monotony of stimulus either objective or subjective. In the latter case, we dwell on some monotonous memory picture, such as sheep passing one by one through a gap in the hedge. To obtain our object, we dismiss painful or exciting thoughts, keep the viscera in health, so that they may not force themselves upon our attention, and render the sense-organs quiet by seeking darkness, silence and warmth.

L. H.

A PROPOSED REVOLUTION IN NAUTICAL ASTRONOMY.

DURING the last two years a movement has been set on foot, which seems likely to be attended by somewhat important results in the simplification of the formulæ of astronomical navigation for every-day use. Any one who has looked even cursorily into a text-book of navigation of the Raper type, can hardly fail to have been impressed by the multiplicity and variety of the precepts, and can easily understand how complicated the various rules must appear to the unlearned men, upon whom, for the most part, the daily routine of practical navigation at sea must devolve.

And the difficulty of comprehending and putting into practice the various rules, is undoubtedly increased by the fact that at one time or another all the trigonometrical functions of an angle are brought into play. Sines, cosines, tangents, cotangents, secants and cosecants, versed sines and half-versed sines, all make their appearance, adding to the bewilderment of the unskilled computer, and introducing the liability to take a required function from a wrong column as a very frequent source of error.

Nautical astronomy, for the most part, may be regarded as simply a practical application of the formulæ employed in the solution of spherical triangles, so that the object to be attained by those who would simplify the various problems, is to devise a system of formulæ in logarithmic shape, which, without materially adding to the amount of arithmetic employed, should introduce but one function of an angle throughout, such as the sine, the cosine, or the tangent. In the verbal precepts, into which, for the benefit of those possessing no knowledge of mathematics, the formulæ have to be translated, the simple word "logarithm" would then take the place of "log sine," "log cosine," &c., and a single table of a few thousand logarithms would do the work formerly effected by the aid of a large collection of different tables.

To M. E. Guyou, an officer of the French navy, belongs the credit of having first devised such a system. As far back as the year 1885 he published in a small pamphlet entitled "Tables de Poche," methods of finding hour angle and azimuth of a heavenly body by means of a single table of logarithms. During the next ten years he employed himself in further researches, and early in 1896 there appeared in connection with the "Annales Hydrographiques," published periodically by the Hydrographic Department of the French navy, a more exhaustive account of his methods, with a special arrangement of the required table, intended to enable his processes to be more easily and effectively carried out.¹

The particular table employed by M. Guyou does not give logarithms for one of the ordinary functions of the

¹ "Les problèmes de Navigation et la Carte Marine. Types de calcul et tables complètes." Par M. le capitaine de frégate E. Guyou, Membre de l'Académie des Sciences. (Paris: Imprimerie Nationale, 1895.)

angle, but is a table which is made use of daily in the calculations which belong to Mercator sailing, and which is consequently to be found in every collection of nautical tables. It is known as the table of "meridional parts," or, as the French call it, "*latitudes croissantes*." The meridional parts for a given latitude are defined by some writers as "the value in minutes of a great circle of the line on the Mercator's chart, into which the true difference of latitude is expanded."

For a given latitude l the meridional parts represent the sum of the series

$$\sec 0' + \sec 1' + \sec 2' + \sec 3' + \dots + \sec (l' - 1')$$

which is found by the integral calculus to be

$$r \log_e \tan \left(45^\circ + \frac{l}{2} \right)$$

or

$$\frac{10800}{\pi} \log_e \tan \left(45^\circ + \frac{l}{2} \right)$$

when r is expressed in minutes.

In the table of meridional parts we have then a series

of logarithms to the base e^{10800} , which has been found to lend itself in a remarkable manner to the purpose which we have in view.

It should be mentioned here that M. Guyou's general method is to deduce his formulæ from a study of the properties of the curves of equal altitude on a Mercator's chart. To other writers, especially in Italy, where considerable attention has been bestowed upon the new formulæ, it has appeared more satisfactory, while accepting the expressions, to deduce them directly from fundamental trigonometrical formulæ.

Shortly before the issue of M. Guyou's second work there was published, in the numbers of the *Nautical Magazine* for November and December 1895, a system of formulæ, for the solution of all the ordinary problems of nautical astronomy, by the aid of this table of meridional parts alone, the general principle adopted being to break up the spherical triangle, or "triangle of position," as it is generally called in nautical astronomy, into two right-angled triangles, and thus obtain expressions which, containing three terms only, would be more manageable than the general formulæ involving four terms.

This treatment of the subject was based upon certain easily established lemmas, the most important of which may be thus stated. (The abbreviation MP will be adopted for meridional parts throughout.)

$$\text{MP}(180^\circ - \theta) = \text{MP}(\theta) \dots \dots \dots (1)$$

It
$$\text{MP}(-\theta) = -\text{MP}(\theta) \dots \dots \dots (2)$$

then will
$$\tan x = \sin \theta,$$

If
$$\text{MP}(2x) = 2\text{MP}(\theta) \dots \dots \dots (3)$$

then will
$$\tan a = \tan b \tan c \dots \dots \dots$$

$$\text{MP}(2a - 90^\circ) = \text{MP}(2b - 90^\circ) + \text{MP}(2c - 90^\circ) \dots (4)$$

With regard to (1) it may be stated that from the form of the expression

$$\text{MP for lat } l' = r \log_e \tan \left(45^\circ + \frac{l'}{2} \right),$$

the meridional parts in the first instance have reference to angles in the first quadrant only. The lemma enables us to pass to angles in the second quadrant.

Similarly by lemma (2) we can introduce negative angles also.

The result involved in (3) is exceedingly important,

for it follows from this that if we have a logarithmic formula connecting the sines and cosines of parts of a spherical triangle, we may pass by means of auxiliary angles to other logarithmic formulæ, involving only the meridional parts of the angles employed, and that not only for right-angled and quadrantal triangles, as in the *Nautical Magazine*, but for any spherical triangle whatever.

As an example we may take one of the family of formulæ which express a function of an angle of a spherical triangle in terms of functions of the sides, supposed known. These expressions are perhaps, from a navigator's point of view, the most important which spherical trigonometry presents; for in the problem of finding the hour angle of a body, and thence the longitude of the place, such a formula may have to be brought into requisition on board a fast steam-ship as many as four or five times in the course of twenty-four hours. And while many of the problems of navigation may be, to some extent, "dodged" or evaded by the use of some of the many tables which ingenious persons have devised, there is no getting away from the hour-angle problem, because in that case the necessary degree of accuracy is more minute than any table of reasonable size could be expected to afford, unless we are content to spend more time and trouble in interpolating for variations in the values of the elements from the arguments given in the tables, than would suffice for the actual calculation by logarithms.

Let us assume that in the spherical triangle ABC we have to deal with the expression

$$\tan \frac{A}{2} = \sqrt{\frac{\sin(s-b)\sin(s-c)}{\sin s \sin(s-a)}}$$

Assume that

$$\begin{aligned} \sin(s-b) &= \tan x & \sin s &= \tan w, \\ \sin(s-c) &= \tan y & \sin(s-a) &= \tan z. \end{aligned}$$

So that

$$\tan \frac{A}{2} = \sqrt{\frac{\tan x \tan y}{\tan w \tan z}}$$

By lemma (3) we have

$$\text{MP}(2x) = 2\text{MP}(s-b),$$

and so on for y, w, z ; a system of equations which will determine $2x, 2y, 2w, 2z$.

Then by lemma (4)

$$\text{MP}(A - 90^\circ) = \frac{1}{2}[\text{MP}(2x - 90^\circ) + \text{MP}(2y - 90^\circ) - \text{MP}(2w - 90^\circ) - \text{MP}(2z - 90^\circ)],$$

whence A is readily determined.

The formula here established is only given as an illustration of the ease with which by the aid of lemma (3) we may pass from a sine or cosine formula to one involving meridional parts only by the simplest possible transformations.

The processes deduced by M. Guyou from the curves of altitude upon the Mercator's chart are probably somewhat shorter, and more likely, therefore, to be adopted for general use. His methods of procedure however, although, as has been well said of them by an Italian critic, "of high scientific interest for their originality and rigorous analysis," may be found somewhat subtle and difficult to follow by any but expert mathematicians. At all events, although, as has been said, the Guyou formulæ were received in Italy with much favour, mathematicians in that country lost no time in setting to work to establish them upon a basis purely trigonometrical.

An interesting article in the *Rivista Marittima* (Rome) for January 1897, by Signor P. L. Cattolica, "Capitano di corvetta," gives a summary of the work done in 1896 by Signor Molfino and other writers, whence it appears

that the principal Guyou formulæ may be deduced with little difficulty from the well-known Napier's analogies as follows.

Let us suppose, as before, that in a spherical triangle the three sides a, b, c being given, it is required to determine the angles A, B .

We have

$$\begin{aligned} \tan \frac{a+b}{2} &= \frac{\cos \frac{A-B}{2} \tan \frac{c}{2}}{\cos \frac{A+B}{2}} \\ &= \frac{\cos \frac{A}{2} \cos \frac{B}{2} + \sin \frac{A}{2} \sin \frac{B}{2}}{\cos \frac{A}{2} \cos \frac{B}{2} - \sin \frac{A}{2} \sin \frac{B}{2}} \tan \frac{c}{2} \\ &= \frac{1 + \tan \frac{A}{2} \tan \frac{B}{2}}{1 - \tan \frac{A}{2} \tan \frac{B}{2}} \tan \frac{c}{2}. \end{aligned}$$

Let

$$\tan \frac{A}{2} \tan \frac{B}{2} = \tan \frac{x}{2} \dots \dots \dots (1)$$

Then

$$\tan \frac{a+b}{2} = \frac{1 + \tan \frac{x}{2}}{1 - \tan \frac{x}{2}} \tan \frac{c}{2} = \tan \left(45^\circ + \frac{x}{2} \right) \tan \frac{c}{2}.$$

Whence

$$MP(x) = MP(90^\circ - c) - MP(90^\circ - a + b) \dots (2)$$

An equation which determines x .

While from equation (1) it may be deduced that

$$MP(90^\circ - A) + MP(90^\circ - B) = MP(90^\circ - x) \dots (3)$$

Proceeding in the same manner to expand

$$\sin \frac{A+B}{2}, \sin \frac{A-B}{2}$$

in the expression

$$\tan \frac{a-b}{2} = \frac{\sin \frac{A-B}{2}}{\sin \frac{A+B}{2}} \tan \frac{c}{2},$$

and assuming that

$$\tan \frac{B}{2} \cot \frac{A}{2} = \tan \frac{y}{2} \dots \dots \dots (4)$$

we arrive at the equations

$$MP(y) = MP(90^\circ - a - b) - MP(90^\circ - c) \dots (5)$$

$$MP(90^\circ - B) - MP(90^\circ - A) = MP(90^\circ - y) \dots (6)$$

By adding and subtracting each side of the two equations (3) and (6), we obtain equations which will enable us to determine the values of A and B respectively.

In place of the notation "MP," M. Guyou adopts the Greek letter λ (lambda). Thus, meridional parts for an angle $\theta = \lambda(\theta)$.

He also indicates the meridional parts of the complement of an angle by the symbol $\text{Co-}\lambda$, so that meridional parts for the angle $(90^\circ - \theta) = \text{Co-}\lambda(\theta)$.

And in his excellent collection of tables the values of λ and $\text{Co-}\lambda$ are given for each angle side by side, an arrangement which much facilitates the work of computation.

The ordinary employment of Napier's analogies in practical work is limited to finding the remaining two sides when two angles and the included side are given, or to finding the remaining angles when two sides and the included angle are known. It is a somewhat remarkable extension of their functions to find that they suffice

also to furnish satisfactory logarithmic formulæ for solving a triangle where the three sides are the given parts. In a similar manner formulæ may be found which will determine the sides when the three angles are given, so that formulæ of the type which gives $\tan \frac{A}{2}$ in terms

of functions of the sides, or $\tan \frac{a}{2}$ in terms of functions of the angles may be dispensed with altogether.

It would be premature at present to hazard a conjecture as to whether the new processes will come into general use in England. In these matters we move slowly. The British mariner does not easily surrender the methods upon which he has been brought up, the practice of which becomes almost automatic with him, and he looks with feelings of doubt, tempered with suspicion, upon any novelties that may be brought to his notice. But some advantages, at least, of a system of rules involving the use of only one table of logarithms must be obvious to all. In the first place, as has been already mentioned, we have that of the greater simplicity in the statement of rules, and the diminished risk of error through the taking out of a logarithm from a wrong column. But even more important than these is the saving of time lost at present in turning over the leaves of tables in hunting for sines and cosines in different parts of a somewhat bulky book. In the table of meridional parts we have but 5400 logarithms, occupying some nine pages of Inman's collection, not more than might be printed on a sheet of cardboard of moderate size, so as to save the turning over of leaves altogether.

These logarithms furnish results correct to the nearest minute of arc, which is the usual limit of accuracy aimed at by the practical navigator.

As the case stands at present, the new system is well thought of in France; it has excited considerable attention in Italy, and has won the approbation of at least one distinguished authority in Spain; so that, perhaps, M. Guyou is not over-sanguine in his expectation that "the table of meridional parts is destined to become sooner or later the universal instrument of computation amongst mariners."

H. B. G.

THE NEW PHYSICAL RESEARCH LABORATORY AT THE SORBONNE.

AN interesting account of the new physical laboratory at the Sorbonne recently appeared in *La Nature*.

This laboratory, originally situated in the old Sorbonne, was founded in 1868 by M. Jamin, who was its director until his death in 1886. In 1894 it was transferred to the new Faculty of Sciences, and was reconstructed by the architect M. Nénot. At the present time M. Lippmann, member of the Institute, is the director. Although this change took place in 1894, the work has only recently been carried on in the usual manner.

The new buildings are surrounded by other buildings connected with the Sorbonne, and are therefore away from any disturbances caused by passing vehicles. On the ground floor, after passing an entrance hall with a cloak-room, there is a large room (Fig. 1) two stories high, and measuring 16 metres (about 52 feet) long by 12 metres broad (about 39 feet). Six physicists can work here, provided their work does not require any special conditions with regard to light and isolation. In the middle of the room, and at the corners there are solid stone pillars isolated from the floor; a "comparateur" is attached to the one in the middle. Each of the six places has four jets of gas, two incandescent lamps, one arc lamp, and a water-tap. About two yards above each table there is a joist, thus making it possible

to suspend apparatus if necessary; the tables themselves are of slate.

Next to this large room is the sub-director's room and laboratory; then we come to a small chemical laboratory, and finally the machine-room. The latter is built over a vault, and contains two Lenoir gas machines of 16 horse-power each, three dynamos, and a large switch-board, which makes it possible to distribute the current for various uses in the laboratory, such as illumination, experiments and accumulators. Above this room, and accessible by a staircase from it, is the mechanical workshop, well equipped with apparatus and under the direction of two mechanics and an electrician. All the machines are worked by electricity. On the same floor there is an open terrace for the accumulators, which include a battery of the Tudor system used for illuminating purposes (60 elements), and another battery, of the Peyrusson system (80 elements), for experiments. Facing

laboratory of the sub-director, M. G. Maneuvrier, whose room adjoins it; the next floor has a dark room for optical researches. Lastly, on the third floor are three small rooms for private students. It may also be added that this tower connects the different parts of the laboratory with the physical amphitheatre, and with the collections of apparatus for the various courses. Under the large hall on the ground floor there are three cellars completely fitted up as laboratories, and a Gauss magnetometer mounted on solid stone pillars. On the ground floor there is a dark room isolated by three stone pillars, and used for electrical measurements and measurements of precision.

It will thus be seen that the laboratory is very complete in itself; but the money allowed for its maintenance (12,000 francs) is quite insufficient, when the general expenses, experiments, and course of lectures are taken into consideration. Nevertheless, the work of the students

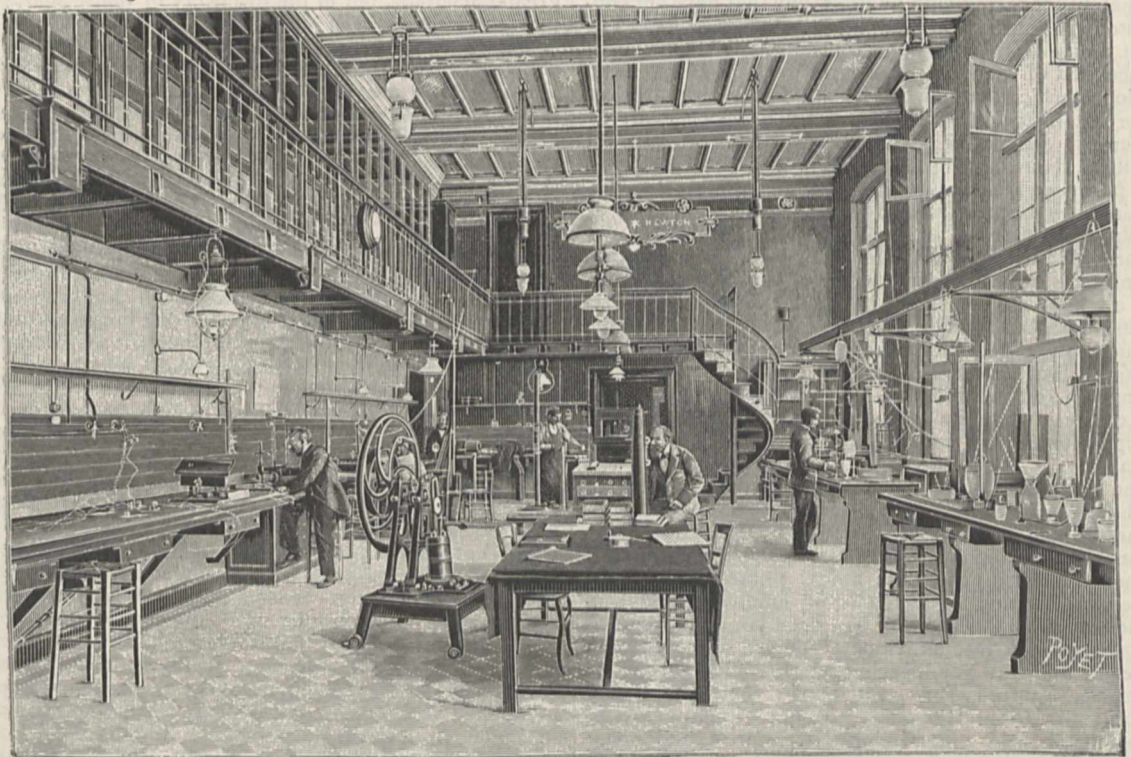


FIG. 1.—New Physical Research Laboratory at the Sorbonne.

the workshop is a large hall, used as a laboratory by the assistants. This is connected with the workshop by a gallery, which is at present given up to experiments on electric waves. Next to this laboratory there is a terrace and a photographic room, and in the large entrance hall on the first floor are M. Lippmann's private room and laboratory. The latter is divided into three parts, a light and a dark room, and another room for optical researches, with optical benches of slate. The ore-dresser occupies the last room on this floor.

A tower 40 metres (nearly 131 feet) high contains the general staircase, and also leads to the extensions of the upper stories. This tower extends 18 metres (59 feet) in the ground, by which means a long vertical range is procured, and experiments in height can be made. The extensions of the upper floors referred to consist of a large hall, two stories high, comprising the library and

who have been through the laboratory is a proof of the thoroughness of the instruction. MM. Bouty, Pellat, Foussereau and Leduc (professors of physics at the Sorbonne) all studied at this laboratory, and qualified for their doctor's degrees in it. Several well-known Roumanians and Russians studied there also, and M. Benoît, director of the Bureau of Weights and Measures of Sèvres, wrote his thesis under Jamin. The laboratory has, indeed, become celebrated by M. Lippmann's own work, for it has all been done there, from the investigations on the electro-capillary phenomena to the wonderful discovery of colour photography. It is, therefore, to be hoped that the additional funds required will be forthcoming, and that the enlarged Institute may be even more successful than the old one.

We are indebted to the editor of *La Nature* for the accompanying illustration of the laboratory

PHOTOGRAPHY AT THE CRYSTAL PALACE.

PHOTOGRAPHY as a practical art of interest to others than a few investigators dates from 1839, when the Daguerreotype was introduced. Its development and applications were well illustrated at the Great Exhibition of 1851, but since that time there have been very few attempts, and none altogether successful, to show its further progress. The Royal Photographic Society has held more than forty annual exhibitions, but as each of these has dealt with its current year only, the Council of the Society considered it desirable to arrange an exhibition that should demonstrate, not only the last year's advances, but the present position of photography and its applications as well as the history of its development.

The exhibition that was opened last week by the Prince of Wales is the result of the Society's endeavours. It must be regarded as eminently satisfactory, for it is not possible to call to mind many individuals or firms intimately connected with photography that have not contributed characteristic and interesting exhibits. The large areas of the north and south naves of the Crystal Palace, and of many of the courts, are well filled. The catalogue, which is published by the Society, will form an important historical work of reference, because of the numerous descriptive notes, references to original literature, dates, and examples of work that it contains. It is particularly fortunate that such an exhibition as this should have been inaugurated now rather than ten or twenty years later, as those of the older generation who are best able to speak of some of the older processes that are obsolete, and the introduction of the methods of today, are fast disappearing from our midst. There are, for example, but few left who are skilled enough in the Daguerreotype process to work it with a fair average of certainty, but Messrs. Negretti and Zambra have arranged a studio for taking Daguerreotypes of any who may desire it while the exhibition remains open. This is an opportunity that in all probability will never occur again.

The exhibition is divided into seven sections, namely: (1) the historical collection, (2) pictorial photography, (3) apparatus and material, (4) scientific and industrial applications, (5) photography in colours, (6) photography as a science, and (7) general technical photography. The Society's collection of portraits of eminent workers in connection with photography has been largely reinforced by loans from private individuals, and the series includes the elder and the younger Niepce, Fox Talbot, five of Daguerre, Andrew Ross, Sir David Brewster, Baron Pollock, Sir John Herschell, Mungo Ponton, W. B. Woodbury, F. von Voigtlander, Dr. Draper, and many others; and in the catalogue there is a short biographical notice of each. Among the works of the elder Niepce there are exhibited the first camera photograph, taken in 1824, and some of the specimens that he submitted to the Royal Society in 1827. The Daguerreotype process is well represented. Daguerre's history and description of the process, dated 1839, and a translation of it into English published in the same year, are on view. The collection of Daguerreotypes and apparatus for producing them dates from 1842. Fox Talbot's calotype process, which was also made public in 1839, is even better represented; but space forbids further reference to these, and the various collodion and gelatine processes. The first methods and the developments of carbon printing are fully illustrated, including the gum-bichromate process, which, after being nearly forgotten, has lately been reintroduced and extolled.

After the examples of early work in the production of photo-etched plates and photo-typographic blocks, there follows the optical section. This is certainly the most complete collection of lenses ever got together. Examples

of nearly ninety different kinds are shown, ranging from the early form of single lens by Chevalier and the first lens made in England for portraiture (in 1841, by Andrew Ross) to the stigmatics of Dallmeyer and Zeiss' planars. Sectional drawings of nearly fifty different kinds of lenses are given in the catalogue, and also a print from a photograph taken for the purpose with Sutton's panoramic water lens and his camera carrying curved plates.

Passing a very fine loan collection of photographs, which includes many examples by deceased workers, particularly Mrs. Cameron, D. O. Hill, O. G. Rejlander, B. B. Turner, and Colonel Stuart Wortley, and also the whole section of present-day apparatus and materials for photographic and photo-mechanical processes, there follows the section of the scientific and industrial applications of photography. The importance of photographic methods of observation was never more fully realised than it is at present. From almost the earliest days of photography the "recording science" has been applied in scientific investigations with the result not only of greater accuracy, but of the discovery of many facts that could never have been known by the use of the eye alone. Astronomy was one of the first of the sciences to derive benefit from photography; and in the delineation of the forms and features of celestial bodies, as well as in the spectroscopic analysis of their constitution, photographic processes have now almost entirely replaced the old method of drawing by hand what it was thought the eye could see. In many other domains of science photography is daily becoming more important, and it must continue to do so, especially as the scientific investigation of photography itself progresses. This important and universal method of work does not yet receive the attention and encouragement that it deserves in our teaching colleges; but this is due doubtless to the fact that, although it has done so much, it is still in its infancy so far as years are concerned. At the next exhibition of this kind there will without doubt be a far richer harvest of results to show, though this section, as it is here represented, well indicates not merely the directions in which future work is possible, but the very fine results that have already been accomplished, some of which it is difficult to believe can ever be surpassed. The Royal Observatory, Greenwich, contributes many exhibits, including some 12 x 10 prints of photographs of the recent solar eclipse, taken with the Thompson coronagraph. Numerous other astronomical photographs are shown by the Royal Astronomical Society, Colonel Waterhouse, Dr. Common and Dr. Gill. Messrs. R. and J. Beck show twelve of De La Rue's original negatives of the moon. Photography as applied to spectroscopy, geology (including forty-one specimens from the B.A. Geological Photographs Committee), meteorology, zoology, botany, and Röntgen-ray work is well illustrated. In connection with the last, six large stereoscopic "skiagrams," by Dr. Mackenzie Davidson, mounted in reflecting stereoscopes, are strikingly good. The Kew Observatory Committee of the Royal Society sends photographs of various photographic recording apparatus, lens-testing apparatus, and other examples.

The section illustrating military photographs is of especial interest just now. The examples date from the Crimean war, and include balloon apparatus and photographs, the pigeon-post film used in the siege of Paris in 1871, and various examples from the School of Military Engineering at Chatham. But probably what will strike photographers as the most wonderful exhibits in this section is the telephotographic work contributed by the Italian Minister of War. The magnifications are far greater than we have been accustomed to, ranging up to one hundred diameters. Photo-micrography forms a large section, and includes a "complete photo-micrographic apparatus" by Zeiss, an apparatus that would

probably be regarded as an extreme luxury by most microscopists.

Photography in colours, by all the current methods, is well illustrated, many examples being of historic interest. G. Lippmann, A. Lumière, L. Vidal and H. W. Vogel and several English exhibitors contribute to this section.

"Photography as a science" refers apparently to what might be called *pure* photography to distinguish it from *applied*. But the distinction is neither clear nor precise. This section includes apparatus for measuring the densities of photographs, including opacities and blacknesses, by Captain Abney, Hurter and Driffield, and Chapman Jones; besides sensitometers, actinometers, and similar apparatus. Many results of the various treatments of photographic plates are shown, such as the sensitising for various colours, and the getting of an image free from stain, &c., that it may be of definite opacity. E. Sanger Shepherd shows an ingenious form of slit for spectroscopes, that is stated to be specially suitable for photographic use.

The National Photographic Record Association, that has recently become established through the energy of Sir Benjamin Stone, is well represented. Sir Benjamin himself contributes twenty-one photographs relating to the Houses of Parliament, every one of which is of general interest. There are numerous other examples of technical work to which we cannot refer in even the most general terms, except to a case exhibited by the Bolt Court Technical School of the London County Council Technical Educational Board, which illustrates the working of some of the most important photo-mechanical processes arranged for educational purposes.

While there are some exhibits that claim attention because of their novelty, these are the exception; the chief interest centres round the old rather than the new, and the complete presentation of the capabilities of photography in its numerous applications at the present day. But those whose knowledge of photography is of the general kind, and those who have not followed up its developments during the last few years, will find more that is new, of both examples and processes, than they will be able to appreciate in a single visit. Such an exhibition has never before been organised, and it must obviously be impossible to arrange another of similar extent until after the lapse of several years. The exhibition will close on May 14.

MICRO-BIOLOGY AS APPLIED TO HYGIENE.

AT the Congress of Hygiene and Demography recently held at Madrid, many matters of scientific interest and importance were introduced and discussed. Unfortunately the papers were not printed and distributed among the members, and as the majority were read in Spanish, the discussions were curtailed. The Section of Micro-biology as applied to Hygiene attracted the largest share of attention. Among the more important contributions was that of Dr. Behring, who announced that, as the result of experimental work with the toxin and antitoxin of tuberculosis, he had isolated a substance from the tubercle bacillus a hundred times more powerful than Koch's tuberculin, and had obtained, by passing the virus through the horse, an antitoxin which he believed to be an efficient cure for the disease. Experiments on a large scale are to be carried out at the Berlin Veterinary University. Dr. A. Calmette, of the Pasteur Institute of Lille, demonstrated in a highly successful manner the prophylactic effect on snake-bitten patients of serum of the blood of horses subjected to small doses of the venom. For this purpose a rabbit was injected with a large dose of a mixture of venom of the cobra, naja, and bothrops; this proved fatal in twenty minutes. Two rabbits were then injected with the pro-

tective serum, and in ten minutes each received a dose of the mixture equal in amount to that which killed the first rabbit. These rabbits appeared to suffer no ill-effects. Further experiments gave unquestionable evidence as to the prophylactic property of the serum, which is easily prepared and retains its protective power for an indefinite period. Great interest was evinced in the paper read by M. Nocard, of the Alfort Veterinary School, and delegate of the French Academy of Medicine, describing a method of cultivating the microbe of pleuro-pneumonia of cattle, the demonstration of which had baffled the efforts of bacteriologists for nearly half a century. This destructive disease of cattle is communicable only by cohabitation, and heretofore has not been communicated to animals of other than the bovine species. As long ago as 1850, Willems had established the fact that the virus existed in the liquid exuding from affected lungs, and laid down rules for a protective inoculation which has been regarded to a great extent efficacious. His method was to introduce into the subcutaneous connective tissue of the animal to be protected a drop of the serosity from an affected lung. The necessity for having an absolutely fresh lung from which to obtain the inoculating material renders Willem's method very inconvenient and often impracticable. It is hoped that the discovery of the specific microbe and the power of cultivating it for indefinite periods, independent of animals suffering from the disease, will afford the means of providing an effectual, protective vaccine at all times available when necessity for preventive inoculation may occur. Heretofore, failure to cultivate the virus has followed sowing in all ordinary media in air or *in vacuo*, and no method of staining has been successful in demonstrating the virus. Nocard and Roux have, however, applied with success the plan adopted by Metchnikoff on the toxin and antitoxin of cholera. Very thin-walled capsules of collodion, rendered sterile by heat, are filled with sterile bouillon, sown with a very small quantity of virulent matter from a fresh pleuropneumonia lung and hermetically sealed. The capsules are then inserted into the peritoneal cavity of a rabbit. The collodion wall proves an absolute barrier to the egress of the microbe and to the ingress of the cells of the animal, which ordinarily have a destructive effect on each other. The wall, however, is permeable to liquids and dissolved matters. Products of the microbe pass out, and sometimes prove fatal to the animal; while it is usually found that products of the animal body, favouring the growth of the microbe, pass inside the capsule, so that after a longer or shorter period, according to the nature of the microbe and the animal, a rich culture is found inside the capsule. The microbe of pleuropneumonia thus cultivated is exceedingly minute. When examined under a very high power (2000 diameters magnification) the culture shows innumerable refractile, motile specks, so fine that, even after staining, their form cannot be exactly determined. Experiments with cows indicate that subcutaneous inoculation of small quantities of these cultures afford protection from the disease. Another interesting fact in connection with these experiments, is the discovery that if collodion capsules filled with sterile bouillon be inserted into the peritoneal cavity of the rabbit or the cow, and remain there for fifteen to twenty days, they are found to contain a medium suitable for cultivation of the microbe *in vitro*. Beyond the definite results in relation to the special disease under consideration, facts elicited concerning the method of providing favourable culture media would appear to have a broad significance.

Among the most novel suggestions for the application of bacteriological science were those of Dr. E. Vallin, of the French Academy of Medicine, who drew attention to the existence of saltpetre on the walls of dwelling-houses, and its ill-effects on the health of the dwellers therein. Dr. Vallin states that the salt is produced by nitrifying

bacilli, and indicates that the prevention and cure are to be effected by removal of conditions favourable to their life and development. Mortar should be mixed with germicides, as coal-tar, sulphate of copper, &c., and where disease of the walls exist, the cure should be effected by inoculation of the walls with anti-nitrifying bacilli.

NOTES.

THE Council of the Institution of Civil Engineers have made the following awards for papers read and discussed before the Institution during the past session:—Watt medals and premiums to Prof. H. L. Callendar, F.R.S., and Mr. J. T. Nicolson; a Telford medal and premium to Mr. A. H. Preece; George Stephenson medals and premiums to Messrs. Whately Eliot and W. O. E. Meade-King; a Crampton prize to Mr. E. W. Anderson; Telford premiums to Messrs. L. B. Atkinson, Henry Fowler, and W. L. Strange. The presentation of these awards, together with those for papers which have not been subject to discussion and will be announced later, will take place at the inaugural meeting of the next session.

THE Reception Committee of the Fourth International Congress of Zoology have issued a circular containing particulars with regard to lodgings and other accommodation at Cambridge during the meeting in August next, and giving information as to the railway fares from various parts of the Continent, and other arrangements for the Congress. The circular is accompanied by a reply-form, to be filled up and returned to the Secretaries by any member of the Congress who wishes rooms to be taken for him. These circulars have been sent to all who have already informed the Reception Committee that they hope to be present at the meeting, and will be sent to other zoologists on application to the Secretaries of the Reception Committee, The Museums, Cambridge.

THE Select Committee appointed to inquire into and report upon the administration and cost of the Museums of the Science and Art Department have agreed to the following preliminary report:—Since the issue of the report of the Museums of the Science and Art Department Committee in July 1897, your Committee have continued the inquiry, but reserve for a further report the publication of additional evidence with their final review and recommendations. They feel, however, bound to report without delay certain conclusions at which they have arrived, on consideration of the evidence, as regards the South Kensington Museum and the Geological Museum in Jermyn Street. They are unanimously of opinion that with a view to present efficient management, to economy of administration, to future development of the collections, and to their full use for the purpose of exhibition and of instruction, it is necessary—

(1) That the whole area on the east side of Exhibition Road (except that occupied by the Royal College of Science, which cannot be sacrificed except at great cost) be exclusively devoted to the Art Museum and the Art Library, with provision for the conduct of the business connected with Loans of Art Objects, and the Art Schools. They are satisfied that the whole of this space is required for the Art Schools, the due exhibition of the Art Collections, and the administration connected with such a museum.

(2) That provision for the whole of the Science Collection, the Science Library, for Loans of Scientific Objects, and for the Science Schools be made on the west side of the Exhibition Road. They are convinced that this concentration of Art on one side of the road and of Science on the other is essential to good administration, to satisfactory results from the money expended, and efficiency both in the museum and in the schools. This arrangement would allow space for the future development both of the Art and of the Science branches.

They also unanimously recommend that the Geological Museum in Jermyn Street be no longer occupied for the same purposes as now; and that the collections there exhibited be removed to the west side of Exhibition Road, and made part of the Science collections.

THE address of the British Institute of Preventive Medicine is now Grosvenor Road, London, S.W., instead of Great Russell Street, London, W.C.

THE death is announced of M. Demontzey, Correspondant of the Section of Rural Economy of the Paris Academy of Sciences.

WE regret to notice the announcement of the death of Dr. Samuel Gordon, president of the Royal Academy of Medicine in Ireland, and successor to the late Dr. Haughton as president of the Royal Zoological Society, Dublin.

AT the Royal Institution on Thursday, May 12, Lord Rayleigh will deliver the first of a course of three lectures on "Heat," and on Saturday, May 21, Mr. J. Arthur Thomson will begin a course of two lectures on "The Biology of Spring." The Friday evening discourse to-morrow is by Mr. E. A. Minchin, whose subject is "Living Crystals."

THE death is announced of Dr. Karl Ludwig Fridolin von Sandberger, who until recently was Professor of Mineralogy and Geology in the University of Würzburg, and Director of the Mineralogisches Institut. Although known for his many important contributions to mineralogical science, to the study of ore deposits and to the microscopic structure of eruptive rocks, he was likewise distinguished for his researches on the fossil Mollusca of various formations in the Rhenish provinces and other parts of Germany. His published works date back to 1847. During the years 1850-56 he issued, in conjunction with his brother Dr. Guido Sandberger, "Die Versteinerungen des rheinischen Schichten-systems in Nassau"—a work remarkable for the beauty of its illustrations and the fidelity of its descriptions, and one which was honoured by the award of the Wollaston Fund, which was given to the authors by the Council of the Geological Society in 1855. In 1863 Dr. Fridolin Sandberger published "Die Conchylien des Mainzer Tertiärbeckens"; in 1870-75 he issued, in two volumes, "Die Land-und Süßwasser-Conchylien der Vorwelt"; and in 1882-5, "Untersuchungen über Erzgänge," an authoritative work on the subject of mineral veins. In the course of his long labours he turned his attention to the Mollusca of many different formations, from those of Devonian age to those of Pliocene and Pleistocene deposits. In later years his work became more concentrated on mineralogical science. In 1875 he was elected a Foreign Member of the Geological Society of London. He was born in 1826, and died at Würzburg on April 11.

MR. W. J. LEWIS ABBOTT sends us the following particulars concerning the career of Mr. Henry Lewis, who died on April 10, at the age of sixty-four:—Though apprenticed to a boot-maker, throughout his early life Lewis spent much of his time in the pursuit of natural history subjects, and thirty years ago was led to the subject of flint implements, and forthwith became one of the most ardent collectors. For many years weekly visits were made to pits in the Thames Valley, in each of which he set workmen hunting. He also successfully worked the Botany Bay section, securing much more material than Skertchley, consisting of worked flakes as well as finished implements. His next work was upon the plateau, where he secured valuable spoil. For the last ten years he visited the glacial and pre-glacial deposits in search of worked flints and implements, glacially striated and otherwise, and accumulated a mass of material at present undescribed. His late Celtic discoveries at

Aylesford were of singular interest and importance, and were described by Mr. Arthur Evans before the Society of Antiquaries. A large amount of material obtained by him still waits description. But, after all, it is this collection of material which is so indispensable and important; and hence great credit is due to Henry Lewis for the part he played in unravelling the secrets of prehistoric anthropology.

THE sixty-ninth anniversary meeting of the Zoological Society of London was held on Friday last, the chair being taken by Sir William H. Flower, K.C.B., F.R.S., President of the Society. Mr. P. L. Sclater, F.R.S., read the report of the Council, from which it appeared that the occurrence of the Queen's Diamond Jubilee in 1897, together with the very favourable weather experienced during the summer and autumn of that year, resulted in a large number of visitors to the Society's gardens, and the total income of the Society consequently reached the large amount of 28,713*l.*, being 1631*l.* more than in 1896, and greater than that of any year since the year 1884. The principal new building opened in the Society's gardens in 1897 was the new ostrich and crane-house, which was commenced in the autumn of 1896. During the past summer, also, a new glass-house for the reception of the Society's collection of tortoises was built, adjoining the reptile-house. The Council referred to the loss sustained by the death of Mr. A. D. Bartlett, for thirty-eight years superintendent of the Society's gardens, and recorded their deep sense of the services rendered by him during the long period he held his post. The vacancy thus caused has been filled up by the appointment, as superintendent, of Mr. Bartlett's second son, Mr. Clarence Bartlett. The number of visitors to the gardens in 1897 was 717,755, being 52,751 more than the corresponding number in 1896. The number of animals in the collection on December 31 last was 2585, of which 792 were mammals, 1362 birds, 431 reptiles and batrachians.

WE learn from the thirty-first annual report of the Peabody Museum of American Archæology and Ethnology, that Miss Maria Whitney has made a gift of great scientific interest from the estate of her brother, the late Prof. J. D. Whitney. This consists of the world-famous "Calaveras skull" and all the original documents relating to its discovery and history; with the gravel, small human bones, and other objects found in the cemented débris in which the skull was enclosed at the time of its discovery, as shown by the photograph taken before the cemented material was removed. With these are also a rude stone mortar, stone pestle and steatite dish, found under similar geological conditions in California. The full history of the discovery of the skull by Mr. Mattison, in 1866, under four beds of lava in a shaft he had sunk to the depth of 127 feet, is given in Prof. Whitney's volume on the "Auriferous Gravels of California," published in 1879 as vol. vi. of the *Memoirs* of the Museum of Comparative Zoology. When taken in connection with other discoveries under similar geological conditions in California, there seems to be no reason to doubt that these human remains were found in the gravel under the lava, as stated by Mr. Mattison. The principal question still in doubt is the exact age of the lava beds and gravels. The skull itself, so far as can be judged by a comparative study of the portion preserved, is of the type which there are reasons for regarding as the oldest on the Pacific coast. The objects, fashioned by the hand of man, found in the gravel, have been considered by some authors to be of a character too advanced in the development of the arts of man on the American continent to have come from so old a deposit. It is pointed out, however, that one cannot apply to American archæology the old classification of the culture epochs which, during the growth of science, has been used to distinguish

several periods of prehistoric culture in Europe. In addition to Miss Whitney's valuable gift, the Museum received during the past year a number of other objects of scientific importance, including gifts from friends and collections made by expeditions to Yucatan and Honduras. A description of some of the results of archæological explorations in Central America and Yucatan recently appeared in these columns (p. 568).

THE Deutsche Seewarte has rendered a valuable contribution to meteorology by the publication of means for the ten years 1886-1895, based upon the observations made three times daily at nine stations connected with that institution. Dr. Neumayer has always carefully adhered to the regulations made by the various meteorological conferences, and the present work, which continues the means previously published for the years 1876-1885, contains monthly, seasonal, and annual values and extremes made with trustworthy instruments and trained observers.

SINCE 1882, the Royal Meteorological Institute of Utrecht has published a yearly volume relating to the thunderstorms and optical phenomena observed in the Netherlands. The number of stations at which thunderstorms are observed is 254; the days on which storms were recorded amounted to 119 during the year 1897. With the exception of the months of January and February, during which no thunderstorms were observed, they were regularly distributed throughout the year. The report contains a discussion of the storms in each month, and is accompanied by various charts.

A VERY useful feature which is being introduced into Russian schools is the sending out of the pupils in summer for small natural science and ethnographic excursions, during which they explore some region and make all sorts of collections and observations. The Caucasus School administration is especially active in that direction. One such excursion will be made to the foot of the Elbrus this summer by fifty pupils of the Ekaterinodar Gymnasium. The party intends to visit the Great Karachai region, to ascend the Elbrus up to the snow-line, and to cross the Main Ridge. The excursion will last fifty days, during which the pupils will collect natural history specimens and ethnographical data, take photographs, sketch landscapes, and live amidst the beautiful pine forests of the Main Caucasus ridge. Some of the boys will take musical instruments with them to enliven the party.

A JOINT expedition of the West Siberian branch of the Geographical Society and the Moscow Society of Amateurs of Natural Sciences will this summer explore the hydrography and the fauna of the lakes in the South of Omsk. The collections will be divided between the two Societies.

PROF. J. TROWBRIDGE, Rumford professor of the application of science to the useful arts, Harvard University, describes in the *Century Magazine* some experiments he made with a view to determining the nature of Röntgen rays. He concludes as follows:—"I believe that the experiments which I have described support the theory that there are really two classes of phenomena—one an electrical disturbance in a medium, another the conversion of this electrical disturbance into fluorescent and phosphorescent light at the surfaces of suitable screens or in the body of suitable crystals. My experiments certainly show that there are anode rays as well as cathode rays, and that both are subject to the well-known laws of electrical induction. One should not expect, therefore, that the electrical rays or lines of force should be reflected and refracted like waves of light."

SOME interesting properties of Röntgen rays were recently described by Prof. Röntgen in a communication to the Berlin Academy of Sciences, and are summarised in the *Electrical*

World. If a fluorescent screen is protected from the direct action of rays emitted by a tube, by means of an opaque plate, a slight fluorescence is nevertheless seen when the tube is in action. Röntgen has now shown that this is due to the fact that the air around the tube gives forth X-rays. The brightness of a screen illuminated with rapidly intermittent rays depends on a number of properties which he enumerates. The X-rays from a platinum focus plate which are most active for showing images are those which leave the plate at the greatest angle, but not much greater than 80° ; thick plates have a relatively larger transparency than thin ones, that is, the specific transparency of a body is greater the thicker the body; the same body has different transparencies with different tubes, "soft tubes" being those requiring a small potential, and "hard tubes" those requiring a high one. The quality of the rays from the same tube depends on: the way in which the interrupter works, the insertion of a Tesla transformer, the vacuum, other processes in the tube which are not yet fully investigated. The smallest pressure at which X-rays are produced is very likely below 0.0002 mm. of mercury. The composition of the rays from a platinum anode depends largely on the element in the current; the quality of the rays does not change with changes of the primary current, or at least very little, but the intensity is proportional to the strength of the primary current between certain limits. The following conclusions are stated: the radiation consists of a mixture of rays of different intensity and absorptibility; the composition depends greatly on the time element in the current; the rays produced by the absorption of bodies are different for different bodies; as X-rays are produced by cathode rays, and as both have common properties, it is probable that both processes are of the same nature. If two screens are illuminated with two tubes of different hardness, the illumination being made equal, and if then replaced by photographic plates, the one illuminated by the harder tube will be blackened much less than the other; rays which produce equal fluorescence can be photographically quite different; the usual photographic plates are very transparent for X-rays (in a pile of ninety-six filaments exposed for five minutes the last one showed photographic action); the eye is not entirely passive to X-rays.

PROF. LOUIS BOUTAN, lecturer on zoology at the Sorbonne, contributes to the *Century Magazine* (May) an account of his experiments in submarine photography. To procure photographs under water, Prof. Boutan uses a camera enclosed in a water-tight case, a blue glass being arranged in front of the lens to suit the conditions of submarine illumination, and so give a picture having pleasing contrasts. He descends under water in a diver's costume, and the camera is sent down to him from an anchored boat. The spot to be photographed is then selected, and the exposure is made in precisely the same way as on land. When no artificial light is used, submarine photographs require a rather long exposure, the time often extending to twenty-five minutes, and depending upon the depth of the water. Four reproductions of photographs obtained at depths from six and a half feet to sixteen and a half feet, accompany Prof. Boutan's article, and they are sufficient to show that submarine photography can produce useful results. It is estimated that not more than one hundred square metres of area can be photographed under water, but even with this limitation the pictures obtained will contain more valuable information than divers can furnish. The problem to be solved is to construct an apparatus which will take photographs in artificial light in any depth of water without needing a submarine photographer to manipulate it.

THE immunity of bee-keepers from the effects of bee-poison, forms the subject of a paper, by Dr. Langer, read before the sixty-ninth Congress of German Naturalists and Physicians in

Brunswick. The author sent circulars to all parts of the country addressed to bee-keepers, and from the answers he received he has compiled some interesting statistics. One hundred and forty-four bee-keepers stated that they were immune to the sting of bees, nine mentioning that they were naturally immune to the poison, whilst twenty-six replied that they could not acquire immunity. The number of bee-stings necessary to produce the much-desired immunity appears to vary considerably, sometimes thirty being sufficient, but in other cases as many as 100 being necessary to accustom the system to the poison. The remedies applied range over a large variety of substances, and include tobacco juice, French brandy, rum, water, spirits of ammonia, seltzer water, acetate of alumina, loam, saliva, cognac, besides massage and heat. The most favourite means of dealing with bee-stings appears to be spirits of ammonia. Dr. Langer states that a 5 per cent. solution of permanganate of potash will counteract the poison, and he recommends an injection of a 2-5 per cent. solution of this substance. Bee-poison is extraordinarily resistant to both desiccation and heat, whilst it is quite unaffected by additions of alcohol. It used to be commonly supposed that the irritating nature of bee-poison was due to the presence of formic acid; but inasmuch as it can withstand heat and retain its poisonous activity, which would effectually volatilise the formic acid were it present, this idea must be abandoned. The opinion now appears to be that the toxic substance present partakes of the nature of an alkaloid.

A COPY of the Act of Incorporation, bye-laws, and list of officers of the recently-established Washington Academy of Sciences has been sent to us. The particular business and objects of the Academy are stated to be the promotion of science, with power to acquire, hold, and convey real estate and other property, and to establish general and special funds; to hold meetings; to publish and distribute documents; to conduct lectures; to conduct, endow, or assist investigation in any department of science; to acquire and maintain a library; and, in general, to transact any business pertinent to an Academy of Sciences. The Academy will act as a federal head of the affiliated scientific societies of Washington, with power to conduct joint meetings, publish a joint directory and joint notices of meetings, and take action in any matter of common interest to the affiliated societies. The term "affiliated societies" at present covers the Anthropological, Biological, Chemical, Entomological, National Geographic, Geological, Medical, and Philosophical Societies, each society nominating a vice-president. The President of the Academy is Mr. J. R. Eastman, and the Secretary Prof. G. K. Gilbert.

CURATORS of museums know that the papers read at the annual meetings of the Museums Association, and the discussions which take place upon them, are serviceable in indicating the best systems of classification and arrangement of specimens, and in evoking expert opinions upon museum technique. The Report of the proceedings of the Oxford meeting of the Association, edited by Mr. James Paton, has just been published by Messrs. Dulau and Co., and from it much valuable information can be gained by the officers of local museums. Among the contents is an address by the president, Prof. E. Ray Lankester, F.R.S., and papers on the methods of setting and labelling Lepidoptera for Museums, by Prof. E. B. Poulton, F.R.S.; the arrangement of the mineral collection in the University Museum, Oxford, by Prof. H. A. Miers, F.R.S.; the arrangement of ethnographical collections, by Mr. F. W. Rudler; popular museum exhibits, the relation of museums to elementary education, and a description of the Colombo Museum. Opinions and conclusions based upon successful experience are always valuable, therefore this report of the Museums Association will

be of service not only to the organised provincial museum officer, but will also educate the curators and managers of local institutions of the "curiosity shop" type to a sense of their responsibilities and opportunities.

IN March 1848, Louis Agassiz began his instruction at Harvard College, and with it a new era in zoological science commenced in America. To commemorate the jubilee of his appearance as a teacher in America, the March number of the *American Naturalist*, which has only just reached us, contains a sketch of the life of Agassiz and reviews of some aspects of his work. It is peculiarly appropriate that the *American Naturalist* should take advantage of the opportunity which this fiftieth anniversary presents to pay a tribute to Agassiz's work, seeing that the periodical was founded by four pupils of that distinguished investigator—Alpheus Hyatt, Edward Sylvester Morse, Alpheus Spring Packard, and Frederick Ward Putnam. The anniversary thus commemorated is also the anniversary of a change in the character of zoological science in America, and of a change in the academic position of zoology in the educational institutions in the New World. To these changes must be ascribed the advances which American students have made in morphological science, and have gained for their country a foremost position among the nations of the earth.

FRIENDLY intercourse between men working in various fields of natural knowledge tends to broaden views and sympathies. With this aphorism in mind, and also the fact that the number of persons in the University of Durham interested in the progress of science is increasing, some members of the University met towards the end of 1896 and formed themselves into a Philosophical Society having for its principal objects the promotion of research and the communication of facts and ideas bearing upon scientific questions. The first number of the *Proceedings* of this Society has just been issued, and it is a creditable production which may, we trust, be taken as an earnest of greater things to come. Among the subjects of papers printed in the *Proceedings* are: education and instruction in England and abroad; the effect of alternating currents upon the frog's heart; native methods of fire-making; and the Great Ice-Age.

THE popular science lectures delivered on Tuesday evenings at the Royal Victoria Hall, Waterloo Bridge Road, provide a valuable means for instructing a large section of the general public in the methods and results of scientific work. The lecturers give their services, and only a few pence is charged for admission, the object being not to make the lectures commercially profitable, but to encourage interest in the pursuit of natural knowledge. After the lecture a short variety entertainment is provided, and it says much for the character of the audience that more people leave at the end of the lecture than are admitted to the entertainment. During May several distinguished men of science will lecture at the Hall. On Tuesday, Prof. Tilden delivered a discourse in which he described "What a Chemist can get out of a Brick"; on May 10, Prof. McLeod will lecture on "A Simple Experiment, and its Explanation"; Prof. Sollas will take as his subject "Funafuti, or three months on a Coral Island," on May 17; and Prof. Marshall Ward will say "Something about Wood," on May 24. The Hon. Secretary of the Hall should feel gratified at being able to offer such an attractive programme as this.

THE many subjects covered by the articles which have appeared in *Science Progress* since its commencement, and the satisfactory way in which they have usually been treated, make the volumes which have been published almost an encyclopedia of science. There are few scientific subjects of prime importance in which advances have been made in recent years but

what have been dealt with by our solid contemporary, and surveyed in sufficient detail to make the volumes very serviceable to students of science. The April number of this "quarterly review of current scientific information" contains an article on Julius Sachs by Prof. K. Goebel, and one on the germination of seeds by Mr. F. Escombe. Prof. H. Crompton describes association and dissociation; Dr. T. Gregor Brodie, the phosphorus-containing substances of the cell; Dr. F. A. Dixey, recent experiments in the production of insect hybrids; Mr. A. Harker, the forms and habits of igneous rocks; Dr. J. S. Haldane, F.R.S., the secretion and absorption of gas in the swimming-bladder and lungs; and Prof. J. Reynolds Green, F.R.S., oxidases or oxidising enzymes.

THE additions to the Zoological Society's Gardens during the past week include a Mona Monkey (*Cercopithecus mona*, ♂) from West Africa, presented by Mrs. Christiana G. R. Potter; a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Mrs. Burrell; a Ring-tailed Coati (*Nasua rufa*) from South America, a Mantled Buzzard (*Leucopternis palliata*) from Brazil, presented by Mr. Basil T. Freeland; a Daubenton's Curassow (*Crax daubentoni*) from Venezuela, presented by Mr. Emil A. Goeldi; two Silver-bills (*Munia malabarica*) from India, presented by Lady Charlotte Amherst; two Moorish Toads (*Bufo mauritanica*) from North-west Africa, presented by Mr. D. P. Turner; a Humboldt's Lagothrix (*Lagothrix humboldti*, ♀) from the Upper Amazons, two Beautiful Grass Finches (*Poephila mirabilis*) from Australia, two Yellow-legged Herring Gulls (*Larus cachinnans*) from Egypt, twelve Midwife Toads (*Alytes obstetricans*), European, purchased; a Californian Sea Lion (*Otaria californiana*) from California, received in exchange; four Barbary Wild Sheep (*Ovis tragelaphus*), a Grey Ichneumon (*Herpestes griseus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET PERRINE (MARCH 19).—The ephemeris of this comet for the ensuing week is as follows:—

1898.	12h. Berlin Mean Time.			} Decl.	Br.	
	h.	m.	s.			
May 5	0	58	43	+ 52	18'3	... 0°46
6	1	4	9	52	38	
7	...	9	35	52	56'9	
8	...	15	0	53	14'7	... 0°42
9	...	20	24	53	31'5	
10	...	25	46	53	47'4	
11	...	31	6	52	2'4	
12	1	36	25	+ 54	16'3	... 0°38

TEMPEL'S COMET (1867 II.).—M. Gautier publishes (*Astr. Nach.*, No. 3490, Beilage) an ephemeris of this periodic comet, which was discovered by Tempel at Marseilles in 1867. The comet has a period of about 6'5 years, and it was observed at its returns in 1873 and 1879, but since that time has not been seen, although two returns have been due. M. Gautier, who has interested himself in this comet, calculated that the last return ought to have occurred in 1892, owing to the perturbing action of Jupiter on its orbit. If this be so, then probably we should expect its return during the present year. The region of the sky which should be swept for picking up this object is, according to M. Gautier, for the present week between R.A. 11h. 20m. and 11h. 43m., and between Declinations +16° 46' and +18° 7'.

KIRCHHOFF'S SPECTROSCOPE.—The Potsdam Astrophysical Observatory has just become possessed of the celebrated spectroscope which Kirchhoff used in his well-known investigations on the solar spectrum. Although this instrument has been previously described, detailed information on several points connected with it was lacking. To remedy this Prof. H. C. Vogel brings together (*Sitzungsberichte der Königlich Preussischen Akademie der Wis., Berlin*, February 1898) such information as is supplementary to that already known, obtaining his facts from a minute examination of the instrument itself. As regards the

optical parts, Prof. Vogel says: "The objectives are very beautiful and colourless; the prisms are masterpieces of workmanship; the glass of which they are composed is pure, colourless and free from streaks, and only in two prisms do a few air bubbles appear." The spectra given by the prisms are said by Prof. Vogel to be very excellent, and the working of the whole set of prisms exceeds even to-day any other instrument of the same dispersion. The refractive angles of the prisms, as measured by Dr. Hartmann, are $44^{\circ} 57' \cdot 1$, $45^{\circ} 6' \cdot 9$, $45^{\circ} 26' \cdot 9$ and $59^{\circ} 50' \cdot 8$, and the relative refractive indices at a temperature of 18° C. was found by the same observer to be for the lines—

B 1'6093	D 1'6158	F 1'6275
a 1'6110	E 1'6220	H γ 1'6375
c 1'6129	b ₁ 1'6230	g 1'6403

JUPITER'S RED SPOT.—Jupiter is now in a good position for observation, and his surface markings have become of late of great interest in consequence of the numerous spots which many observers have seen on his disc. Dr. A. A. Nijland draws attention to two very curious spots (*Astr. Nachr.*, No. 3488) which are situated on the northern hemisphere, their coordinates in longitude and latitude (according to "Marth's System," ii., *Monthly Notices*, lviii. p. 107) being $\lambda = 272^{\circ} \beta + 31^{\circ}$, $\lambda = 289^{\circ} \beta + 38^{\circ}$. Dr. Fauth, from the private observatory at Landstuhl, gives us a continuation of the list of longitudes of several prominent spots observed by him. Another short communication of interest is that which appears in the *Astr. Nachr.*, No. 3490. In this Dr. Lohse discusses the movement of the great red spot from observations extending over a period of twenty years. The proper motion of the spot is, according to him, distinct and regular, and this will be clearly seen from the short table given below.

The method of reducing this proper motion was to obtain for each opposition a normal position for the centre of the spot on the surface of Jupiter, on the assumption of a fixed meridian and a regular velocity of rotation of the planet. In plotting the positions of these deduced normal positions on paper with the time as abscissæ and the Jovian longitudes as ordinates, a regular and symmetrical curve was brought to light. The following figures give the Jovian normal longitudes of this spot as shown in this manner, together with the name of the observer:—

Epoch.	Normal longitude	Obs.
1878 65	249 5	L.
1878 86	237 1	Tr.
1879 73	182 7	L.
1880 71	128 5	L.
1881 70	89 2	L.
1882 14	78 0	L.
1883 14	50 4	L.
1884 15	32 6	L.
1885 27	15 8	L.
1886 27	8 3	L.
1887 27	2 9	St. D.
1888 27	358 9	L.
1890 15	353 6	T. P.
1891 74	352 0	L.
1892 76	356 2	L.
1894 03	358 8	L.
1895 18	5 2	L.
1896 13	10 1	L.
1897 27	20 4	L.

The observers mentioned above were Lohse, Trouvelot, Stanley Williams, Denning, Terby, and Pritchett. From the curve it can be seen at a glance that the spot in the year 1891 rotated in the same time as that assumed for the rotation of the planet. The curve at this period has reached a turning point, and the longitudes of the spot commence now to increase instead of decrease. The observations show that for thirteen years (1878–1891) this spot has moved through nearly three-quarters of the whole circumference of the planet, and since that interval has begun to retrace its path. The fact of such a distinct acceleration and retardation of the motion of this large spot will, if the observations be continued, help us probably to gain some knowledge of the system of circulation involved in the Jovian atmosphere. It would be interesting to know whether any other comparatively large marking on the planet's surface follows the same or a similar law.

PETROLIFEROUS SANDS AND MUD VOLCANOES IN BURMA.

THE occurrence of petroleum in Burma, and its technical exploitation have, in a recently published volume, been very fully treated by Dr. Fritz Noetling, paleontologist to the Geological Survey of India (*Mem. Geol. Survey India*, vol. xxvii. part 2). The Yenangyaung oil-fields occupy an area of about 350 acres on the borders of the left bank of the Irawadi, a few miles distant from the river. They have been known from time immemorial, while the methods of obtaining the oil at the present day differ but little from those of a hundred years ago. In 1855 there were about 130 productive wells; there are now about 600, together with six or seven bore-holes. The oil-field is situated in a low but rugged table-land which is intersected by numerous ravines, and the strata which yield the oil have been bent into a gentle dome-like anticline. The strata consist of sands or soft sandstones, and shales of Tertiary ages overlaid by drift. The oil is held in the sandy beds, the thickest of which (though not the richest in oil) is a little over 130 feet. As many as ten bands yielding oil may occur in vertical succession; but water and petroleum occur independently in different beds, or in the same layer, and in the latter case the petroleum generally rests on the water.

Oil has been found by boring in a bed of sandstone 900 to 1000 feet deep, but the main oil-sand is from 200 to 350 feet from the surface. The sands are somewhat inconstant in character, and the strata generally exhibit false-bedding. They have yielded numerous remains of land mammalia and reptiles, as well as some marine fossils, so that Dr. Noetling believes the strata were accumulated in shallow water not far from land, and that carcasses of animals brought down by a river were entombed in the estuarine sediment. He regards the petroleum as indigenous in these sandy estuarine or deltaic deposits. The clays contain no trace of it. Moreover, he considers that the strata were laid down on a plane gently inclined towards the sea, and that this inclination facilitated a sliding of the sediments seawards, whereby certain minor folds and irregularities, otherwise difficult to explain, were produced. These folds were intersected by cracks, which became filled with mud-like veins of eruptive material.

Turning his attention to the mud volcanoes of Minbu, Dr. Noetling points out that they are connected with subterranean petroliferous strata: both volcanoes and mud-wells produce a



The Mud Volcanoes of Minbu, in Burma (Dr. F. Noetling).

greyish-blue mud more or less saturated with petroleum. The low temperature of the ejected mud, seldom so much as 85° , indicates that its source is not deep-seated. Some of these mud volcanoes are figured (the accompanying illustration is reduced from a Plate in the *Memoir*.) The largest had, in 1888, a crater about 6 feet in diameter, and this was filled with viscous mud from which rose enormous bubbles of inflammable gas with a strong odour of petroleum. The temperature was 76° . Some of the other cones rise about 30 feet from the ground. It seems at first difficult to say why mud volcanoes occur at Minbu and not at Yenangyaung, but Dr. Noetling points out that at Minbu these volcanoes arise through fissures in the Tertiary strata beneath an alluvial cover, and he considers that the pressure of gas and petroleum forced a way through this comparatively thin overlying deposit. No fiery eruptions have been recorded; in fact, there are no known instances of spontaneous combustion.

Dr. Noetling traces some connection between the fluctuating heights of the river and the production of petroleum at the wells.

There is also some relation between the activity of the mud volcanoes and the height of the river. The explanation is that during rains the ground-water presses on the petroliferous sands, and it is noteworthy that the main bed of oil-sand is found at about the level of high-water of the river.

Some signs of exhaustion in the oil-field are noticed by the author, but it is possible that further productive beds may be found by boring. H. B. W.

EXPERIMENTS ON THE WORKING OF GAS-ENGINES.

A GENERAL meeting of the Institution of Mechanical Engineers was held last week, when the President, Mr. Samuel W. Johnson, delivered an inaugural address dealing chiefly with the progress of locomotive engineering on the Midland Railway, of which he is chief mechanical engineer. The most interesting feature in the ordinary proceeding was the discussion of the first report to the Gas-Engine Research Committee of the Institution. The author of the report was Prof. Frederick W. Burstall, under whose superintendence the investigations had been carried out. The object of the experiments was to determine the effect produced upon the economy of gas-engines by altering one or more of the conditions which governed their working. In internal combustion engines there are a much larger number of factors to consider than in steam-engines, and it is difficult to ascertain where to look for economy. The factors to be considered are the amount of compression, the speed, the ratio of air to gas, and the amount of heat which is to be ejected through the walls of the cylinder. An increase of compression, for example, is often regarded as conducive to more economical results; but it is uncertain whether the attendant increase in economy is really due to compression alone. To ascertain this, the conditions of working should be altered successively one at a time. This has been done for the steam-engine, but all published results of tests made on gas-engines are based upon only one fixed set of conditions.

A small engine was used by the committee, but was one specially constructed for experimental purposes. Small size was an advantage, inasmuch as it allowed measurements, such as those of volumes of air, to be made with accuracy. The work of the committee appears to have been undertaken with commendable care, and a precision was aimed at more typical of the physical laboratory than of ordinary engineering experiments. This is particularly noticeable in the arrangement of the apparatus and methods of calibration followed. It would take far too much space to follow these in detail, interesting and instructive as they are to engineers, and we can only hope to give a partial idea of the methods followed. This report, it should be remembered, is but introductory to the description of the actual work of testing, most of which has yet to be undertaken. As the author stated, experimental work is often compromised by being carried out with instruments upon the accuracy of which no information is furnished. When a comparison is made of a number of results, it is always difficult to discover how far differences are due to working conditions or to inevitable experimental error. In purely physical experiments, the report continued, accuracy may be obtained to the degree of one part in a thousand; in a few special cases, even better results may be reached. In an engineering experiment it is hopeless to expect such accuracy, owing to the great difficulty of keeping the working conditions sufficiently steady from beginning to end of the experiment. With ordinary care, and the use of appliances which are found in all works, probably all that can be expected is to get results correct to 3 or 4 per cent. With special care, half of 1 per cent. may be reached; but the author does not suggest that all the results of the experiments made by the committee have this high degree of accuracy, but in the principal measurements probably the experimental error involved does not in any case exceed 1 per cent.

The engine used was of 2-horse nominal power, capable of developing a maximum of 5 I.H.P.; it has a 6-inch cylinder and 12-inch stroke. The valves are worked in the ordinary manner; there is an ordinary Watt governor acting on a small roller, and causing a charge of gas to be cut off when the speed is too high. To effect changes in compression the connecting-rod is made so that its length can be varied. Compressions employed

in the experiment varied between 35 and 90 lbs. per square inch; variation in the amount of gas admitted was effected by throttling. For measuring the supply of gas a calibrated holder was used; the wet test meter being discarded, as it does not control the fluctuations of pressure in the mains. By this instrument accuracy to the extent of one-tenth of 1 per cent. was obtained; calibration was effected by means of a standard cubic foot measure. To determine the air supply per stroke, a meter was used in place of trusting to the usual method of calculation. The arrangement followed was practically that employed by Dr. A. Slaby, of Berlin. The meter employed was a 400-light standard wet meter made by Alexander Wright and Co., of Westminster. Air is passed in by a blower, the pressure being kept constant by a governor. After passing through the meter the air is delivered into a safety-box, which is used to prevent inflammable gas from passing back into the meter, and also to give relief in case of back ignition. A rubber-bag is used to prevent fluctuations in the meter during the suction stroke. The direct measurement of air supply is usually considered a difficult and dangerous undertaking; but the author stated that no trouble had been found with this portion of the apparatus. The air meter was checked by blowing air through it into the gas-holder, and was found to be correct to the half of 1 per cent.

The amount of heat passed into the jacket was measured by running all the cooling water for a single test into a tank, and taking the temperature by means of thermometers. Samples of exhaust gases were taken and analysed. In this detail the great difficulty is not in making the analysis, but in obtaining a true sample. A single bubble of gas was taken from just below the exhaust valve after each explosion. The apparatus for doing this was illustrated by means of wall diagrams, which showed that the object aimed at was obtained by an electrical relay which actuated a small needle valve that allowed a single bubble of gas to be sucked into the gas receiver. Power developed was ascertained by a Wayne indicator; an instrument found superior to others tried. Prof. Burstall states that it is in careful hands, apparently the most accurate indicator of the present time. It has a rotating piston in place of the ordinary reciprocating piston. This piston does not touch the containing cylinder at its outer extremities, but is guided at the centre on circular bearings. In this way friction is small and not liable to change, because the bearings can be well lubricated. There are many interesting points about its mechanism which were described in the report. Thin sheets of smoked mica are used in place of the ordinary metallic faced paper or "cards." This device is highly spoken of by those who have had experience in its use.

As the engine was not fitted with a timing valve—a device which the author considers absolutely necessary to all sizes of gas-engines—it was decided to attempt to ignite the charge by means of an electric spark, and it was hoped that electric ignition would prove more certain than any form of hot-tube igniter. This, however, did not prove to be the case; and not the least interesting part of the report is contained in the discussion of the failure in this detail. The rope-break used was of the ordinary kind, having dead weights on the lower end of the rope and a spring balance at the upper end. A Harding counter for ascertaining the number of revolutions was employed, and analyses of the coal-gas were made by Mr. G. N. Huntly, who also supervised the analyses of the exhaust gas. The results of seventeen preliminary experiments made were given in a table contained in the report, and on copies of indicator diagrams attached. The mechanical efficiency of the engine varied from 76 to 84 per cent., the mean value of the whole seventeen tests being 81 per cent. It must be remembered, however, that these experiments are, as stated, preliminary, and, it may be added, they have been carried out under circumstances of exceptional difficulty, which conditions, however, will not recur. The report states that it would seem probable that the influence of increased compression on economy is due to the fact that weaker charges can be burnt completely during the stroke when the compression is high. The tests seem to indicate, the report continues, that economy depends on the choice of the correct ratio of air to gas; and this ratio increases with the compression. The number of experiments, however, are, as the report states, not yet sufficient to determine what this ratio is for any given compression. It is intended to make a series of tests sufficient for determining this important point. Further experiments are to be made at a constant speed; the variables being the load, the ratio of air to gas, and the compression. It is

stated that, so far as these additional experiments have been carried, the first results have been borne out in regard to the advantage of using a suitable mixture, and in showing the importance of making an accurate analysis of the exhaust gases.

The discussion which took place on the presentation of the report did not add materially to information on the subject. Some of the criticisms were very wide of the mark, more especially in regard to one point, upon which much stress was laid, viz. the leakage of gas through the indicator. This was supposed by some speakers to be sufficient to vitiate the value of the experiments, but, according to Prof. Burstall's tests, made in order to elucidate this point, the consumption of gas by the indicator was so minute as to be imperceptible. It was stated during the discussion by Mr. Burstall, a brother of the author, that, according to calculation, if diagrams were taken every five minutes, when running at 200 revolutions, and if the whole of the gas escaped on the stroke, the loss would be one-fiftieth of 1 per cent.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—A combined examination of non-resident candidates for open scholarships, exhibitions, &c., will be held at Trinity College, Clare College and Trinity Hall, beginning on November 1. At Trinity College there will be offered for competition about ten scholarships, about ten exhibitions, and about three sizarships. Scholarships include (1) major scholarships, of the value of 80*l.* a year, (2) minor scholarships, of the value of 75*l.* a year or of 50*l.* a year. Exhibitions are generally of the value of 40*l.* a year. Scholarships and exhibitions are tenable for two years from the commencement of residence. Sizarships are of the value of about 100*l.* a year (namely, a payment in money of 80*l.*, and a remission of College fees and dues to the extent of about 20*l.*). They are tenable until the expiration of nine terms from the commencement of residence, unless the holder is previously elected to a major scholarship. Candidates for sizarships must send satisfactory evidence to one of the Tutors that they are in need of the assistance given to sizarships. The subjects of examination will be classics, mathematics, natural sciences, moral sciences, and history. A candidate may take any one of these subjects, or any combination of subjects so far as the arrangement of the papers in the examination permits. At Clare College about eight scholarships of values varying from 80*l.* to 40*l.*, and at Trinity Hall six scholarships at least, ranging between the same values, will be awarded. These scholarships are offered for proficiency in classics, or mathematics, or natural science, or history. Deserving candidates who do not attain the standard for these scholarships may be awarded exhibitions of the annual value of 30*l.* Forms of application for admission to the examination may be obtained from any of the Tutors of the Colleges named.

In the House of Commons on Thursday, in reply to a question whether it was the intention of the Government to take the second reading of the London University Commission Bill before Whitsuntide, Mr. Balfour said he could not give any definite promise in view of the present state of public business, but he would not discourage the hope that they might have a chance of reaching the Bill as early as some time before Whitsuntide.

A PARLIAMENTARY paper issued by the Science and Art Department states that the total amount expended on technical education during the year 1895-96 in the United Kingdom was 787,467*l.*, and that the estimated total expenditure for the year 1896-97 was 847,620*l.*, exclusive of the sums allocated to technical education under the Welsh Intermediate Education Act, 1889. The total amount of the residue received under the Local Taxation Act by counties and county boroughs in England in 1895-96 was 775,944*l.*, of which 616,607*l.* was appropriated to educational purposes, and 159,336*l.* to relief of rates, the latter sum including 121,558*l.* devoted by the London County Council to that purpose. In Wales the whole of the residue grant of 37,236*l.* paid to thirteen counties and three county boroughs is devoted to intermediate and technical education. The amount of residue received by Scottish authorities was 38,262*l.*, of which 28,999*l.* was apportioned to technical education, and 9158*l.* to relief of rates. In Ireland the residue is not applicable to technical education, but eleven local authorities are making grants out of the rates for that purpose.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xx. No. 2.—On the focal surfaces of the congruences of tangents to a given surface, by A. Pell. This paper is based upon two theorems given by Darboux ("Théorie générale des Surfaces," vol. iii. p. 121) and Kœnigs ("Sur les propriétés infinitésimales de l'espace réglé"), viz.: the locus of the centres of geodesic curvature of lines of curvature of any surface is the edge of regression of the developable surface, generated by the tangent planes of the surface at all points of the lines of curvature, and the edges of regression of the developable surfaces of a congruence form two families of curves on the focal surfaces (say S_A and S_B corresponding to the focal surfaces A and B), the osculating planes of which are tangent to the surfaces B and A respectively, and the points of contact describe on these surfaces two families of conjugate lines S_A and S_B . Other theorems discussed are due to T. Caronnet (*Comptes rendus*, 1892), E. Cosserat (*C.R.*, 1894) and A. Demoulin (*C.R.*, 1894).—Displacements depending on one, two and three parameters in a space of four dimensions, by T. Craig. This is a concise generalisation to a space of four dimensions of the kinematical methods developed by Darboux in the first two volumes of his "Théorie générale des Surfaces." The author employs Poincaré's nomenclature (cf. "Sur les résidus des intégrales doubles," *Acta Math.*, t. 9, p. 385).—Further researches in the theory of quintic equations, by Emory McClintock. The paper contains four parts. The first part is a preliminary classification of quintics into reducible and irreducible, and again into resolvable and unresolvable quintics. The second is a simplified restatement of the author's earlier discoveries. The third contains a presentation of the necessary form of the coefficients of the general resolvable quintic; and the last part is occupied with the development of a theorem according to which any given resolvable quintic engenders another for which the author's sextic resolvent has the same rational value. The memoir was read at the Toronto meeting of the American Mathematical Society in August last.

Symons's Monthly Meteorological Magazine, April.—The climate of Paris, by M. J. Jaubert. This is an account of an interesting and useful book by the meteorologist of the Montsouris Observatory, compiled from all available sources in the Paris district. The mean temperature at the National Observatory is 51°·3, but in the suburbs it is less, e.g., Parc St. Maur, 50°·0. The lowest temperature recorded in the neighbourhood was -17°·5, in December 1871, and the highest was 101°·1 in 1874 and 1881. Fogs are rather frequent, about forty in a year, but a foggy day is defined as one on which objects at a distance of a mile cannot be distinguished. The mean rainfall is about 22 inches, but the amount varies in different parts of the city. About thirty thunderstorms occur in a year, mostly in summer. Very little hail falls, and the stones are seldom more than $\frac{3}{4}$ of an inch in diameter. The yearly average amount of cloud is 6°·0.—Results of meteorological observations at Camden Square for forty years, 1858-97. The average rainfall was 1·71 inches; the amount last March was 1·46 inches. The mean of all the highest shade temperatures was 61°·9, and the mean of all the lowest minimum temperatures was 25°·3. In March last the absolute extremes were 59°·1 and 25°·1, while the temperature on the grass fell below freezing point on twenty-four nights.

Bollettino della Società Sismologica Italiana, vol. iii. No. 7.—Some modifications of the doubly sensitive electric seismoscope, and instructions for its installation and working, by G. Agamennone.—The seismic recorder with increased velocity on the occasion of the earthquake of September 21, 1897, by P. Tacchini.—Diurnal movement of the obelisk of Washington, by E. Oddone.—Notices of earthquakes recorded in Italy (May 14-23, 1897), the most important being an elaborate account of the earthquake of the Tyrrhenian Sea on May 15.

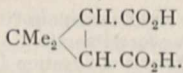
SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 10.—"On the Rotation of Plane of Polarisation of Electric Waves by a Twisted Structure." By Jagadis Chunder Bose, M.A., D.Sc., Professor of Physical Science, Presidency College, Calcutta. Communicated by Lord Rayleigh, F.R.S.

"On the Production of a 'Dark Cross' in the field of Electromagnetic Radiation." By Jagadis Chunder Bose, M.A., D.Sc., Professor of Physical Science, Presidency College, Calcutta. Communicated by Lord Rayleigh, F.R.S.

Chemical Society, April 21.—Prof. Dewar, President, in the chair.—The following papers were read:—The carbohydrates of barley-straw, by C. F. Cross, E. J. Bevan and C. Smith. The ratio of the furfural-yielding carbohydrates to total carbohydrates in barley-straw is not affected by removing the ears at the flowering stage; the constancy of this ratio under wide variations of the conditions of growth has now been established.—Isomeric bornylamines, by M. O. Forster. The base obtained from the formyl derivative got by heating camphor with ammonium formate, and from the reduction of camphoroxime, is a mixture of bornylamine and an isomeride which the author terms neobornylamine.—Some derivatives of benzophenone, by F. E. Matthews. The author has obtained a benzophenone hexachloride, $C_6H_6Cl_6$, COPh, which yields a mononitro-derivative and a sulphonic acid.—Experiments on lauronic acid, by S. B. Schryver.—The drying of ammonia and of hydrogen chloride, by H. B. Baker. A repetition of the author's previous work shows that ammonia and hydrogen chloride can be dried by phosphorus pentoxide, and that dry ammonium chloride is not dissociated at 350° ; Gutmann's strictures on the work are hence unfounded.—Note on some of the properties of methylene diiodide, by H. G. Madan. Methylene iodide darkens appreciably in colour on a few hours' exposure to sunlight, and in the cold dissolves sufficient sulphur to raise its refractive index for the D line from 1.756 to 1.778; it dissolves phosphorus readily, giving a light yellow solution which has the refractive index for D of 1.95 at 14° , and is not spontaneously inflammable on evaporation in the air.—The condensation of chloral hydrate with orcinol, by J. T. Hewitt and F. G. Pope. Chloral hydrate and orcinol condense on heating in aqueous solution, yielding an acid of the composition $C_{16}H_{16}O_6$, which is easily converted into a lactone $C_{16}H_{14}O_5$.—Note on hexamethylene and its derivatives, by Miss E. C. Fortey. Gallician petroleum, like American light petroleum, contains hexamethylene; it boils at 81.75° , and has the specific gravity of 0.7899 at $0^\circ/0^\circ$. Its mono- and dichloro-derivatives have been prepared and investigated.—The yellow colouring matter of the leaves of *Arctostaphylos uva ursi*, by A. G. Perkin. In addition to gallic acid, arbutin, ericolin and gallotannin, the author has separated a yellow colouring matter of the composition $C_{15}H_{10}O_7$ from the leaves of this plant, and has also demonstrated the presence of ellagitannin.—The yellow colouring matters of various adulterants of Sicilian sumach, Part iv., by A. G. Perkin and P. J. Wood.—The hydrolysis of starch by acids, by H. Johnson.—Synthesis of cis- and trans-caronic acids, by W. H. Perkin, jun., and J. F. Thorpe. On hydrolysing the alkylic salts of α -bromodimethylglutarate, a mixture of cis- and trans-caronic acid is obtained; caronic acid is therefore, as Baeyer concluded, a dimethyltrimethylenedicarboxylic acid of the constitution



—Preparation of solid ammonium cyanate, by J. Walker and J. K. Wood. On mixing a solution of ammonia and of cyanic acid in anhydrous ether at -20° and filtering, a residue of solid ammonium cyanate is obtained.—The chlorine derivatives of pyridine, Part i., by W. J. Sell and F. W. Dootson.—Simple experimental illustrations of the law of multiples, by A. W. Jones. Equivalent weights of potassium chlorate and perchlorate are heated, and it is shown that the residues of potassium chloride are equal in weight, and that the volumes of the oxygen evolved are as three to four in the two cases.—Lauronic acid, by R. W. Collinson and W. H. Perkin, jun. Lauronic acid yields a hydrobromide, $C_9H_{10}O_2Br$, and when oxidised gives a syrupy acid of the composition $C_9H_{14}O_3$.—The action of aluminium chloride on camphoric anhydride, by F. H. Lees and W. H. Perkin, jun.—On the action of bromoacetal on the sodium derivative of ethylic malonate, by W. H. Perkin, jun., and C. H. G. Sprankling. On heating bromoacetal with ethylic sodiomalonate at 140 – 150° , ethylic acetalmalonate, $(CO_2Et)_2CH.CH_2.CH(OEt)_2$ is obtained.—The sulphonation of benzophenone and of diphenylmethane, by A. Lapworth.—The separation of optical isomerides, by F. S. Kipping and W. J. Pope. It is shown that enantiomorphously related substances are not equally soluble in a solution containing a third enantiomorphous substance.

Zoological Society, April 19.—Prof. Howes, F.R.S., in the chair.—Mr. Ernest W. L. Holt read a paper on the breeding of the Dragonet (*Callionymus lyra*) in the Marine Biological Association's aquarium at Plymouth, and made some remarks

on the significance of the sexual dimorphism of this fish, the courtship and pairing of which were described in detail.—A communication from the Rev. H. S. Gorham contained an account of the Serricorn Coleoptera of St. Vincent, Grenada, and the Grenadines, obtained through the operation of the West India Committee of the Royal Society and the British Association, for the exploration of the fauna of the West Indies.—A second communication from the Rev. H. S. Gorham on the Coleoptera of the families *Erotylidae*, *Endomychidae*, and *Coccinellidae* from the West Indies, obtained in the same manner, was also read.—A communication was read from Dr. Bashford Dean, describing further evidence of the existence of possible paired fins in the problematical Devonian organism *Paleospondylus*. He maintained his former views, as opposed to those of Dr. R. H. Traquair expressed in a former communication to the Society.

Mathematical Society, April 7.—Dr. Hobson, F.R.S., Vice-President, in the chair.—The following communications were made:—An essay towards the generating functions of ternariants, by Prof. Forsyth, F.R.S.—On systems of forces in space of n dimensions, by W. H. Young.—Zeros of the Bessel functions, by H. M. Macdonald.

PARIS.

Academy of Sciences, April 25.—M. Wolf in the chair.—The Secretary announced to the Academy the death of M. Demontzey, Correspondant in the section of Rural Economy.—Influence of the place and mode of introduction on the development of the immunising effects of anti-diphtheric serum, by M. S. Arloing. When the anti-diphtheric serum is administered separately its complete antitoxic action is at a maximum when it is introduced into the blood, at a minimum when introduced into the conjunctive tissue.—On rectilinear congruences, by M. C. Guichard.—On differential equations of the second order with fixed critical points, by M. Paul Painlevé.—On groups which occur in the generalisation of analytical functions, by M. P. Medolaghi.—On the resistance of thick plates, by M. Ribière.—On a new standard of light, by M. Ch. Féry. The flame proposed is that of acetylene burnt from a special jet of thermometer tube, 0.5 mm. in diameter. For flames whose heights are between 10 mm. and 25 mm., the relation between the intensity and the height of the flame is a linear one. The apparatus is suggested as a suitable one for rapidly determining the quality of a commercial calcium carbide.—On the thermo-electric electromotive forces in crystallised bismuth, by M. Louis Perrot. The chief difficulty in these determinations was obtaining the bismuth in large, clearly-defined crystals, a difficulty surmounted by slowly cooling the pure metal in a Perrot furnace. The other metal chosen for the couple was copper, measurements being made at temperatures varying from 11° to 100° C. on surfaces parallel and perpendicular respectively to the principal axis. The ratios found for the electromotive forces in the two positions of the crystal were between 2.0 and 2.4 according to the temperature, the crystalline structure thus exerting a greater influence than had been previously supposed upon the thermo-electric constants of bismuth.—On the constitution of the explosive spark in a dielectric liquid, by M. L. Décombe. Photographs from a rapidly revolving mirror of a spark between metallic poles in melted vaseline, show that the spark differs from that obtained in air in possessing a uniform brightness throughout its whole length.—Remarks on the cathode rays, by M. E. Goldstein. A discussion of some results of M. Deslandres, and more especially of the relation between the cathode rays, and the repulsion of the tails of comets by the sun.—Study of the speaking voice by the phonograph, by M. Marage. The quality of each vowel is due to a certain number of harmonics, I, U, OU being formed by one only, A by three.—On the industrial treatment of the emerald in the electric furnace, by M. P. Lebeau. A mixture of 100 kilograms of emerald with half its weight of coke, submitted for an hour to a current of 1500 amperes in the electric furnace, gave two layers, the upper consisting of silicides of aluminium and beryllium, the lower of impure crystallised silicon.—On the quinoneoximes, by M. Amand Valeur. A thermochemical paper giving the heats of combustion and formation of quinoneoxime, thymoquinoneoxime, and α - and β -naphthoquinoneoximes. As a general result it is found that the replacement of the quinonic oxygen atom by the residue N(OH) raises the heat of combustion about sixty calories.—On the products of hydrolysis of ouabaine, by M. Arnaud. A study of the sugar produced shows that the crystals were identical in form

and habit with rhamnose, with which the other physical constants and chemical properties also agreed. The other product of hydrolysis was a resin, the further study of which is deferred.—Chlorinating action of ferric chloride in the aromatic series, by M. V. Thomas. By the action of ferric chloride upon boiling benzene, monochlorobenzene is readily obtained. This again, submitted to the action of more ferric chloride, gives a mixture of dichlorobenzenes. The reaction can be pushed as far as the hexachloride. Toluene behaves similarly, the substitution being always in the ring and not in the side chain.—On the dialkyl phosphoric ethers, by M. J. Cavalier.—On the acid phosphoglycerates, by MM. Adrian and Trillat.—On the saccharification of starch by malt, by M. Henri Pottevin. The experiments given show that the transformation of starch into maltose is the result of two distinct operations, dextrine being always an intermediate product. The differences observed between the various dextrines are differences in physical state only.—Hepatic pigments in the Vertebrates, by MM. A. Dastre and N. Floresco.—On the ferments causing the diseases of wines, by M. J. Laborde.—On some points of external morphology of the *Aphrodita*, by M. G. Darboux.—On the nitrogenous nutrition of phanerogamous plants by the aid of amines, salts of ammonium compounds, and alkaloids, by M. L. Lutz. The amines can be assimilated directly without previous conversion into ammoniacal salts or nitrates. Amines of low molecular weight are more easily taken up by the plant.—Influence of some poisons on the antitoxic power of the blood, by MM. C. J. Salomonsen and Th. Madsen.—Remarks on a paper of M. Daniel Berthelot, entitled "On the rigorous determination of the molecular weights of gases," by M. G. Marqfoy.

DIARY OF SOCIETIES.

THURSDAY, MAY 5.

ROYAL SOCIETY, at 4.30.—Observations on the Action of Anæsthetics on Vegetable and Animal Protoplasm: Dr. Waller, F.R.S., and Prof. Farmer.—On certain Structures formed in the Drying of a Fluid with Particles in Suspension: Miss C. A. Raisin.—On Photographic Evidence of the Objective Reality of Combination Tones: R. W. Forsyth and R. J. Sowter.—The Relations between the Hybrid and Parent Forms of Echinoid Larvæ: H. M. Vernon.

LINNEAN SOCIETY, at 8.—On some Spitsbergen Collembola: Sir John Lubbock, Bart., M.P., F.R.S.—On the Structure and Development of *Soranthera*: Miss Etel Barton.—The Species, the Sex, and the Individual: J. T. Cunningham.

CHEMICAL SOCIETY, at 8.—The Reactions of the Carbohydrates with Hydrogen Peroxide: C. F. Cross, E. J. Bevan, and Claud Smith.—The Properties and Relationships of Dihydroxytartaric Acid, Part II.: H. J. H. Fenton.—The Affinity Constants of certain Hydroxy-acids: S. Skinner.—Molecular Weights in Solution of Permanganates, Perchlorates, and Periodates: J. Murray Crofts.

INSTITUTION OF ELECTRICAL ENGINEERS (Society of Arts), at 8.—The Prevention of Interruptions to Electricity Supply: Leonard Andrews.

FRIDAY, MAY 6.

ROYAL INSTITUTION, at 9.—Living Crystals: Edward A. Minchin.

GEOLOGISTS' ASSOCIATION, at 8.—Notes on Skye: Horace B. Woodward, F.R.S.—Observations in Lapland: Aubrey Strahan.

SATURDAY, MAY 7.

GEOLOGISTS' ASSOCIATION.—Excursion to Hillmorton and Rugby. Director: Beeby Thompson.

MONDAY, MAY 9.

SOCIETY OF ARTS, at 8.—Electric Traction: Prof. Carus Wilson.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journey across Tibet from West to East: Captain M. S. Wellby.

TUESDAY, MAY 10.

ANTHROPOLOGICAL INSTITUTE, at 8.30.

RÖNTGEN SOCIETY, at 8.—Notes on the Description of a New Induction Coil in *Electrical Review*, February 4, 1898: A. Apps.—Some Notes on Contact Breakers: Dr. J. Macintyre.

ROYAL VICTORIA HALL, at 8.30.—A Simple Experiment and its Explanation: Prof. McLeod.

WEDNESDAY, MAY 11.

SOCIETY OF ARTS, at 8.—Water Gas and its Applications: Vivian B. Lewes.

THURSDAY, MAY 12.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Electrical Response of Nerve to a Single Stimulus investigated with the Capillary Electrometer. Preliminary Communication: Prof. Gotch, F.R.S., and G. J. Burch.—A Study of the Phyto-Plankton of the Atlantic: G. Murray, F.R.S., and V. H. Blackman.—Effects of Prolonged Heating on the Magnetic Properties of Iron: S. R. Roget.—On the Connection of Algebraic Functions with Automorphic Functions: E. T. Whittaker.

ROYAL INSTITUTION, at 5.—Heat: Lord Rayleigh.

MATHEMATICAL SOCIETY, at 8.—On the Numerical value of $\int_0^h e^{x^2} dx$:

H. G. Dawson.—On the Reflection and Transmission of Electric Waves

by a Metallic Grating: Prof. Lamb, F.R.S.—Notes on some Fundamental Properties of Manifolds: A. E. H. Love, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS (Society of Arts), at 8.

FRIDAY, MAY 13.

ROYAL INSTITUTION, at 9.—Recent Experiments on certain of the Chemical Elements in Relation to Heat: Prof. W. A. Tilden, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 8.

PHYSICAL SOCIETY, at 5.—Galvanometers, Part II.: Prof. W. E. Ayrton and T. Mather.

MALACOLOGICAL SOCIETY, at 8.

SATURDAY, MAY 14.

GEOLOGISTS' ASSOCIATION (King's Cross, G.N.R.), at 1.20.—Excursion to Ayot and Hatfield. Directors: J. Hopkinson and A. E. Salter.

BOOKS AND SERIALS RECEIVED.

BOOKS.—A Student of Nature: R. M. Fergusson (A. Gardner).—Royal University of Ireland Calendar, 1898 (Dublin, Thom).—A Course in Mechanical Drawing: J. S. Reid (Chapman).—Quantitative Chemical Analysis by Electrolysis: Drs. A. Classen and W. Löb, translated by W. H. Herrick and B. B. Boltwood (Chapman).—Technical Mycology: Dr. F. Lafar, translated by C. T. C. Salter, Vol. 1 (Griffin).—Electro-Physiology: Prof. W. Biedermann, translated by F. A. Welby, Vol. 2 (Macmillan).—Text-Book of Physical Chemistry: Prof. C. L. Speyers (Spon).—Methods for the Analysis of Ores, Pig Iron and Steel (Easton, Pa., Chemical Publishing Company).—First Stage Magnetism and Electricity: Dr. R. H. Jude (Clive).—A Northern Highway of the Tsar: A. Trevor-Battye (Constable).—Elementary General Science: A. T. Simmons and L. M. Jones (Macmillan).—Journal of the Iron and Steel Institute, Name-Index, Vols. 1 to 4: edited by B. H. Brough (Spon).

SERIALS.—National Geographic Magazine, April (Washington).—American Journal of Psychology, Vol. ix. No. 3 (Worcester, Mass.).—Good Words, May (Isbister).—Sunday Magazine, May (Isbister).—Natural Science, May (Dent).—Botanische Jahrbücher, Vierundzwanzigster Band, v. Heft (Leipzig, Engelmann).—Century Magazine, May (Macmillan).—American Naturalist, March (Boston, Ginn).—Humanitarian, May (Hutchinson).—Proceedings of the University of Durham Philosophical Society, Part 1 (Newcastle-on-Tyne).—Journal of the Royal Microscopical Society, April (Williams).—Journal of Botany, May (West).—Bulletin of the American Mathematical Society, April (N.Y., Macmillan).—Contemporary Review, May (Isbister).—Scribner's Magazine, May (Low).—National Review, May (Arnold).—Brain, Part 80, May (Macmillan).—Fortnightly Review, May (Chapman).—Among British Birds in their Nesting Haunts: O. A. J. Lee. Part xi. (Edinburgh, Douglas).—Knowledge, May (High Holborn).—Zeitschrift für Physikalische Chemie, xxv. Band, 4 Heft (Leipzig, Engelmann).

CONTENTS.

PAGE

Scientific Worthies, XXXI.—Albert von Kölliker. (With Photogravure Plate Engraving.) By Prof. W. F. R. Weldon, F.R.S. 1

Nitro-Explosives. By A. D. 4

Psychical Research. By Dr. W. Leslie Mackenzie 5

British East Africa 6

Our Book Shelf:—

 Lupton: "Notes on Observations" 7

 Cox: "Prospecting for Minerals" 7

 Dunbar: "The Process of Creation Discovered" 8

 Murché: "Domestic Science Readers" 8

 Reid: "A Course in Mechanical Drawing" 8

 Deas: "Flower Favourites, their Legends, Symbolism, and Significance" 8

Letter to the Editor:—

 Röntgen Rays and Ordinary Light.—Prof. J. J. Thomson, F.R.S. 8

Sleep, and the Theory of its Cause. By L. H. 8

A Proposed Revolution in Nautical Astronomy. By H. B. G. 10

A New Physical Research Laboratory at the Sorbonne. (Illustrated.) 12

Photography at the Crystal Palace 14

Micro-biology as applied to Hygiene 15

Notes 16

Our Astronomical Column:—

 Comet Perrine (March 19) 19

 Tempel's Comet (1867 II.) 19

 Kirchhoff's Spectroscope 19

 Jupiter's Red Spot 20

Petroliferous Sands and Mud Volcanoes in Burma. (Illustrated.) By H. B. W. 20

Experiments on the Working of Gas-Engines 21

University and Educational Intelligence 22

Scientific Serials 22

Societies and Academies 22

Diary of Societies 24

Books and Serials Received 24