

Biblioteka Główna i OINT  
Politechniki Wrocławskiej



100100353936

A 610 II

~~M~~





*Nature,*  
*August 12, 1922* ]

# Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

VOLUME CIX

JANUARY, 1922, to JUNE, 1922

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



London

MACMILLAN AND CO., LIMITED

NEW YORK: MACMILLAN COMPANY

1921. 1002.





# INDEX.

## NAME INDEX.

- A. (H. E.), Calcium Carbide and the Board of Trade, 230, 343  
 Abbot (C. G.), New Observations on the Variability of the Sun, 30  
 Aberconway (Lord), The Rat and its Repression, 744  
 Abraham (H.), and R. Planiol, An Astronomical Chronograph of Precision, 29  
 Abrest (K.), The Toxic Index of Illuminating Apparatus, of Heating Apparatus, and of Explosion Motors, 631  
 Ackermann (A. S. E.), The Helmholtz Theory of Hearing, 649  
 Adam (N. K.), The Properties and Molecular Structure of Thin Films, Parts 2 and 3, 762  
 Adams (Dr. C. E.), elected president of the New Zealand Astronomical Society, 52  
 Adams (F. W.), The Manufacture of White Glass in a Tank Furnace, 763  
 Adcock (F.), The Internal Mechanism of Cold-work and Recrystallisation in Cupro-nickel, 396  
 Addyman (F. T.), My Electrical Workshop, 372  
 Adeney (W. E.), A. G. G. Leonard, and Miss A. M. Richardson, The Aeration of Quiescent Columns of Distilled Water and of Solutions of Sodium Chloride, 667  
 Aidie (Mrs.), Discovery of a Parasite in the Salivary Glands of the Bed-bug, 20  
 Alcock (Lt.-Col. A.), Discoveries in Tropical Medicine, 611  
 Allbutt (Sir T. Clifford), awarded the Gold Medal of the British Medical Association, 317; elected honorary foreign member of the American Academy of Arts and Sciences, 788; Greek Medicine in Rome: The Fitz-Patrick Lectures on the History of Medicine delivered at the Royal College of Physicians of London in 1909-10, with other Historical Essays, 438  
 Allcock (H.), The Power of the Penny, 724  
 Allemand-Martin (A.), The Lignites of Cap-Bon, Tunis, 94  
 Allen (Dr. F. J.), Where did Terrestrial Life Begin? 207  
 Allen (W. H.) and Sons, Ltd., The Laboratory of, 151  
 Allix (A.), Relief Sculpture by Ice, 194  
 Ampère (A.-N.), Mémoires sur l'Électromagnétisme et l'Électrodynamie, 677  
 Amundsen (Capt. R.), co-operation with the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, 280; completion of plans for his new Arctic Expedition, 420; the expedition of, 789  
 Andant (A.), The Variations of Critical Opalescence with the Temperature and the Wave-length of the Incident Light, 799  
 Anderson (J.), and W. J. Bean, Fertile Seeds from *Araucaria imbricata*, 87  
 André (G.), The Transformations undergone by Oranges on Keeping, 30  
 Andrews (Dr. C. W.), A new Plesiosaur from the Weald Clay of Berwick (Sussex), 361  
 Andrews (Miss E.), Rush and Straw Crosses, 529  
 Andrews (E. A.), Spontaneous Ignition of Peaty Soils, 77  
 Appleton (E. V.), An Electric Wave Detector, 397  
 Arber (Agnes), The Development and Morphology of the Leaves of Palms, 499  
 Armstrong (Dr. E. F.), and T. P. Hilditch, A Study of Catalytic Actions at Solid Surfaces, vii, 93  
 Armstrong (Prof. H. E.), The Indigo Situation in India, 790  
 Asher (J.), Catalogue of Stone Implements in the Perth Museum, 423  
 Aspinall (Sir John), Some Post-War Problems of Transport ("James Forrest" Lecture), 695  
 Aston (Dr. F. W.), Isotopes, 736; The Isotopes of Tin, 813  
 Atholstan (Lord), offer of a prize for the discovery of a cure for Cancer, 147; gift for research work in Cancer, 184  
 Aubel (E.), The Attack of Glucose and Levulose by the Pyrocyanic Bacillus, 63  
 Auden (Dr. H. A.), Sulphur and Sulphur Derivatives, 235  
 Arousseau (M.), The Distribution of Population, 23  
 Babcock (E. E.), and J. L. Collins, 30  
 Babcock (W. H.), Legendary Islands of the Atlantic: A Study in Medieval Geography, 803  
 Bacon (Prof. F.), The College-trained Engineer, 722  
 Bacot (A. W.), [death], 525; [obituary article], 618  
 Bahl (Dr. K. N.), Enteronephric Excretory Organs in Earthworms, 529  
 Baillie (W. L.), Zulkowski's Theory of the Relation between the Composition and Durability of Glass, 157  
 Baird and Tatlock, Ltd., Catalogue of Physiological Apparatus, 528  
 Bairstow (Prof. L.), Aeroplane Crashes: The "Hole in the Air," the Spin, 612  
 Baker (C.), A New Science Microscope, 562  
 Baker (F. C. S.), The Game-Birds of India, 2 vols., 606  
 Baker (G. F.), Gift for the Endowment of the Metropolitan Museum of Art, New York, 789  
 Baker (Instr.-Comdr. T. Y.), Atmospheric Refraction, 8, 105, 550  
 Baldi (A.), Études élémentaires de météorologie pratique, 440  
 Balfour (Sir Arthur), conferment of an Earldom upon, 526  
 Balfour (H.), Earth Smoking-Pipes, 691; Native Life in the Highlands of Assam, 539; The Archer's Bow in the Homeric Poems (Huxley Memorial Lecture), 91; presented with the Huxley Memorial Medal, 92  
 Balfour (Sir I. Bayley), retirement of, 526  
 Ball (Dr. J.), Atmospheric Refraction, 8, 444  
 Ball (W. W. Rouse), Offer to constitute a Trust Fund for occasional Mathematical Lectures, 697  
 Ballard (Prof. C. W.), The Elements of Vegetable Histology, 773  
 Balliol (The Master of), The relationship of History and Science, 56  
 Balls (Dr. W. L.), Apparatus for Determining the Standard Deviation Mechanically, 534; Further Observations on Cell-wall Structure as seen in Cotton Hairs, 499; The Advantages and Disadvantages of Team Work in Economic Biology, 534; and others, The Quantitative Analysis of Plant Growth, 189  
 Baly (Prof. E. C. C.), Photosynthesis, 344; Prof. Heilbron and Mr. Barker, The Synthesis of Formaldehyde and Carbohydrates, 153  
 Banerji (Prof. S. K.), The Depth of Earthquake Focus, 108  
 Banta (Dr. A. M.), Selection Experiments with Cladocera, 187  
 Barker (Dr. E.), elected a Member of the Athenæum Club, 420  
 Barker (M.), The Use of very Small Pitot Tubes for Measuring Wind Velocity, 698

- Barker (W. H.), appointed Reader in Geography in Manchester University, 155; Medieval Cartography, 803
- Barlot (J.), and Mlle. M. T. Brenet, The Determination of Fatty Acids by the Formation of Complex Compounds with Uranyl and Sodium, 127
- Barnard (Prof. E. E.), The Naming of the Minor Planet No. 907, Barnardiana, 176
- Barnjum (F. J. D.), Offer of a Prize for a Practical Method of Combating and Suppressing the Spruce Bud Worm, 689
- Barr and Stroud, Ltd., a New Internal-combustion Engine, 120
- Barratt (S.), appointed Assistant Lecturer and Demonstrator in Chemistry in Leeds University, 697
- Barrowcliff (M.), and F. H. Carr, Organic Medicinal Chemicals (Synthetic and Natural), 37
- Bartlett (F. C.), appointed Reader in Experimental Psychology and Director of the Psychological Laboratory in Cambridge University, 828
- Barton (E. C.), Snow Furrows and Ripples, 374
- Baskerville (Dr. C.), [obituary], 315
- Bateman (H.), The Numerical Solution of Integral Equations, 224
- Bateson (Dr. W.), elected a Trustee of the British Museum, 655; Evolutionary Faith and Modern Doubts, 356, 553; and Miss Gairdner, and others, Gametic and Zygotic Sterility, 391
- Bather (Dr. F. A.), Morphological Aberration, 640
- du Baty (Capt. R. R.), New Surveys in Kerguelen, 319
- Baudouin (M.), The Prehistoric Material Representation of the Pleiades with the Stars in a Rock Basin in Epesses (Vendée), 362
- Bauer (E.), "La Théorie de Bohr, la constitution de l'atome et la classification périodique des éléments," 591
- Baxendell (J.), Meteorological Observations at Southport, 88
- Bayeux (R.), Maximum Respiration at very High Altitudes, 631
- Bayliss (Prof. W. M.), British Scientific Instruments, 106; The Hormone Theory of Heredity, 35
- Beale (Sir W. Phipson), [obituary article], 589; Bequests to the Royal Institution and the Mineralogical Society, 724
- Beccari (the late Prof. O.), and Prof. J. Rock, The Geographical Distribution of the Palm *Pritchardia*, 392
- Beck (C.), Requirements to be met in Microscope Illumination, 657
- Beck, Ltd. (R. and J.), Standard London Petrological Microscope, 58
- Beckett (T. A.), and F. E. Robinson, Plane Geometry for Schools. Part 1, 737
- Becquerel (Prof. J.), La Principe de relativité et la théorie de la gravitation, 770
- Behrend (B. A.), The Induction Motor and other Alternating Current Motors. Second edition, 545
- Beilby (Sir George), Aggregation and Flow of Solids: Being the Records of an Experimental Study of the Microstructure and Physical Properties of Solids in Various States of Aggregation, 1900-1921, 262
- Belin (E.), The Telegraphic Transmission of Photographs, Drawings, or Manuscripts, 463, 687
- Bell (W. B.), Damage done by Rodents in North America, 87
- Belot (E.), The Periodicity and the Movement of the Sunspots in Latitude explained by the Pulsation of the Nucleus, 226
- Belz (M. H.), The Measurement of Magnetic Susceptibilities at High Frequencies, 398
- Bemmelen (Dr. W. van), The Antitrades, 172
- Bénard (Prof. H.), Improvement of Visibility of Distant Objects, 412
- Benedicks (C.), The Homogeneous Electro-thermic Effect (Including the Thomson Effect as a Special Case), 608
- Benedict (F. G.), M. F. Hendry, and M. L. Baker, The Basal Metabolism of Girls Twelve to Seventeen Years of Age, 158
- Bengough (G. D.), The Corrosion and Protection of Condenser Tubes, 396
- Benham (C. E.), Liquid Inclusions in Glass, 456
- Benham (Dr. W. B.), Polychæta, 604
- Benoit (J.), The Physiological Conditions Relating to the Periodic Nuptial Adornment in Birds, 463
- Benoît (Dr. J. René), [obituary article], 820
- Berger (E.), The Reduction of Oxides by Hydrogen, 799
- Berman (Dr. L.), The Glands Regulating Personality: A Study of the Glands of Internal Secretion in Relation to the Types of Human Nature, 670
- Berry (Prof. R. A.), The Production and Utilisation of Whey, 25
- Berthelot (A.), and Mme. St. Danysz-Michel, The Presence of Acetone-producing Micro-organisms in the Intestinal Flora of Diabetes, 764
- Bertrand (G.), M. Freundler, and Mlle. Ménager, The Variations in the Chemical Composition of Sea-water and the Evaluation of Salinity, 732
- Betts (Annie D.), Age Incidence of Influenza, 240; The Spiracular Muscles of Hymenoptera Aculeata, 813
- Bevan (E.), Hellenism and Christianity, 409
- Beveridge (Sir William), Cycles in the Yield of Crops, 261; Weather and Harvest Cycles, 627
- Bews (Prof. J. W.), An Introduction to the Flora of Natal and Zululand, 510
- Bidder (Dr. G. P.), Conditional Offer to the Stazione Zoologica at Naples for the sending of a Research Student, 697
- Biddulph-Smith (T.), Coke-oven and By-product Works Chemistry, 4
- Bigot (A.), Kaolins, Clays, Bauxites, etc., 731
- Bilham (E. G.), A Problem in Economics, 341
- Bilt (J. van der), The Stellar Magnitude of the Ringless Saturn, 352
- Bishop (C. W.), The Tomb of Confucius, 319
- Bishopp and Læake, The Dispersion of Flies by Flight, 561
- Bispham (J. W.), appointed Principal of the Borough Polytechnic Institute, 665
- Black (F. A.), Ratios of Planetary Distances, 422
- Blackmann (Dr. A. M.), Naturalistic Art in Egypt, 319
- Blair (K. G.), *Carpophilus ligneus*, Murray, 726
- Blaise (E. E.), and Mlle. Montagne, The Action of Thionyl Chloride on the  $\alpha$ -acid Alcohols, 700
- Blakely (W. F.), The Lorantheæ of Australia. Part 1, 832
- Blanc (Prof. M. le), translated from the fourth enlarged German edition by Dr. W. R. Whitney and Dr. J. W. Brown, A Text-book of Electro-chemistry, 100
- Blandy (Lt.-Col. L. F.), The Use of Light as an Aid to Aerial Navigation, 286
- Blaringhem (L.), Abnormal Heredity of the Colour of the Embryos of a Variety of Pea, *Pisum sativum*, 567
- Bledisloe (Lord), Wheat as the Basis of Britain's Food-supply in Time of War, 25
- Boas (Dr. F.), Indian Fishing Tribes in Vancouver's Island, 423
- Boelter (W.), The Rat Problem, 659
- Bogitch (B.), The Expansions of some Refractory Materials at High Temperatures, 29
- Bohn (Prof. G.), La Forme et le mouvement: essai de dynamique de la vie, 675
- Bohr (Prof. N.), The Difference between Series Spectra of Isotopes, 745
- Bolingbroke (L. G.), offer of the Strangers' Hall, Norwich, etc., to the Corporation of Norwich, 84
- Bolton (L.), An Introduction to the Theory of Relativity, 544
- Bonacina (L. C. W.), Phenological Observations, 373; The Theory of the South-west Monsoon, 109
- Bond (Dr. C. J.), The Free-flowering of the Hawthorn, 823
- Bond (W. N.), Viscosity Determination by Means of Orifices and Short Tubes, 462
- Bone (Prof. W. A.), A. R. Pearson, E. Sinkinson, and W. E. Stockings, Researches on the Chemistry of Coal. Part 2, 156
- Bonnet (E.), The Action of Soluble Salts of Lead on Plants, 327
- Bonney (Rev. Canon T. G.), Memories of a Long Life, 607
- Booth (A. L.), The Microstructure of Coal from an Industrial Standpoint, 290
- Boothby (Dr. W. M.), and Dr. Irene Sandiford, Laboratory Manual of the Technic of Basal Metabolic Rate Determinations, 514
- Bordet (Prof. J.), elected an honorary member of the Royal Irish Academy, 487



- Borelius (Dr. G.), Periodical Phenomena in the Temperature Functions of certain Properties of the Metals, 613  
 Borradaile (Dr. L. A.), The Mouth-parts of the Shore Crab, *Carcinus maenas*, 534  
 Borzi (A.), Problemi di filosofia botanica, 547  
 Bosanquet (Prof. R. C.), The First European Civilisation, 466  
 Bose (Sir J. C.), The Ascent of Sap, 561  
 Boswell (Prof. P. G. H.), Research Degrees and the University of London, 373; The Separation of the Finer Constituents of Sedimentary Rocks, 496  
 Bottomley (Dr. J. F.), [obituary article], 212  
 Bottomley (Prof. W. B.), [death], 419; [obituary article], 524  
 Boulger (Prof. G. S.), [obituary article], 653  
 Boulnois (H. P.), Municipal Engineering, 135  
 Bourne (Prof. G. C.), Tribal Name of the Ramnidæ, 108  
 Boutaric (A.), Observations carried out on Mont Blanc, 226; and M. Vuillaume, The Flocculation of Colloidal Sulphide of Arsenic, 799  
 Bowden-Smith (E. C.), Oil Firing for Kitchen Ranges and Steam Boilers, 204  
 Bowie (W.), Some Geologic Conclusions from Geodetic Data, 158  
 Boyer-Guillon (A.), Vibrations of Vehicles, 251  
 Braak (Dr. C.), The Climate of the Netherland Indies, 594  
 Brackett (F. S.), A New Series of Spectrum Lines, 209  
 Brady (Prof. G. S.), [obituary article], 19  
 Bragg (Sir William), The Crystal Structure of Ice, 256  
 Brame (Prof. J. S. S.), The International Petroleum Commission, 497  
 Bramwell (J. C.), and A. V. Hill, The Velocity of the Pulse Wave in Man, 430  
 Branly (E.), a fund on behalf of, 52  
 Branner (Prof. J. C.), [obituary article], 557  
 Brash (J. C.), appointed professor of anatomy in Birmingham University, 498  
 Brauner (Prof. B.), an appreciation of NATURE, 350; Metchnikoff (Měchnikov) and Russian Science in 1883, 478; Science in Bohemia, 625; Transcription of Russian Names, 552  
 Breeze (Miss M. S. G.), The Degeneration in Anthers of Potato, 26  
 Brencley (Dr. Winifred), The Effects of Competition on Plant-life, 57; The Effect of Long-continued Manuring of Grassland, 25  
 Breton (M.), and V. Grysez, The Reactions of Defence and Immunity provoked by the Intradermic Injection of Micro-organisms, either Living or Killed by Heat, 764  
 Brewer (G.), The Langley Machine and the Hammondsport Trials, 305  
 Bridel (M.), The Presence of a Glucoside giving Rise to an Essential Oil in the Stems and Roots of *Sedum telephium*, 158; and Mlle. Marie Braecke, The Presence of Saccharose and Aucubine in the Seeds of *Melampyrum arvense*, 30  
 Bridgman (Dr.), Effect of Stress on the Heat Conductivity of Metals, 793  
 Briggs (G. E.), Experimental Researches on Vegetable Assimilation and Respiration. Parts 15 and 16, 730  
 Brodetsky (Dr. S.), Chatley's Aeronautical Engineering, Third edition, 808; Elementary Pure Mathematics, 737; Palmer's Commercial Arithmetic and Accounts, and The Use of Graphs in Commerce and Industry, 644; Optical Theories, 706; The Fourth Dimension, 474; The Mechanical Principles of the Aeroplane, 296  
 Brolemann (H. W.), Myriapods collected in Mesopotamia and N.-W. Persia by W. E. Evans, 398  
 Bromehead (C. E. N.), Geology and the History of London, 324  
 Brönsted (Prof. J. N.), and Dr. G. Hevesy, The Atomic Weight of Mercury from Different Sources, 780  
 Brooks (A. H.), The Scientist in the Federal Service, 569  
 Brooks (C. E. P.), and J. Glasspoole, The Drought of 1921, 257  
 Brooks (F. T.), The Inheritance of Disease-resistance in Plants, 155; and C. G. Hansford, Mould Growths on Cold Store Meat, 462  
 Brown (Prof.), New Lunar Tables, 690  
 Brown (S. E.), Experimental Science. I. Physics. Section 5, Light, 641  
 Brown (T. A.), awarded a Rayleigh prize at Cambridge University, 360  
 Brown (Dr. W.), and Prof. G. H. Thomson, The Essentials of Mental Measurement, 472  
 Brown (W. G.), The Faraday-tube Theory of Electromagnetism and other Notes, 225  
 Browne (Edith A.), Cocoa, 269  
 Browne (Prof. E. G.), Arabian Medicine: Being the FitzPatrick Lectures delivered at the College of Physicians in November 1919 and November 1920, 438  
 Browne (Rt. Rev. Dr. G. F.), On Some Antiquities in the Neighbourhood of Dunecht House, Aberdeenshire, 265  
 Browning (Prof. C. H.), Synthetic Dyes as Antiseptics and Chemotherapeutic Agents, 750  
 Brownlee (Dr. J.), An Inquiry into the Population of the British Isles, 92; Use of Death-rates as a Measure of Hygienic Conditions, 389  
 Bruce-Low (Dr. R.), [obituary article], 721  
 Brues (Prof. C. T.), Insects and Human Welfare, 710  
 Bruijning (Dr. F. F.), The Sacred Herakleopolite Nome Tree, 756  
 Bryan (Prof. G. H.), Principles and Problems of Aeronautics, 296  
 Bryce (Lord), [obituary article], 113  
 Buchner (Prof. P.), Tier und Pflanze in intrazellulärer Symbiose, 538, 576  
 Bull (A. J.), A Non-polarising Spectrophotometer, 430  
 Bull (L.), An Apparatus for the Rapid Dissociation of Images in Kinematography by the Electric Spark, 631  
 Buller (Prof. A. H. R.), The Shooting of the Spore-case of *Pilobolus*, 155  
 Burkill (J. C.), awarded the Allen scholarship in Cambridge University, 394  
 Burkitt (M. C.), Prehistory: A Study of Early Cultures in Europe and the Mediterranean Basin, 167; Col. W. Verner, 213  
 Burnet (E.), A New Method of Diagnosis of Mediterranean Fever, 259  
 Burns (Dr. D.), An Introduction to Biophysics, 704  
 Burt (Dr. C.), Juvenile Delinquency, 250  
 Burton (Prof. E. F.), The Physical Properties of Colloidal Solutions. Second edition, 39  
 Burton (W.), Early Chinese Pottery, 705  
 Bush (Dr. H. J.), Electrical Precipitation in Industry, 388  
 Butcher (R. W.), and Dr. G. C. Druce, *Tillæa aquatica* found at Adel, near Leeds, 54  
 Butler (Prof. A. S.), resignation of the chair of Natural Philosophy in St. Andrews University, 828  
 Butler (G. W.), Age Incidence of Influenza, 342  
 Buxton (Earl), The Ways and Methods of the Modern Egg-collector, 623  
 Cadell (H. M.), The Geology of the Blackness District, 62  
 Cajori (Prof. F.), Pricked Letters and Ultimate Ratios, 477  
 Callendar (Prof. H. L.), Abridged Callendar Steam Tables, Centigrade Units: Fahrenheit Units: Callendar Steam Diagram, Centigrade Units: Fahrenheit Units, 171  
 Campbell (Prof. W. W.), elected President of the International Astronomical Union, 727  
 Capitan (Prof.), Mr. Reid Moir's Discoveries of worked Flints, 185  
 Carleman (T.), and Prof. G. H. Hardy, Fourier's Series and Analytic Functions, 290  
 Carlisle (Rosalind, Countess of), Bequest to Girton College, Cambridge, 532  
 Carpenter (Prof. G. H.), Insect Transformation, 673  
 Carpenter (T. M.), Tables, Factors, and Formulas for Computing Respiratory Exchange and Biological Transformations of Energy, 475  
 Carr (Prof. H. Wildon), The Subjectivity of Psychology, 368  
 Carroll (J. A.), elected to an Isaac Newton Studentship in Cambridge University, 360  
 Carruthers (D.), New Surveys in Arabia, 756  
 Carruthers (Dr. W.), [obituary article], 787  
 Carslaw (Prof. H. S.), Introduction to the Theory of

- Fourier's Series and Integrals and the Mathematical Theory of the Conduction of Heat. Second edition. Vol. 1, Fourier's Series and Integrals, 435
- Cartailhac (Dr. E.), [obituary article], 147
- Carter (Sir George), [obituary article], 314
- Carter (G. S.), elected to a Research Studentship at Naples, 828
- Carter (H. G.), appointed Curator of the Herbarium, Cambridge University, 565
- Carter (H. J.), Australian Coleoptera: Notes and New Species. No. II., 832
- Carus-Wilson (C.), The Weathering of Mortar, 478
- Casanowicz (I. M.), Catalogue of Collection of Buddhist Art in the U.S. National Museum, 53
- Cash (J.), and G. H. Wailes. Assisted by J. Hopkinson. The British Freshwater Rhizopoda and Heliozoa. Vol. 5, 441
- Cashmore (N.), Fermat's Last Theorem: Proofs by Elementary Algebra. Third edition, 39
- Cassal (Col. C. E.), [obituary], 83
- Catalán (M. A.), Series and other Regularities in the Spectrum of Manganese, 461
- Cathcart (Prof. E. P.), and others, Heavy Muscular Work, 122
- Caulley (Prof. M.), Le Parasitisme et la Symbiose, 643
- Cave (C. J. P.), Elementary Meteorology, 440
- Cave (F. E.), The Organisation of Knowledge, 716
- Cawston (F. G.), The Differentiation of closely-allied Schistosomes, 599
- Cecil (Lord Robert), Geography and Peace, 91
- Chamberlain (J. F.), Geography: Physical, Economic, Regional, 102
- Chamberlin (T. C.), Study of Fundamental Problems of Geology, 594
- Chambers (Dr. R. W.), appointed Quain Professor of English Language and Literature at University College, London, 728
- Chambrier (P. de), Exploitation du pétrole par puits et galeries, 443
- Chamot (Prof. E. M.), Elementary Chemical Microscopy. Second edition, 546
- Champy (Prof.), and H. M. Carleton, The Shape of the Nucleus and the various Mechanical Causes, 22
- Chandler (Miss M. E. J.), The Geological History of the genus *Stratiotes*, 598
- Chandler (Dr. S. E.), and others, The Brown Bast Disease of the Para Rubber-Tree, 357
- Chapas (M.), The Solubility of the Isomeric Toluic Acids in the three Xylenes, 399
- Chapin (Dr. H. E.), [obituary article], 558
- Chapman (A. Chaston), The Profession of Chemistry, 322
- Chapman (Prof. S.), Certain Integrals occurring in the Kinetic Theory of Gases, 258; and Miss E. Falshaw, The Lunar Atmospheric Tide at Aberdeen, 1869-1919, 599
- Chapman (Dr. T. A.), [obituary article], 50
- Chapple (H. J. B.), appointed Lecturer in Electrical Engineering at the Bradford Technical College, 664
- Chappuis (J.), and M. Hubert-Desprez, Electrolysis by Stray Currents, 29
- Charcot (J. B.), The Temperatures at Different Depths in the Chasm of Cap Breton, 731
- Charpy (G.), and L. Grenet, The Penetration of Tempering in Steel, 763
- Charriou (A.), The Lime carried down by Ferric Hydroxide Precipitates, 30
- Chatelier (H. le), Manufacture of Soda with Ammonia, 566
- Chatley (Prof. H.), A Text-book of Aeronautical Engineering: The Problem of Flight. Third edition, 808; The Molecular Forces involved in Cohesion, 731
- Chattock (Prof. A. P.), Globular Lightning Discharge, 106
- Chaudron (G.), and G. Juge-Boirard, The Estimation of Sulphur in Iron Pyrites, 463
- Chazy (J.), The Astronomical Verifications of the Theory of Relativity, 699
- Cheplin (H. A.), and L. F. Rettger, The Transformation of the Intestinal Flora, VI. Feeding Experiments on Man, 31
- Chevenard (P.), The Expansion of Chromium and the Chrome-Nickel Alloys over a wide Temperature Interval, 127
- Chéveneau (C.), An Optical Method for the Determination of the Reciprocal Solubility of Slightly Miscible Liquids, 535
- Chofardet (P.), Observations of Skjellerup's Comet, 799
- Chree (Dr. C.), British ("Terra Nova") Antarctic Expedition, 1910-1913; Terrestrial Magnetism, 508; elected President of the Royal Meteorological Society, 117; Photographic Studies of Heights of Aurora, 47; The 27-Day Period (Interval) in Terrestrial Magnetism, 698
- Christie (Sir William) [death], 116; [obituary article], 145
- Christmas (W. D.), Rainfall and Drainage at Rothamsted in 1921, 107
- Christophers (Lt.-Col.), The *Leishmania donovani* parasite of Kala-azar, 688
- Church (Major A. G.), Safeguarding of Industries Act, 1921, 583
- Ciamician (Prof. G.), [obituary article], 245
- Clapp (C. H.), Mixed Products of Granitic Intrusion, 187
- Clark (Dr. A. H.), Sea-lilies and Feather-stars, 531; The Echinoderms as Aberrant Arthropods, 640
- Clark (J. E.), Flowering Dates of Trees along Main British Railway Routes, 210
- Clarke (Dr. J. M.), Organic Dependence and Disease: Their Origin and Significance, 708
- Claude (G.), Burst Tubes in the Claude Process, 219; The Claude Ammonia Process, 424
- Clausius (R. J. E.), The Centenary of, 85
- Clayton (Dr. G. C.), The Effect of the War on the heavy Chemical Industry, 24
- Cleghorn (W. S. H.), A Study in Charcoal, 599
- Clerc (M.), Increasing the Sensitiveness of Photographic Plates, 726
- Clerk (Sir Dugald), awarded the Albert Medal of the Royal Society of Arts, 823
- Cobb (Dr. H. H.), Classification of Nematodes, 353
- Cobb (Prof. J. W.), Carbon Monoxide in Gas, 355
- Coblentz (Dr. W. W.), Effective Temperatures of Stars, 560
- Cockerell (Prof. T. D. A.), A Fossil Buttercup, 42; Fossils in Burmese Amber, 713; Land Snails of the Madeira Islands, 446; The Name of the Gid Parasite, 310
- Cohen (Prof. J. B.), Prof. C. H. Browning, R. Gaunt, and R. Gulbransen, Relationships between Antiseptic Action and Chemical Constitution, 255
- Colchester (G. V.), appointed Geologist on the Geological Survey of the Anglo-Egyptian Sudan, 216
- Coleman (Prof. A. P.), Geology and the Nebular Theory, 775; Labrador and New Quebec, 353
- Colin (H.), and Mlle. A. Chaudun, The Law of Action of Sucrose, 194
- Collenette (A.), [obituary article], 788
- Colquhoun (Dr. D.), The Pitcairn Islanders, 150
- Combes (R.), The Detection of the Pseudo-bases of Anthocyanidines in Plant Tissues, 94; The Formation of Anthocyanic Pigments, 194
- Comey (Dr. A. M.), and Prof. Dorothy A. Hahn, A Dictionary of Chemical Solubilities. Inorganic. Second edition, 505
- Conrad (Dr. W.), Trichocysts in *Reckertia sagittifera*, n.g., n.sp., 22
- Conrady (Prof. A. E.), A Study of the Balance, 289
- Cooper (P. A.), Oscillation Circuits for the Determination of Di-electric Constants at Radio Frequencies, 814
- Corbett (Sir J. S.), History of the Great War, based on Official Documents: Naval Operations. Vol. 2, 135
- Cornish (Dr. Vaughan), Snow Furrows and Ripples, 374
- Cortie (Father A. L.), Terrestrial Magnetic Disturbances and Sun-spots, 44
- Cosens (C. R. G.), and Dr. H. Hartridge, The Resonance Hypothesis of Audition, 11
- Costantin (J.), The Maltese Cross shown by Wood that has undergone Traumatism, 799
- Coster (D.), The L series of the X-ray Spectrum, 258
- Cotter (J. R.), Pythagoras's Theorem as a Repeating Pattern, 579
- Cotterill (Prof. J. H.), [death], 84; [obituary article], 115
- Cotton (A. D.), appointed Keeper of the Herbarium and Library, Royal Botanic Gardens, Kew, 384
- Cotton (C. W. E.), Handbook of Commercial Information for India, 809



- Coulthard (Dr. A.), A First Book of Chemistry for Students in Junior Technical Schools, 774
- Courau (R.), Technique des pétroles, 548
- Courtines and Villey, Barovariometers with Capillary Flow, 362
- Cousins (H. H.), The Chemistry of the Garden: A Primer for Amateurs and Young Gardeners. Revised edition, 443
- Coward (T. A.), elected President of the Manchester Literary and Philosophical Society, 590
- Cowley (Dr. A. E.), elected a Member of the Athenæum Club, 420
- Cox (Dr. G. H.), Prof. C. L. Dake, and Prof. G. A. Muilenburg, Field Methods in Petroleum Geology, 474
- Cox (H. A.), appointed Gurney University Lecturer in Forestry in Cambridge University, 828
- Cracknell (A. G.), The School Algebra (Matriculation edition). Sixth Impression (Second edition), 737
- Craig (Sir Maurice), Nerve Exhaustion, 744
- Cramer (W.), A. H. Drew, and J. C. Mottram, Blood-platelets, 666
- Craven (Mrs. M. B.), appointed Assistant Lecturer in Chemistry (Technology), in Manchester University, 155
- Crawford (O. G. S.), Man and his Past, 302
- Crehore (Dr. A. C.), The New Physics, 39
- Crew (F. A. E.), Sex-Reversal in Frogs and Toads, 218
- Cristol (R.), Zinc and Cancer, 567
- Crommelin (Dr. A. C. D.), International Astronomical Union, 727; The Centenary of the Royal Astronomical Society, 760
- Cross (Capt. H. E.), Treatment of Surra in Camels, 320
- Crowe (F. J. W.), and Dr. J. W. French, Suggested Use of Fine Concrete for Astronomical Mirrors, 185
- Crowther (C. R.), Evolutionary Faith and Modern Doubts, 777
- Crowther (Dr. J. A.), and B. J. Schonland, The Scattering of  $\beta$ -rays, 156
- Cuénot (Prof. L.), elected a Foreign Member of the Linnean Society, 655
- Cunningham (Dr. Brysson), Waterways, Harbours, and Docks, 151
- Cunningham (E.), More Books on Relativity, 770
- Cunningham (J. T.), Hormones and Heredity: A Discussion of the Evolution of Adaptations and the Evolution of Species, 35; Some Problems in Evolution, 41, 173; Species and Adaptations, 775; The Hormone Theory of Heredity, 343
- Cunnington (Mrs.), An Early Iron-Age Village near Devizes, 593
- Cunnington (Dr. W. A.), Fauna of African Lakes, 28
- Curie (Mme.), elected a Free Associate Member of the French Academy, 183
- Curie (M.), The Action of the Red and Infra Red rays on Phosphorescent Sulphides, 362
- Currie (J.), Columnar Structure in Sandstone Blocks, 763
- Curtis (W. E.), Half Quanta, 713; Neon Lamps, 343; The Structure of the Band Spectrum of Helium, 326
- Cushman (Dr. J. A.), Shallow-water Foraminifera of the Tortugas Region, 708
- Cushny (Prof. A. R.), and others, The Relation of Tests for Studying the Efficiency of the Kidney, etc., 122
- Cussons (George), [obituary article], 315
- Dale (Dr. H. H.), and C. H. Kellaway, Anaphylaxis and Anaphylatoxins, 430
- Dall (W. H.), Marine Molluscan Fauna of America, 282
- Dalladay (A. J.), Some Measurements of the Stresses Produced at the Surfaces of Glass by Grinding with Loose Abrasives, 431
- Dallimore (W.), The Effect produced by Wind at Llandudno, 290
- Dalton (Prof. J. P.), A Rainbow Peculiarity, 716; The Rudiments of Relativity: Lectures delivered under the Auspices of the University College, Johannesburg, Scientific Society, 544
- Damant (Capt. G. C. C.), and Prof. A. E. Boycott, The Buoyancy of the Sun-fish, 578
- Damiens (A.), The "Dynamic" Allotropy of Tellurium, 799
- Dance (E. H.), The Channels of Education, 597
- Daniel (L.), New Researches on Grafts of Helianthus, 63
- Danjon (A.), A New Interference Method for Measuring the Apparent Diameter of Stars, 831
- Darch (J.), The Lighting of Hospitals, 657
- Darmois (E.), The Action of Acids on Ammonium Molybdo-malate, 631; Two New Molybdo-malates of Ammonium, 226
- Dasgupta (S. N.), The Logic of the Vedanta, 362
- Datta (S.), The Spectrum of Beryllium Fluoride, 326
- Dauvillier (A.), Lines in the L X-ray Spectrum of Celtium, 781; The Complexity of the K-series of the Light Elements and its Theoretical Interpretation, 326
- David (Sir T. Edgeworth), and Profs. Skeats and Richards, The Summit of Mount Kosciuszko formerly covered by Glaciers, 51
- Davies (Miss Ann Catherine), awarded the Grant from the Ellen Richards Research Prize Fund, 789; The Minimum Electron Energies associated with the Excitation of the Spectra of Helium, 156
- Davison (Dr. C.), A Manual of Seismology, 368
- Dean (Prof. H. R.), appointed Professor of Bacteriology at University College Hospital Medical School, 360; resignation of the Proctor Chair of Pathology in Manchester University, 325
- Debbarman (P. M.), An Artifice of Nectar-sipping Birds, 489
- Decarrière (E.), The rôle of Gaseous Impurities in the Catalytic Oxidation of Ammonia, 326, 535
- Deeley (R. M.), A Curious Physiological Phenomenon, 44
- Deetz (C. H.), and O. S. Adams, Elements of Map Projection, 88
- Defant (Prof. A.), Die Zirkulation der Atmosphäre in den gemässigten Breiten der Erde. Grundzüge einer Theorie der Klimaschwankungen, 469
- Deguide (C.), and P. Baud, A New Method for the Industrial Manufacture of Baryta for the Treatment of Sugar Molasses, 700
- Dehorne (A.), The Formation of Myolytic Spindles and their Phagocytosis in the Cœlom of *Lipobranchus intermedius*, 763
- Delany (M. C.), The Historical Geography of the Wealden Iron Industry, 410
- Delépine (M.), The Auto-oxidation of Organic Sulphur Compounds, 763
- Delf (E. Marion), and M. M. Michell, Studies in *Macrocystis pyrifera*, 194
- De Man (Dr. J. G.), Nouvelles Recherches sur les Nématodes libres terrioles de la Hollande, 513
- Dempster (A. J.), Positive-ray Analysis of Magnesium, 159
- Dendy (Prof. A.), The Evolution of the Tetraxonid Spongespicule, 191
- Denham (H. J.), Microscope Illumination and Fatigue, 78; Pilot Lamps in Laboratories, 683
- Denning (W. F.), Conjunction of Mars with a Star, 186; Detonating Fireball in Sunshine, 249; Fireball observed in Sunshine, 217; Jupiter and his Markings, 591; Meteoric Shower of December 4-5, 1921, 121; Observation of Comets, 613; The April Meteors, 1922, 560; The Meteors of Pons-Winnecke's Comet, 824; The Planet Mercury, 623; The Shower of January Meteors, 55
- Desch (Prof. C. H.), Measurements of Foam Cells in Soap and other Foams, 153; The Steel Industry of South Yorkshire, 691
- Descour (L.), Translated by A. F. and Dr. B. H. Wedd, Pasteur and his Work, 805
- Detlefsen (J. A.), Is Crossing Over a Function of Distance? 30
- Detwiler (S. R.), Functional Regulations in Animals with Composite Spinal Cords, 31
- Dévé (C.), The Noise caused by Aeroplanes, 631
- Dewey (H.), Lead, Silver-lead, and Zinc Ores of Cornwall, Devon, and Somerset, 6; and C. C. A. Bromehead, The Geology of South London, 562
- Dickson (Dr. H. N.), [obituary article], 525
- Dickson (Prof. L. E.), First Course in the Theory of Equations, 773
- Dines (J. S.), Where did Terrestrial Life Begin? 207
- Dines (W. H.), Observations on Radiation from the Sky, 54
- Dingle (H.), Relativity for All, 770

- Dixon (A. L.), appointed Waynflete Professor of Pure Mathematics in Oxford University, 394
- Dixon (Prof. H. H.), and N. G. Ball, Transport of Organic Substances in Plants, 236
- Dixon (Prof. W. E.), A Manual of Pharmacology. Fifth edition, 372
- Dobell (C.), and F. W. O'Connor, The Intestinal Protozoa of Man, 98
- Doberck (Dr. W.), The Orbit of Castor, 89
- Doig (P.), Colours of Binary Stars, 824
- Dolejšek (V.), On the N-Series in X-ray Spectra, 582; The *K $\alpha$*  lines of the Lighter Elements, 326
- Donatien (A.), and R. Bosselut, Acute Contagious Encephalitis of the Ox, 194
- Donnan (Prof. F. G.), Auxiliary International Languages, 491; Inorganic Chemistry as a Science, 300
- Doodson (Dr. A. T.), A Manual of Tides, 767; Harmonic Development of Tidal Theory, 283; The Accuracy of Tide-predicting Machines, 239, 479
- Davies (Dr. A. M.), Research Degrees and the University of London, 238
- Dowling (J. J.), and C. J. Haughey, Electrification of Phosphorus Smoke Nuclei, 562
- Downes (H.), A Relic of Henry Lyte's Library, 699
- Dowson (V. H. W.), Date Cultivation in the 'Iraq, 250
- Drever (Dr. J.), The Psychology of Everyday Life, 368; The Psychology of Industry, 511
- Dreyer (Dr. J. L. E.), The History of the Royal Astronomical Society, 760
- Druce (Dr. G. C.), elected a Corresponding Member of the Botanical Society of Czecho-Slovakia, 117
- Druce (J. G. F.), Transcription of Russian Names, 777
- Drummond (Dr. J. C.), Vitamins and their Relation to Public Health, 123
- Duane (Dr. W.), awarded a John Scott Medal, etc., 558
- Duke (Sir F. W.), elected a Member of the Athenæum Club, 526
- Duncan (J. C.), Changes in the Crab Nebula, 24
- Dunlap (Prof. K.), Personal Beauty and Racial Betterment, 339
- Duparc (Prof.), to Organise the Platinum Industry of Russia, 755
- Durand (J.), The Thermal Treatment of some Cast Irons, 535
- Durand (Prof. W. F.), Hydraulics of Pipe Lines, 606
- Durell (C. V.), A Concise Geometry, 574; and R. M. Wright, Elementary Algebra. Part 2, 574
- Durell (Dr. F.), and E. E. Arnold, A First Book in Algebra; A Second Book in Algebra; Plane and Solid Geometry, 737
- Durrant (J. H.), The Species of Insects found in Grain, 119
- Dupont (G.), The Composition of Aleppo Essence of Turpentine, 258
- Dye (D. W.), Calculation of a Standard of Mutual Inductance and Comparison of it with the Similar Laboratory Standard, 461
- Dyson (Sir Frank), elected President of the Optical Society, 385; Sir William Christie, K.C.B., F.R.S., 145
- Eastman (E. D.), Electronic Structures in Unsaturated Molecules, 629
- Ebler (Prof. E.), [death], 246
- Eccles (Prof. W. H.), Continuous Wave Wireless Telegraphy, Part 1, 38
- Eddington (Prof. A. S.), A Century of Astronomy, 815; elected an Honorary Foreign Member of the American Academy of Arts and Sciences, 788; elected President of the Royal Astronomical Society, 217; Progress of Astronomy in the Past Hundred Years, 760
- Eddy (Prof. H. T.), [obituary], 50
- Edmondson (C. H.), The Edible Mollusca of the Oregon Coast, 530
- Edridge-Green (Dr. F. W.), The proposed standard of Rejection of Seamen for Colour-blindness, 185
- Edwards (C. A.), and A. J. Murphy, The Rate of Combination of Copper and Phosphorus at various Temperatures, 397
- Edwards (F. W.), Oligocene Mosquitoes in the British Museum, with a summary of our Present Knowledge Concerning Fossil Culicidae, 598
- Edwards (J.), A Treatise on the Integral Calculus, with Applications, Examples, and Problems. Vol. 1, 435
- Edwards (W. N.), awarded a Travelling Scholarship of the Anglo-Swedish Society, 384
- Effront (J.), The Distinctive Properties of Amylases of different origins, 94
- Ehrenfest (Prof. P.), The Difference between Series Spectra of Isotopes, 745
- Elford (P.) and S. Heaton, Practical School Gardening. Second edition, 514
- Elliot (Dr. W. E.), and A. Crichton, Feeding and Metabolic Experiments on Pigs, 26
- Ellis (C. D.),  $\beta$ -Ray Spectra and their meaning, 289; Interpretation of the  $\beta$ -ray and  $\gamma$ -ray Spectra, 667
- Elmhirst (R.), Cyclic Conditions and Rejuvenation in Hydroids, 208
- Elton (P. M.), Silk Weavers and their Output, 388
- Elwell (C. F.), Ltd., Catalogue of Apparatus for Wireless Communication, 824
- Emsley (H. H.), and E. F. Fincham, Diffraction Haloes in Normal and Glaucomatous Eyes, 566
- Evans (Sir Arthur), The Bull Acrobats at Knossus, 387; The Palace of Minos: A Comparative Account of the Successive Stages of the Early Cretan Civilisation as illustrated by the Discoveries at Knossos. Vol. 1. The Neolithic and Early and Middle Minoan Ages, 466
- Evans (Dr. C. A. Lovatt), appointed Professor of Physiology at St. Bartholomew's Hospital Medical College, 429
- Evans (Dr. J. W.), Rosenbusch's Petrology, 303
- Evans (E. V.), Chemistry of Coke-oven and By-product Works, 4
- Evans (J. L.), grant to, from the Worts Fund, 797
- Evans (Miss Joan), awarded a Travelling Scholarship of the Anglo-Swedish Society, 384
- Evans (U. R.), Passivity and Overpotential, 257
- Ewart (Prof. J. Cossar), Nestling Feathers of the Mallard, 662; Report on Sheep-breeding Experiments, 594; The Evolution of Plumage, 779
- Ewing (Sir J. Alfred), The Atomic Process in Ferromagnetic Induction, 224; Theory of Magnetic Induction, 321
- Fabre (J. H.), The Wonder Book of Science, 270; translated by A. T. de Mattos, More Hunting Wasps, 270
- Fabry (C.), and H. Buisson, Photography of the Ultra-violet Solar Spectrum, 352
- Faillebin (M.), A Mixed Organo-metallic Compound of Aluminium, 127
- Fairgrieve (M.), Birthdays in Relation to Intelligence, 218
- Fankhauser (Dr. F.), Troisième édition française par M. Petitmermet. Guide Pratique de Sylviculture, 7
- Färber (Dr. E.), Die geschichtliche Entwicklung der Chemie, 603
- Farmer (E.), Industrial Motion Study, 219; The Economy of Human Effort in Industry, 123; and R. S. Brooke, Motion Study in Metal Polishing, 222
- Farmer (Dr. R. C.), Industrial and Power Alcohol, 577; The Manufacture and Uses of Explosives, with Notes on their Characteristics and Testing, 270
- Farnell (Dr. L. R.), and Mr. Fisher, Specialisation at Universities, 759
- Fawdry (R. C.), Co-ordinate Geometry (Plane and Solid) for Beginners, 574
- Ferens (Rt. Hon. T. R.), Gift of Land for a Technical College at Hull, 395
- Ferrier (M.), The Deviations of Light Rays passing in the Neighbourhood of a Star, 831
- Ferry (Prof. E. S.), General Physics and its Application to Industry and Everyday Life, 641
- Fessenden (Prof. R. A.), awarded a John Scott medal, etc., 558
- Feytaud (Dr. J.), "La Cité des Termites," 150
- Fiedler (Prof. H. G.), and Prof. F. E. Sandbach, A First German Course for Science Students. Second edition, 204
- Fierz (Prof. H. E.), The Modern Dye Industry, 183



- Filon (Prof. L. N. G.), An Introduction to Projective Geometry. Third edition, 737; and H. T. Jessop, The Stress-optical effect in Transparent Solids Strained beyond the Elastic Limit, 326
- Findley (A. E.), and R. Wigginton, A Practical Chemistry of Coal and its Products, 678
- Fisher (R. A.), and Winifred A. Mackenzie, The Correlation of Weekly Rainfall, 598
- Fleming (A.), A new Bacteriolytic Element found in Tissues and Secretions, 430
- Fleming (A. P. M.), and J. G. Pearce, Research in Industry; The Basis of Economic Progress, 807
- Fleming (Prof. J. A.), Fifty Years of Electricity: The Memories of an Electrical Engineer, 3; Some Problems of Long-distance Radio-telegraphy, 140, 179, 209
- Fleming (Miss R. M.), Cephalic Index and Sex, 715; Growth and Sex Factors in Racial Analysis, 389; Sex Development, 691
- Fleming (R. N.), Ancient Tales from Many Lands: A Collection of Folk Stories, 269
- Flesche (F. la), The Osage Tribe of American Indians, 756
- Floure (Dr.), Plea for Co-operation between Historians and Geographers, 91
- Folgrad (J. C.), and S. M. Thomson, The Commercial Apple Industry of North America, 645
- Foord-Kelcey (Prof. W.), [obituary], 84
- Ford (E.), the term "Nurse-hound," 55
- Forrest (S. N.), Mathematics for Technical Students: Junior Course, 574
- Forrester (R. B.), appointed Sir Ernest Cassel Lecturer in Commerce at the London School of Economics, 728
- Fortescue (Prof. C. L.), appointed Professor of Electrical Engineering at the City and Guilds (Engineering) College, 664
- Fosse (R.), The Synthesis of a Nitrogenous Principle of Plants, etc., 30; and A. Hieulle, The Synthesis of Hydrocyanic Acid by Oxidation, in Ammonio-silver Solution, of Alcohols, Phenols, and Amines, 94; and A. Hieulle, The Tendency of Formaldehyde to form Hydrocyanic Acid by Oxidation in an Ammoniacal Silver Solution, 631
- Foster (V. Le Neve), Plane Geometry: Practical and Theoretical, *Pari Passu*, 737
- Foulkes (Col. C. H.), Science and Gas Warfare, 661
- Fournier (L.), C. Levaditi, A. Navarro-Martin, and A. Schwartz, The Preventive Action in Syphilis of the Acetyl derivative of Oxyaminophenylarsinic Acid (sodium salt), 800
- Fowler (G. J.), and D. Z. Sen, Bacteria associated with Rice and other Cereals, 756
- Fowler (R. H.), and C. N. H. Lock, The Aerodynamics of a Spinning Shell, 224
- Fox (C.), reappointed Principal of the Cambridge University Training College for Schoolmasters, 797
- Fox (H. M.), Lunar Periodicity in Reproduction, 237
- Fox (Prof. P.), The Sun's Rotation from Spectroheliograms, 422
- Fox (W. L.), Flowering Dates of Trees, 310
- Francis (Prof. F.), Notes on Inorganic Chemistry for First Year University Students, 707
- Franck (M.), La Loi de Newton est la Loi Unique: théorie mécanique de l'Univers, 739
- Frankland (Prof. P. F.), a Commemoration Fund in Birmingham University, 125; Memorial of his work in Birmingham University, 148
- Franklin (T. B.), The Colloidal content of Soils, 225
- Frazer (Sir James), Missionaries as Anthropologists, 593
- Freeth (F. A.), The System:  $\text{Na}_2\text{O}-\text{CO}_2-\text{Na Cl}-\text{H}_2\text{O}$ , 461
- Fremont (C.), awarded the Bessemer Gold Medal of the Iron and Steel Institute, 590
- French (Dr. J. Weir), Columnar Structure in Sandstone Walls of a Glass Furnace, 274; Principles of Spectacle Design, 772; The Barr and Stroud 100 ft. self-contained Base Rangefinder, 157
- Freshfield (Dr. D. W.), Lord Bryce, O.M., F.R.S., 113
- Freudenberg (Prof. K.), appointed successor to Prof. Pfeiffer at the Technische Hochschule, Karlsruhe, 729
- Friend (Dr. J. N.), Iron and its Compounds (A Text-book of Inorganic Chemistry. Vol. 9. Part 2), 505; Protective Colloids—A Pretty Lecture Experiment, 341; The Chemistry of Combustion, 709
- Fritch (Prof. F. E.), and Dr. E. J. Salisbury, Botany for Students of Medicine and Pharmacy, 773
- Froidevaux (J.), The estimation of Ammoniacal Nitrogen in Nitrogenous Organic Material, 731
- Fuller (H. C.), The Chemistry and Analysis of Drugs and Medicines, 509
- Fyson (Prof. P. F.), The Flora of the Nilgiri and Pulney Hill-Tops. Vol. 3, 510
- Gain (E.), The Ultra-maximum Temperature supported by the Embryos of *Helianthus annuus*, 631
- Gale (R. C.), and Capt. E. R. Macpherson, A Specimen of Wrought-iron Currency from the Kisi Country, Sierra Leone Protectorate, West Africa, 138
- Galibourg (M.), The Utilisation of the Thermo-electric Force of Contact for the Identification of certain Steels, 362
- Galibourg (J.), and P. Ryziger, A Method of Recognising Cultivated Japanese Pearls, 631
- Gallenkamp and Co., Ltd., Catalogue of Electrical Resistance Furnaces, 455; Standard Apparatus for Determining the Viscosity and Flash Point, 793
- Galloway (Dr. W.), Aeroplane Crashes: The "Hole in the Air," the "Spin," 612
- Galton (Sir Francis), The Centenary of the Birth of, 214
- Gamble (Prof. F. W.), Studies in Symbiosis, 538, 576
- Gardner (J. A.), and F. W. Fox, The Origin and Destiny of Cholesterol in the Animal Organism. Part 12, 126; Part 13, 730
- Gardiner (Prof. J. Stanley), Fish Preservation, 71
- Garner (H. V.), appointed to Explain to Farmers and others the Plots at Rothamsted, 248
- Garrick (Miss Kate C.), Bequest to the University of Queensland, 729
- Garwood (Prof. E.), and Miss E. Goodyear, The Lower Carboniferous Succession in the Settle District, etc., 730
- Gaster (L.), Industrial Lighting, 354
- Gatenby (Prof. J. B.), Cytoplasmic Inclusions of the Germ-cells, 529
- Gates (Prof. R. R.), Some Problems in Evolution, 174; The Inheritance of Flower Size in Plants, 290
- Geddes (A. E. M.), Weather and the Crop-yield in the North-east Counties of Scotland, 763
- Geer (S. de), Population Maps, 390
- General Electric Company, Research Staff of the, The Effect of Impurities on Recrystallisation and Grain Growth, 396
- Gentil (L.), The Age of the Phosphates of Morocco, 94; The Climatology of Morocco, 226
- Gerhards (K.), Der mathematische Kern der Auszenwelts-hypothese, 691
- Gessard (C.), Varieties of Pyocyanoid Bacilli, 763
- Gheury de Bray (M. E. J.), Exponentials Made Easy, or the Story of "Epsilon," 574
- Gifford (J. W.), Atmospheric Pressure and Refractive Indices, with a Corresponding Table of Indices of Optical Glass, 94
- Gill (F.), elected President of the Institution of Electrical Engineers, 690
- Gilligan (Dr. A.), elected Professor of Geology in Leeds University, 697
- Gilmore (C. W.), New Dinosaur from New Mexico, 756; The Smallest Horned Dinosaur, 792
- Gilson (G.), elected a Foreign Member of the Linnean Society, 655
- Giuffrida-Ruggeri (Prof. V.), [obituary article], 183
- Gladstone (Prof. L.), A Human Cranium dredged from the River Trent, 593
- Glazebrook (Sir Richard), Specific Heats of Air, Steam, and Carbon Dioxide, 461
- Gleditsch (Mlle. Ellen), and B. Samdahl, The Atomic Weight of Chlorine, 456
- Gleichen (Dr. A.), Submarine Periscopes, 490
- Gleichen (Major-Genl. Lord Edward), Transcription of Russian Names, 648

- Glew (F. H.), Radium Synthesis of Carbon Compounds from Air, 714
- Glover (J.), Electrical Auscultation of Respiration at the Commencement of Tuberculosis, 363
- Godden (W.), appointed Head of the Biochemical Department of the Rowett Institute for Research in Animal Nutrition, 697
- Godchot (M.), and P. Brun, Some Derivatives of Suberone, 399; and P. Bédos, The Oxide of Cyclohexene and Ortho-methylcyclo-hexanol, 326
- Goldsbrough (G. R.), The Cause of Encke's Division in Saturn's Ring, 533
- Gomberg (M.), and C. L. Buchler, The Preparation of Benzl Ethers of Carbohydrates, 24
- Gonner (Sir Edward), [obituary article], 314
- Good (F. F.), Laboratory Projects in Physics: A Manual of Practical Experiments for Beginners, 641
- Goodman (Prof. J.), resignation of the Chair of Civil and Mechanical Engineering in the University of Leeds, 429
- Goodrich (Prof.), The Parasitisation of certain Grain Beetles by Hymenoptera, 119
- Gorceix (C.), The Formation of the "Gouf de Cap-Breton," 363
- Gordon (Prof. W. T.), Discovery of Gold in Devonshire, 583
- Gorgas (Major-Genl. W. C.), proposed Memorial to, 148; initiation of a Foundation Memorial to, 488
- Goris (A.), and H. Deluard, The Influence of Solar Radiation on the Culture of Belladonna and the Formation of Alkaloids in the Leaves, 158; and A. Liot, The Culture of the Pyocyanic Bacillus on Definite Artificial Media, 363
- Gould (Sir Alfred Pearce), [death], 558; [obituary article], 589
- Goursat (E.), The Problem of the Thrust of Earth, 631
- Gouy (G.), The Surface Tension of Electrified Electrolytes, 29; The Tensions and Pressures of Maxwell in Magnets and Dielectrics, 362
- Gow (C. C.), The Electro-Metallurgy of Steel, 768
- Gowland (Prof. W.), [death], 788
- Grace (S. F.), Free Motion of a Sphere in a Rotating Liquid Parallel to the Axis of Rotation, 762
- Graebe (Prof. C.), Geschichte der organischen Chemie, Erster Band, 806
- Graham (Dr. H.), [obituary], 485
- Gramont (A. de), and G. A. Hemsalech, The Evolution of the Spectrum of Magnesium under the Influence of Increasing Electrical Actions, 258
- Grandmougin (E.), Diphenylsulphone, 158
- Granqvist (Dr. G.), Wind Observations in Finnish Lightships, 88
- Grant (J.), Confectioners' Raw Materials: Their Sources, Modes of Preparation, Chemical Composition, the Chief Impurities and Adulterations, their More Important Uses, and Other Points of Interest, 269
- Grant (Prof. K.), A Method of Exciting Vibrations in Plates, Membranes, etc., based on the Bernoulli Principle, 256; An Efficient Sound-Producer, 692
- Gray (Prof. A.), Absolute Measurements in Electricity and Magnetism. Second edition, 166; "G. B. M.," 712; On Immediate Solutions of some Dynamical Problems, 645
- Gray (J.), The Mechanism of Ciliary Movement. Parts 1 and 2, 193
- Gray (Prof. J. G.), and Capt. J. Gray, Solutions of the Problem of the Vertical on Moving Vehicles, with Special Reference to Aircraft: The Gray Gyroscopic Stabilisers, 398
- Greaves (W. M. H.), renewal of an Isaac Newton Studentship in Cambridge University, 360
- Grebel (A.), A Comburiometer and a Controller for Gas, Grebel-Velter System, 763
- Green (Prof. J. A.), [obituary article], 452
- Greenhill (Sir G.), Immediate Solution of Dynamical Problems, 778; Units in Aeronautics, 74
- Greenwood (Dr. M.), The Scientific Value of Life Tables, 691
- Gregory (Prof. J. W.), Iron Ores in Europe, 794; Where did Terrestrial Life Begin? 107, 310; with Ten Appendices by various Authors, The Rift Valleys and Geology of East Africa, 233; and C. J. Gregory, Proposed Expedition to Yunnan and Szechuan, 51; Forthcoming Expedition to S.W. China to be under the Auspices of the Sladen Trust, 281
- Gregory (Sir Richard), elected President of the Decimal Association, 655; and Dr. C. Hagberg Wright, Scientific Literature for Russia, 208
- Grenet (H.), and H. Drouin, A Bismuth Compound of the Aromatic Series and its Therapeutic Activity, 399
- Grey (E.), Testimonial to, 655
- Griffith (Rev. J.), Pictish Stone Circles, 265
- Griffiths (A.), and W. T. Heys, A New Apparatus for the Measurement of the Polarisation Capacity of Platinum Plates in Sulphuric Acid, 731
- Griffiths (Dr. E.), Chemical and Physical Constants, 369
- Grinnell (G. B.), When Buffalo Ran, 7
- Gudger (Dr. E. W.), Rains of Fishes, 423
- Guérin (P.), The Mucilage of the Urticaceæ, 327
- Guild (J.), Angle Comparators of High Precision for the Goniometry of Prisms, 830; The Photometry of Optical Instruments, 431
- Guillaume (C. E.), Recent Fundamental Determinations and Verifications of the Standard Metres, 62
- Guillaume (J.), Observations of the Sun made at the Lyons Observatory, 29, 631; Observations of the Skjellerup Comet, 831
- Guillet (L.), and J. Cournot, The Variations of the Mechanical Properties of Metals and Alloys at Low Temperatures, 258
- Guilliermond (A.), and G. Mangenot, The Significance of the Reticular Apparatus of Golgi, 463
- Gunther (R. T.), Early British Botanists and their Gardens, based on Unpublished Writings of Goodyer, Tradescant, and others, 806
- Guntz (A. A.), Phosphorescent Zinc Sulphide, 800
- Gutbier (Prof. A.), appointed Professor of Chemistry at the University of Jena, 729
- Guye (Prof. Ch.-Eug.), S. Ratnowsky and Ch. Lavanchy, Vérification expérimentale de la formule de Lorentz-Einstein, 406; and R. Rüdy, A New Mode of Determination of the Molecular Diameters by the Electromagnetic Rotation of the Discharge in the Gases, 258
- Guye (Prof. P. A.), [obituary article], 523
- Haber (Prof. F.), Chemical Warfare, 40
- Hackett (W. W.), Tests of Weldless Steel Tubing, 188
- Hackh (Prof. I. W. D.), Chemical Reactions and their Equations: A Guide and Reference Book for Students of Chemistry, 678
- Haddon (Dr. A. C.), appointed Acting Curator of the Cambridge Museum of Archaeology and Ethnology, 92; Dr. W. H. R. Rivers, 786
- Hadfield (Sir Robert), The Corrosion of Ferrous Metals, 527
- Hadrill (C. F. T.), [obituary], 147
- Hagen (Rev. J. G.), A Study of Obscure Nebulæ, 455; The Definition of a Nova, 352
- Haig (Lord), elected Chancellor of the University of St. Andrews, 155
- Haler (P. J.), and A. H. Stuart, An Introduction to Physics for Technical Students, 641
- Hall (E. H.), The Peltier Effect, 159
- Haller (A.), and Mme. Ramart, The Dehydration of 2-methyl-2-phenyl-1-propanol and of 2,2-dimethyl-3-phenyl-1-propanol, 731
- Halliburton (Prof. W. D.), The Teeth of the Nation, 356
- Hambridge (J.), Dynamic Symmetry in Ancient Architecture, 22
- Hamel (G.), The Algæ of Rockall, 194
- Hammick (D. Ll.), An Introduction to Organic Chemistry, 39
- Hammond (J.), and E. T. Halnan, A Course of Practical Physiology for Agricultural Students, 443
- Hamy (M.), A Property of Photographic Emulsions and the Registration of Stars during Total Eclipses of the Sun in View of the Verification of the Einstein Effect, 534; The Determination of the Diameter of Stars by the Interference Method, 599
- Hankin (E. H.), An Experimental Investigation of Soaring Flight, 799



- Hannay (A. H.), Standards and Principles in Art, 256  
Hansen (Dr. H. J.), Studies of Arthropoda, 456  
Hanson (C. O.), Forestry for Woodmen. Second edition, 547  
Hanson (D.), and Miss M. L. V. Gayler, The Alloys of Aluminium and Zinc, 397  
Harbutt's Plasticine, Ltd., "Thymo-plas," 559  
Harden (Prof. A.), Biochemical Method, 291; German Monographs on Biochemistry, 741  
Hardy (G. H.), Australian Bombyliidae and Cyrtidae (Diptera), 692  
Hardy (Prof. G. H.), Mathematical Analysis, 435  
Hardy (W. B.), Historical Notes upon Surface Energy and Forces of Short Range, 375; and Ida Doubleday, Boundary Lubrication: The Paraffin Series, 224  
Harkins (Prof. W. D.), and A. Hayes, The Separation of the Isotopes of Chlorine by Diffusion, 122; and R. S. Mulliken, Separation of Isotopes of Mercury, 388  
Harland (S. C.), Some Problems in Evolution, 175  
Harle (H.), The Viscosities of the Hydrogen Halides, 94  
Harmer (Sir Sidney), Effect of Light on Museum Specimens, 757  
Harper (H.), Introduction to Textile Chemistry, 268  
Harris (D. T.), Active Hyperæmia, 255  
Harris (G. W.), Inheritance of a Cheek-mole, 78  
Harris (J. A.), and E. W. Sinnott, The Vascular Anatomy of Normal and Variant Seedlings of *Phaseolus vulgaris*, 159  
Hartland (Dr. E. S.), Primitive Society: The Beginnings of the Family and the Reckoning of Descent, 203; The Evolution of Kinship, 825  
Hartley (Brig.-Gen. H.), and others, The Teaching of Physical Chemistry in Schools, 57  
Hartridge (Dr. H.), The Helmholtz Theory of Hearing, 649; The Radiant Spectrum, 445; The Resonance Theory of Hearing, 76, 374; and R. A. Peters, Interfacial Tension and Hydrogen Ion Concentration, 666  
Hatschek (E.), An Introduction to the Physics and Chemistry of Colloids. Fourth edition, 270  
Hauman and Vanderveken, Catalogue of the Flowering Plants of the Argentine Republic, 60  
Hausding (A.), Translated from the Third German edition by Prof. H. Ryan, A Handbook on the Winning and the Utilisation of Peat, 774  
Haüy (R. J.), The Centenary of the Death of, 753  
Havelock (Prof. T. H.), Dispersion Formulæ and the Polarisation of Scattered Light: with Application to Hydrogen, 533; The Effect of Shallow Water on Wave Resistance, 224  
Hawkes (L.), The Brittleness of Ice at Low Temperatures, 240  
Hawley (Col. W.), Recent Excavations at Stonehenge, 781  
Hay (D.), appointed Professor of Mining in Sheffield University, 223  
Hay (O. P.), New Fossil Sea Cow from Florida, 825  
Hayden (J. L. R.), and N. A. Lougee, Lightning Arresters, 54  
Haynes (E.), awarded a John Scott Medal, etc., 558  
Heald (Lt.-Col. C. B.), and Major W. S. Tucker, Recoil Curves as shown by the Hot-Wire Microphone, 126  
Heath (Sir T. L.), elected President of the Mathematical Association, 85; A History of Greek Mathematics. 2 vols., 330  
Heaton (N.), The Preservation of Stone, 287  
Hegner (Prof. R. W.), and Dr. Wu, Nuclear Division in Opalina, 319  
Helbronner (A.), and W. Rudolfs, The Attack of Minerals by Bacteria, 800  
Henderson (G. H.), An Attempt to Influence the Random Direction of a Particle Emission, 398;  $\alpha$ -Particles as Detonators, 749  
Hendrick (Prof. J.), Rainfall and Drainage in 1921, 207; The Absorption and Retention of Manurial Substances by Granitic Soils, 25  
Henri (V.), The Absorption Spectrum of Benzine Vapour and the Fundamental Magnitudes of the Benzene Molecule, 535  
Henroteau (F.), Stars of the  $\beta$  Canis Majoris Type, 422  
Henry (Marguerite), The Freshwater Entomostraca of N.S.W. Part 1, Cladocera, 832  
Hepworth (H.), Magnesium in Organic Chemistry, 251  
Herdman (Sir W. A.), An Elusive Group of Marine Organisms, 130; *Spolia Runiana*—V., 396  
Hering (Dr. C.), Phenomena produced by the Flow of Heavy Currents in Conductors, 119  
Hérissey (H.), The Biochemical Synthesis of  $\alpha$ -methyl- $d$ -mannoside, 30  
Hetherington (A. L.), The Early Ceramic Wares of China, 705  
Heycock (C. T.), appointed Prime Warden of the Goldsmiths' Company, 753  
Heyn (Prof. E.), [death], 419  
Hickson (Prof.), and others, The Teaching of Natural History in Schools, 628  
Higgins (A. L.), The Transition Spiral and its Introduction to Railway Curves, 103  
Highton (H. P.), Shooting-trips in Europe and Algeria: Being a Record of Sport in the Alps, Pyrenees, Norway, Sweden, Corsica, and Algeria, 336  
Hilbert (Prof. D.), Celebration of the Sixtieth Birthday of, 655  
Hill (Dr. A. W.), appointment of, as Director of the Royal Botanic Gardens, Kew, 51  
Hill (Prof. L.), D. H. Ash, and J. A. Campbell, The Heating and Cooling of the Body by Local Application of Heat and Cold, 255; Dr. H. M. Vernon, and D. H. Ash, The Kata-Thermometer—a Measure of Ventilation, 126  
Hilton-Simpson (Capt. M. W.), Among the Hill Folk of Algeria: Journeys among the Shawia of the Aurès Mountains, 336; Ethnographical Researches among the Berbers of the Aurès Mountains in South-East Algeria, 699  
Hinch (J. de W.), Irish Eskers, 353; The Post-Glacial Climatic Optimum in Ireland, 353  
Hinshelwood (C. N.), H. Hartley, and B. Topley, Influence of Temperature on Two Alternative Modes of Decomposition of Formic Acid, 157  
Hirsch (Dr. P.), Die Einwirkung von Mikroorganismen auf die Eiweisskörper, 741  
Hirst (Major C. C.), The Genetics of Egg-Production in Poultry, 26  
Hjort (Dr. J.), The Distribution of Fat-soluble Vitamins in Marine Animals and Plants, 666  
Hobley (C. W.), The Fauna of East Africa and its Future, 256  
Hobson (Prof. E. W.), The Theory of Functions of a Real Variable and the Theory of Fourier's Series. Second edition. Vol. 1, 435  
Hoch (Dr. A.), Benign Stupors: A Study of a New Manic-depressive Reaction Type, 743  
Hodgman (Prof. C. D.), assisted by Prof. M. F. Coolbaugh and C. E. Senseman, Handbook of Chemistry and Physics. A Ready-reference Pocket-book of Chemical and Physical Data. Eighth edition, 369  
Hodkin (F. W.), and Dr. W. E. S. Turner, The Relative Advantages and Disadvantages of Limestone, Burnt Lime, and Slaked Lime as Constituents of Common Glass Batches containing Soda Ash and Saltcake. Part 2, 291  
Hodson (Col. T. C.), The Mound-builders of Dunstable, 21  
Hoel (A.), Norwegian Explorations in Spitsbergen, 561  
Hoernlé (Prof. R. F. A.), Some Byways of the Theory of Knowledge, 431  
Hoffman (Dr. F. L.), Health in the Tropics, 792; The Organisation of Knowledge, 596  
Hogarth (Dr.), Hejaz, 91  
Hogben (L. T.), and F. R. Winton, The Pigmentary Effector System, 499  
Holden (H. F.), re-elected to the Benn W. Levy Studentship in Biochemistry in Cambridge University, 92  
Holland (Sir Thomas H.), appointed Rector of the Imperial College of Science and Technology, 655; A Treatise on Petroleum, 403  
Holleman (Prof. F.), Issued in English in Co-operation with H. C. Cooper. A Text-book of Inorganic Chemistry. Sixth English edition, 677  
Hollis (Dr. W. A.), [obituary], 558  
Holmes (Sir Charles J.), Leonardo da Vinci as a Geologist, 499  
Holmyard (E. J.), Arabic Chemistry, 778  
Holtum (R. E.), The Flora of Greenland, 396



- Holzwarth (Prof. J.), [obituary], 788  
 Homén (T.), East Carelia and Kola Lapmark. Described by Finnish Scientists and Philologists, 372  
 Hooker (R. H.), The Weather and the Crops in Eastern England, 1885-1921, 193  
 Hopkins (Prof. F. G.), elected a Member of the Athenæum Club, 247  
 Hopkinson (Dr. Edward), [obituary article], 82  
 Horgan (S. H.), Photo-Engraving Primer: Concise Instructions for Apprentice Engravers or for those seeking Simple yet Practical Knowledge of Line and Half-tone Engraving, 547  
 Horne (Sir Robert), The Proposals of the Geddes Committee on National Expenditure, 316  
 Hornor (H. A.), Spot and Arc Welding, 171  
 Horvath (Dr. C. Von), Raum und Zeit im Lichte der speziellen Relativitätstheorie. Versuch eines synthetischen Aufbaus der speziellen Relativitätstheorie, 770  
 Howard (Dr. L. O.), War against Insects, 79; The Ages of Presidents of the British and American Associations, 85  
 Howe (Prof. H. M.), [obituary article], 721  
 Howell (E.), River Control in Mesopotamia, 215  
 Howell (G. C. L.), Ocean Research and the Great Fisheries, 201  
 Howell (J. P.), An Agricultural Atlas of Wales, 304  
 Houston (R. A.), A New Method of Investigating Colour-blindness, 225  
 Hoyt (F. C.), The Intensities of X-rays of the L-Series, III., 30  
 Hügel (Baron A. A. von), Proposed Conferment upon, of the Honorary Degree of Sc.D. by Cambridge University, 254  
 Hughes (W.), The Blue Flame produced by Common Salt on a Coal Fire, 683  
 Hull (A. W.), Crystal Structure of Common Elements, 490  
 Hull (T.), Oils, Fats, and Fuels, 774  
 Humphreys (Prof. W. J.), Cloud Forms, 657; Day and Night Distribution of Rainfall, 188  
 Hunter (Dr. J. de Graaff), Atmospheric Refraction, 549  
 Hunter (Col. W.), The Serbian Epidemics of Typhus and Relapsing Fever in 1915: Their Origin, Course, and Preventive Measures employed for their Arrest, 743  
 Hurst (Major), Origin of the Moss Rose, 190; and Miss M. S. G. Breeze, The Moss Rose, 283  
 Hutchinson (C. M.), Pébrine in Silkworms, 253  
 Hutton (J. H.), The Angami Nagas, with some Notes on Neighbouring Tribes, 539; The Sema Nagas, 769  
 Huxley (J. S.), and L. T. Hogben, Experiments on Amphibian Metamorphosis and Pigment Responses in Relation to Internal Secretions, 193  
  
 Imison (C. S.), and W. Russell, Ammonia Oxidation, 388  
 Imms (Dr. A. D.), Metamorphoses of Insects, 673  
 Ingold (Dr. C. K.), awarded the Meldola Medal, 249; presented with the Meldola Medal, 322  
 Ingram (Dr. T. A.), The New Hazell Annual and Almanack for the year 1922, 103  
 Iqbal (Sheikh Muhammad), translated, with Introduction and Notes, by Dr. R. A. Nicholson, The Secrets of the Self (Asrār-i Khudī), 370  
 Iredale (T.), The Notion of Asymmetry, 779  
 Irvine (Principal), and others, Advanced Study and Research in Universities, 759  
 Irwin-Smith (Miss Vera), Nematodes of the Genus Physaloptera, with Special Reference to those Parasitic in Reptiles, 95; Part II., 832  
 Isenthal and Co., Ltd., Catalogue of Regulating Resistances, 793  
 Iyengar (N. V.), Rainfall in Mysore, 218  
  
 Jackson (Miss Dorothy J.), The Genus Sitones and Leguminous Crops in Britain, 26  
 Jacob (C.), The Structure of Southern Tonkin, 326  
 Jaeger (Prof.), Method of Measuring the Surface Tension of Liquids, 153  
  
 James (R. W.), The Distribution of the Electrons in Atoms, 257  
 Jameson (Dr. H. Lyster), [obituary article], 314  
 Jarry-Desloges (M.), Planetary Observations at Sétif, 386  
 Jeans (Dr. J. H.), awarded the Gold Medal of the Royal Astronomical Society, 84; The Origin of Binary Stars, 89; and Dr. Van Maanen, Movements in Spiral Nebulae, 55  
 Jeffers (H. M.), The Orbits of the Two Components of Taylor's Comet, 1916 I., 725  
 Jeffery (Dr. G. B.), appointed Professor of Mathematics at King's College, London, 429; The Motion of Ellipsoidal Particles Immersed in a Viscous Fluid, etc., 326  
 Jeffreys (Dr. H.), The Theory of Probability, 132; and others, Evaporation from Large Expanses of Water, 354  
 Jelu (Prof.), The Geology of Iona, 62  
 Jenkins (Dr. J. T.), A History of the Whale Fisheries: From the Basque Fisheries of the Tenth Century to the Hunting of the Finner Whale at the Present Date, 298  
 Jessop (Prof. C. M.), Elementary Analysis, 737  
 Job (A.), and R. Reich, The Systematic Extension of the Preparation of Organo-metallic Compounds, 800  
 Johannsen (Prof. W.), Cephalic Index and Sex, 714  
 Johansen (F.), The Canadian Arctic Expedition of 1913-18, 256  
 Johns (C.), The Surface of Freely Flowing Liquid Steel, 153  
 Johnson (V. E.), Modern High-speed Influence Machines, 103  
 Johnson (W. E.), Logic. Parts 1 and 2, 506  
 Johnston (T. H.), and O. W. Tiegs, New Gyrodactylid Trematodes from Australian Fishes, etc., 832  
 Johnstone-Wallace (D. B.), appointed Agricultural Organiser for Devonshire, 697  
 Jolibois (P.), and R. Bossuet, The Relations between the Different Oxides of Uranium, 258  
 Joly (Prof. J.), A New Method of finding the Discharge of Rivers, 398; A New Method of Gauging the Discharge of Rivers, 624; Haloes and Earth History: A New Radioactive Element, 517, 578; The Age of the Earth, 480; The Small Haloes of Ytterby, 711  
 Jones (D. C.), A First Course in Statistics, 473  
 Jones (Dr. E. Lloyd), reappointed Demonstrator of Medicine in Cambridge University, 697  
 Jones (Sir Henry), [obituary article], 182  
 Jones (H. S.), Calculus for Beginners: A Text-book for Schools and Evening Classes, 574  
 Jones (J. E.), The Dynamics of Collision of Diatomic Molecules, 258; The Velocity Distribution Function and the Stresses in a Non-uniform Rarefied Monatomic Gas, 224  
 Jopson (N. B.), appointed University Reader in Comparative Slavonic Philology at King's College, London, 728  
 Jordan (C.), [obituary article], 349  
 Joseph (J.), Applications of the Thermionic Valve, 522  
 Jouaust (R.), The Reception of Waves maintained by Modulation, 94  
 Joyce (T. A.), Culture of Ancient Peru, 187  
  
 Kamensky (M.), The Perturbations of Wolf's Periodic Comet from 1884 to 1918, 725  
 Kanitz (Dr. A.), Temperatur und Lebensvorgänge, 741  
 Kanthack (R.), edited by Dr. J. N. Goldsmith, Tables of Refractive Indices. Vol. xi. Oils, Fats, and Waxes, 371  
 Kapteyn (Prof. J. C.), [death], 822; and P. J. van Rhiijn, The Distances of the Short-period Cepheid Variables, 488  
 Karrer (E.), The Shape assumed by a Deformable Body immersed in a Moving Fluid, 54  
 Karsner (Prof. H. T.), and Dr. E. E. Ecker, The Principles of Immunology, 7  
 Karsten (Dr. R.), Studies in South American Anthropology, 119  
 Kaye (Dr. G. W. C.), Radiology and Physics, 414  
 Keith (Sir Arthur), Endocrines in Excelsis, 670; India as a Centre of Anthropological Inquiry, 408

- Kempe (Sir Alfred Bray), [death], 558; [obituary article], 588
- Kendall (J.), The Correlation of Compound Formation, Ionisation, and Solubility in Solutions, 159
- Kennard (A. S.), elected President of the Malacological Society of London, 249
- Kennard (Dr. E. H.), The Speed of Light, 581
- Kenner (J.), Configurations of Molecules of Benzenoid Substances, 581
- Keogh (Sir Alfred), and Sir Edward Boyle, Science and Industry, 728
- Kephart (H.), Camping and Woodcraft: A Handbook for Vacation Campers and for Travellers in the Wilderness. New edition, 368
- Keynes (J. M.), A Treatise on Probability, 132
- Kidd (F.), Problems of Fruit Storage, 534
- Kidd (Mrs. M. N.), Diseases of Apples in Storage, 462
- Kidston (Dr.), and Dr. W. H. Lang, Silicified Plant Remains, 251
- Kimmins (Dr. C. W.), Organisation for Visual Instruction, 617
- King (A. S.), Experiments with the Tube Resistance Furnace on the Effect of Potential Difference, 31
- King (Dr. H. S.), A Proposed Laboratory Test of the Theory of Relativity, 582
- King (Col. W. G.), The Conquest of Malaria, 647
- Kingzett (C. T.), A Popular Chemical Dictionary: A Compendious Encyclopædia. Second edition, 338
- Kirk (Sir John), [death], 84; [obituary article], 114
- Klein (Major), A New Three-colour Printing Process, 24
- Kling (A.), and Mme. A. Lassieur, An Apparatus for the Determination of the Concentration of a Solution in Hydrogen Ions, 158
- Klingstedt (F. W.), The Ultra-violet Absorption of Phenol in Different Solvents, 535
- Knight (Dr. M. M.), Dr. Iva L. Peters, and Dr. Phyllis Blanchard, Taboo and Genetics: A Study of the Biological, Sociological, and Psychological Foundation of the Family, 235
- Knox (Dr. J.), The Fixation of Atmospheric Nitrogen, 73
- Kobayasi (T.), A Cyclone which crossed the Korean Peninsula and the Variations of its Polar Front, 257
- Kofoid (Prof. C. A.), and Dr. Olive Swezy, A Parasitic Amoeba with Pathogenic Capacities, 282; The Free-living Unarmoured Dinoflagellata, 130
- Kopaczewski (W.), Surface Tension and Narcosis, 226
- Koskowski (W.), Nicotine and the Inhibitory Nerves of the Heart, 631; The Action of Histamine on the Secretion of the Gastric Juice in Pigeons, 194
- Kossel (Prof. W.), Valenzkräfte und Röntgenspektren: Zwei Aufsätze über das Elektronengebäude des Atoms, 170
- Krogh (Prof. A.), A Simple Apparatus for measuring Oxygen Consumption, 123
- Laby (Prof. T. H.), and W. Mephram, The Isotopes of Mercury, 206
- Lafferty (H. A.), and G. H. Pethybridge, A Phytophthora Parasitic on Apples, 831
- Lallemand (C.), re-elected President of the International Union of Geodesy and Geophysics, 759; The Parabolic Wage, 566
- Lamb (C. G.), appointed Reader in Electrical Engineering in Cambridge University, 254; The Geometry of Insect Pairing, 730
- Lamb (G. C.), Alternating Currents, 2 Parts, 710
- Lambert (W. D.), The Directive Tendency of Elongated Bodies, 271
- Lampland (C. O.), Photograph of R. Aquarii, 530
- Landell-Mills (T.), Dr. A. Smith Woodward, and A. Gilligan, The Carboniferous Rocks of the Deer Lake District of Newfoundland, 361
- Lang (Dr.), Dr. Kidston, and others, The Rhynie Chart Beds, 189
- Lang (W. D.), L. F. Spath, and W. A. Richardson, Shales-with-reef, a Sequence in the Lower Lias of the Dorset Coast. 3 Parts, 157
- Langley (Prof. J. N.), The Autonomic Nervous System. Part 1, 773
- Langworthy (Mrs. C. D.), Migration Instinct in Birds, 756
- Lankester (Sir E. Ray), Discoveries in Tropical Medicine, 549, 812; Intestinal Protozoa of Man, 98
- Lapworth (Prof. A.), appointed Sir Samuel Hall Professor of Chemistry in the University of Manchester, 429
- Larmor (Sir Joseph), Precursors of Wireless Telegraphy, 410
- Laroquette (M. de), Measurement of the Mean Penetrating Power of a Bundle of X-rays by a New Radio-chronometric Method, 399
- Lascelles (B. P.), [obituary], 83
- Lauder (Dr. A.), Agriculture at the British Association, 25
- Laurie (Prof. A. P.), Pigments and Medium of the Old Masters, 421; Stone Preservation, 814
- Laveran (Prof. C. L. A.) [death], 722; [obituary article], 819
- Lavington (F.), appointed Girdler's University Lecturer in Economics in Cambridge University, 728
- Lawrence (R. D.), Enzyme Action and X-Rays, 320
- Lawson (Dr. R. W.), A Proposed Laboratory Test of the Theory of Relativity, 613; Intelligence Statistics, 716
- Layard (Miss N.), Prehistoric Cooking-places in Norfolk, 593
- Lazennec (I.), Manuel de parfumerie, 774
- Leaf (C. S.), Aurora Borealis of January 30, 176
- Lebeau (P.), The Oxides of Uranium, 258
- Lecarme (J.), Experiments relating to the Course of a Pendulum and a Chronometer, 831
- Le Chatelier (Prof. H.), presented with a Commemorative Gold Medal, 247
- Leche (Prof. J. W. E. G.), elected a Foreign Member of the Linnean Society, 655
- Lee (A. B.), The Microtometist's Vade-Mecum: A Handbook of the Methods of Microscopic Anatomy. Eighth edition. Edited by Prof. J. B. Gatenby, and others, 72
- Lees (Prof. C. H.), A Graphical Method of Treating Fresnel's Formulæ for Reflection in Transparent Media, 362; The Thermal Stresses in Solid and in Hollow Circular Cylinders Concentrically Heated, 762
- Lees (S.), appointed University Lecturer in Thermodynamics in Cambridge University, 728
- Léger (M.), and A. Baur, The Shrew, *Crocidura Stampfli*, and the Plague in Senegal, 259
- Leisenring (W. W.), The Organisation of Knowledge, 715
- Lemay (P.), and L. Jaloustre, Some Oxydasic Properties of Thorium, x, 158
- Lémeray (E. M.), L'Éther actuel et ses précurseurs (simple récit), 770
- Lemoine (G.), The importance of Scientific Research Work, 183
- Lemoine (P.), and R. Abrard, The Existence of the Upper Cretaceous in the Central Cavity of the Channel from the Dredgings of the *Pourquoi Pas?* 194
- Lenard (Prof. P.), Über Äther und Uräther, 739
- Lenox-Conyngham (Sir Gerald), appointed Reader in Geodesy in Cambridge University, 797
- Leonard (A. G. G.), and Miss A. M. Richardson, The Occurrence of Helium and Argon in the Boiling Well at St. Edmundsbury, Lucan, 831
- Lesage (P.), The Determination of the Germinative Faculty other than by the Actual Germination of the Seeds, 535
- Levaditi (C.), and A. N. Martin, The Preventive and Curative Action in Syphilis of the Acetyl Derivative of Oxyaminophenylarsinic acid (Sodium Salt), 567; and S. Nicolau, A Pure Cerebral Vaccine: its Virulence for Man, 194
- Levy (H.), The Number of Radio-active Transformations as determined by Analysis of the Observations, 362
- Lévy (P.) and others, The Theory of Probability, 90
- Lewes (Prof. V. B.), Liquid and Gaseous Fuels and the Part they Play in Modern Power Production. Second edition revised and edited by J. B. C. Kershaw, 73
- Lewis (Prof. J. V.), A Manual of Determinative Mineralogy. Third edition, 772
- Lewis (S. J.), The Ultra-violet Absorption Spectra and the Optical Rotation of the Proteins of the Blood Sera, 126
- Liebisch (Prof. T.), [death], 315
- Liévin (O.), The Kinetic Study of Alkaline Solutions of Iodine, 567



- Lindblad (B.), Determination of Luminosities by Spectrophotometry, 656
- Line (J.), Parasitism of *Nectria cinnabarina*, 462
- Lipman (C. B.), and G. A. Linhart, A Critical Study of Fertilised Experiments, 30
- Lipschütz (A.), B. Ottow, C. Wagner, and J. Bormann, The Hypertrophy of the Interstitial Cells in the Testicle of the Guinea Pig under different Experimental Conditions, 255
- Littlewood (T. H.), The Diffusion of Solutions, 225
- Livingston (Dr. B. E.), The American Association at Toronto, 285; and Dr. E. Shreve, The Distribution of Vegetation in the United States as related to Climatic Conditions, 371
- Lockyer (Major W. J. S.), A Rainbow Peculiarity, 309; A Unique Long-period Variable Star, 530
- Locquin (R.), and S. Wouseng, The Action of Acetylene on the Sodium Derivatives of Ketones, etc., 831
- Lodge (Sir Oliver), Generalised Lines of Force, 74; The History of Zeeman's Discovery, and its Reception in England, 66
- Loeb (L. B.), The Attachment of Electrons to Neutral Molecules in Air, 158
- Lofffield (J. V. G.), Behaviour of Stomata, 387
- Löhnis (Dr. F.), Life-cycles of Bacteria, 252
- Loisel (P.), and R. Castelnau, The Radio-activity of the Waters from Mont-Dore, 30
- Lones (T. E.), Mechanics and Engineering from the Time of Aristotle to that of Archimedes, 214
- Longworth-Dames (M.), [obituary], 147
- Loring (F. H.), Atomic Theories, 372
- Lotsy (Dr. J. P.), Factors of Evolution, 190
- Louis (Father G.), [obituary], 84
- Louis (Prof. H.), British Mineral Resources, 6
- Low (A. R.), Units in Aeronautics, 12, 139
- Low (J. W.), Variations in Organs of Aurelia, 320
- Lowie (Dr. R. H.), Primitive Society, 203
- Lowndes (A. G.), The Teaching of Natural History in Schools, 748
- Lowry (Prof. T. M.), and Dr. P. C. Austin, Optical Rotatory Dispersion (Bakerian Lecture), 447; and L. P. MacHatton, The Grading of Powders by Elutriation, 496
- Lowson (Dr. J. P.), appointed to the Research Chair of Medical Psychology in Queensland University, 395
- Lucanus (F. von), Die Rätzel des Vogelzuges. Ihre Lösung auf experimentellem Wege durch Aeronautik, Aviatik und Vogelberingung, 573
- Lucas (A.), Forensic Chemistry, 470
- Ludford (R. S.), Morphology and Physiology of the Nucleolus, 666
- Ludlam (E. B.), An Attempt to Separate the Isotopes of Chlorine, 398
- Lumière (A.), and H. Couturier, The Resistance of Females during Pregnancy to Anaphylactic and Anaphylactoid Shock, 327; and J. Chevroter, Antityphoid Vaccination by Scarification, 632
- Lumière (L.), Capillary Movement, Diffusion, and Displacement, 667
- Lunt (Dr. J.), Spectroscopic Study of Procyon's Orbit, 455
- Lyons (Col. H. G.), awarded the Symons Gold Medal of the Royal Meteorological Society, 117
- Maanen (Dr. van), Internal Motions in the Spiral Nebula M81, 186; Movements in Spiral Nebulae, 249; Parallaxes and Proper Motions, 318
- Macalister (Prof. R. A. S.), A Text-book of European Archaeology. Vol. 1, The Palaeolithic Period, 605
- MacCallum (Dr. G. A.), Parasitic Worms from Animals, 187
- Macdonald (Dr. A. G.), Meteorology in Medicine, 354
- MacDougall (Prof. F. H.), Thermodynamics and Chemistry, 100
- Macfie (Dr. R. C.), Where did Terrestrial Life Begin?, 107
- Mach (E.), Die Prinzipien der physikalischen Optik. Historisch und erkenntnispsychologisch entwickelt, 706
- Mackinder (Sir Halford), Problems of the Pacific, 91
- MacMahon (Major P. A.), New Mathematical Pastimes, 200; Pythagoras's Theorem as a Repeating Pattern, 479
- MacNair (Prof. P.), Introduction to the Study of Minerals and Guide to the Mineral Collections in Kelvingrove Museum. Second edition, 370
- Mahen (J.), A Retarded Regeneration of Moss, 667
- Mahnkopf (H.), Search Ephemeris for Comet 1916 II. (Taylor), 186
- Maiden (J. H.), An Additional Blue-leaf Stringybark, 226
- Maignon (F.), The Physiological and Therapeutic Properties of the Diastases of the Tissues, 363; The Utilisation of the Tissue Diastases for the Determination of the Organ, the Functional Insufficiency of which is the Cause of a Pathological State, 463
- Mailhe (A.), A New Preparation of Amino-naphthenes, 326; The Catalytic Decomposition of Oleic Acid, 567
- Malfitano (G.), and M. Catoire, Amylocellulose considered as a Compound of Silicic Acid and Amylose, 667
- Malinowski (Dr. B.), Melanesian Witchcraft, 827; Sexual Life and Marriage among Primitive Mankind, 502; The Sociology and Economics of some Island Communities, 532
- Mallik (Prof. D. N.), Optical Theories: Based on Lectures delivered before the Calcutta University. Second edition, 706
- Mallock (A.), Definition, Resolving Power, and Accuracy, 678; Muscular Efficiency, 711; Test-plates for Microscopes and Microscopic Definition, 205
- Mangham (S.), Transport of Organic Substances in Plants, 476
- Manouélian (Y.), Histo-microbiological Researches on General Paralysis, 667
- Manson (Sir Patrick), A Portrait of, unveiled at the London School of Tropical Medicine, 117; [death], 485; [obituary article], 587
- Mantey (J. J.), A Defect in the Sprengel Pump: Its Causes and a Remedy, 225
- Maquenne (L.), and R. Cerighelli, The Influence of Lime on the Yield of Seeds during the Germinative Period, 763; and E. Demoussy, Plant Growth in Media poor in Oxygen, 831
- Marage (M.), Acuteness of Hearing and Aptitude for Military Service, 158
- Marchal (P.), The Metamorphosis of the Females and Hypermetamorphosis of the Males in the Coccidia of the Margarodes Group, 667
- Marmer (H. A.), The Accuracy of Tide-predicting Machines, 136, 479
- Marsden (E.), concerning review of "Geography for Junior Classes," 55
- Marsh (J. K.), and Prof. A. W. Stewart, A Magnetic Model of Atomic Constitution, 340
- Marshall (J. F.), The Destruction of Mosquito Larvæ in Salt or Brackish Water, 746
- Martin (B. K.), nominated for the Princeton Visiting Fellowship, 697
- Martin (Dr. G.), Perfumes, Essential Oils and Fruit Essences used for Soaps and other Toilet Articles, 271
- Martin-Zédé (M.), The Influence of Orientation on the Success of the Transplantation of Trees, 94
- Marvin (F. S.), An Epic of Science, 638; The Science of Ancient Greece, 169
- Mascart (J.), Observations of the Partial Eclipse of the Sun of March 28, 1922, 599
- Mason (F. A.), Revival of Sporophores of *Schizophyllum commune*, Fr., 272
- Mather (S.), Gift to Western Reserve University, 317
- Mather (Prof. T.), Impending Retirement of, from the Chair of Electrical Engineering in the City and Guilds (Engineering) College, 192
- Mathews (Dr. G. B.), [death], 384; [obituary article], 450
- Matignon (C.), and M. Fréjaques, The Transformation of Ammonia into Urea, 326
- Matsumoto (T.), The Effect of Moisture Content upon the Expansion of Concrete, 320
- Matthews (Mr.), The Distribution of Certain Elements of the British Flora, 190
- Matthews (Sir William), [obituary article], 83
- Maxwell (Sir Herbert), *Araucaria imbricata*, 209; Nectar-sipping Birds, 612
- Mayo-Robson (Sir Arthur), and Commdr. L. C. Bernacchi, The British Science Guild, 728
- McAdie (Prof. A.), Forecasting Annual Rainfalls, 139

- McAulay (Prof. A.), Multenions and Differential Invariants. Parts 2 and 3, 290
- McCall (J. S. J.), A Handbook on Cotton and Tobacco Cultivation in Nyasaland: A Guide to Prospective Settlers, 337
- McClendon (J. F.), Hydrogen-ion Concentration of the Contents of the Small Intestine, 30
- McClure (Sir John), [obituary], 246
- McConnel (J. W.), [obituary article], 821
- McCulloch (A. R.), Australian Fishes (2), 95; Lord Howe Island, 22
- McGibbon (M.), appointed Demonstrator in Botany in St. Andrews University, 829
- M'Intosh (Prof. W. C.), Antarctic Polychæta, 604; re-elected President of the Ray Society, 384
- McKee (Prof. R. H.), Gasoline from Oil Shale, 594
- McLaughlin (T. A.), Cataphoresis of Air Bubbles in various Liquids, 667
- McLean (Prof.), Behaviour of the Somatic Nucleus in Development, 190
- McLeish (N.), awarded the Gray Prize in Logic and the Tyndall Bruce Logic Prize in St. Andrews University (United College), 254
- McLennan (Prof. J. C.), and D. S. Ainslie, The Structure of the Line  $\lambda = 6708$  Å of the Isotopes of Lithium, 698
- McMurrich (Prof. J. P.), elected President of the American Association, 286
- McVail (Dr. J. C.), awarded the Jenner Medal of the Royal Society of Medicine, 823
- McWilliam (Dr. A.), [obituary article], 557
- Meade (A.), Modern Gasworks Practice. Second edition, 199
- Meares (J. W.), Hydro-electric Survey of India. Vol. 3, 531
- Mehta (K. C.), The Occurrence of Wheat Rusts near Cambridge, 462
- Meldola (the late Prof. R.), a Commemoration Medal of, 49
- Mellor (C. T.), and A. L. Du Toit, the Johannesburg Sheet of the Geological Survey of South Africa, 562
- Mellor (Dr. E. T.), Recent Additions to our Knowledge of the South African Coalfields, 564
- Mendel (G.), The Centenary of the Birth of, 486
- Mennell (F. P.), The Bone-cave at Broken Hill, Rhodesia, 116
- Mercanton (P. L.), The Magnetic State of Arctic Basalts, 667
- Merton (Prof. T. R.), Problems in the Variability of Spectra, 519; The Blue Flame produced by Common Salt on a Coal Fire, 683; and S. Barratt, The Spectrum of Hydrogen (Bakerian Lecture), 430
- Merz (Dr. J. T.), [death], 419; [obituary article], 451
- Metabnikov (S.), Sterile Death in Infected Caterpillars, 158
- Metchnikoff (Olga), Life of Elie Metchnikoff, 1845-1916, 163
- Meunier (G.), Action of Mineral Acids on Crude Celluloses, 326
- Miall (Dr. S.), The Structure of the Atom: Notes on some Recent Theories, 710
- Michaud (F.), The Rigidity of Jellies, 763
- Mie (Prof. G.), Die Einsteinsche Gravitationstheorie: Versuch einer allgemein verständlichen Darstellung der Theorie, 544; ouvrage traduit de l'allemand, La Théorie einsteinienne de la Gravitation: Essai de vulgarisation de la théorie, 770
- Miers (Sir Henry A.), Organisation of Adult Education, 760
- Mill (Dr. H. R.), New Methods of Arctic Exploration, 636; Northernmost Greenland, 702; Sir Ernest Shackleton, C.V.O., 143
- Millar (A.), Galicia and its Petroleum Industry, 624
- Millikan (R. A.), and I. G. Barber, The Reflection and Re-emission of Electrons from Metal Surfaces, etc., 158
- Millot (S.), Calculating Balances, 599
- Mills (J. P.), The Lhota Nagas of Assam, 393
- Mills (Dr. W. H.), and Sir William Pope, A New Sensitiser for Green Light, 825
- Milne (E. A.), appointed University Lecturer in Astrophysics in Cambridge University, 797; awarded a Smith's prize at Cambridge University, 360
- Milne (Prof. W. P.), and G. J. B. Westcott, A First Course in the Calculus. Part 2, 574
- Milner (H. B.), Courant's Technique des pétroles, 548; de Chambrier's Exploitation du pétrole par puits et Galeries, 443; Helium in Natural Gas, 112; Imperial Institute: Monographs on Mineral Resources with Special Reference to the British Empire: Petroleum, 475; Nature and Origin of the Pliocene Deposits of the County of Cornwall, etc., 62; Whitehead's Benzol, 513
- Milner (Lord), Classical and Scientific Studies, 33
- Milroy (Dr. J. A.), and Prof. J. H. Milroy, Practical Physiological Chemistry. Third edition, 704
- Mitchell (C. Ainsworth), Pencil Markings in the Bodleian Library, 516
- Moir (Sir Ernest), offer of a Memorial Prize in the Engineering Department of Cambridge University, 797
- Moir (J. Reid), The Ice Age and Man, 529
- Moldenhauer (Dr. W.), translated by Dr. L. Bradshaw, Laboratory Exercises in Applied Chemistry for Students in Technical Schools and Universities, 710
- Molliard (Prof.), A New Acid Fermentation produced by *Sterigmatocystis nigra*, 567; Encyclopédie scientifique: Bibliothèque de Physiologie et de Pathologie végétales: Nutrition de la plante. Parts I., II., 769
- Monaco (Prince Albert of), elected a Foreign Member of the Zoological Society of London, 21
- Monie (M. M.), A Photographic Survey of Soils, 25; 151
- Monnet (P.), The Italian Earthquake of September 7, 1920, 326
- Monval (P. M.), The Preparation of Ammonium Chloride, 631
- Moore (A. E.), The Rat and its Repression, 659
- Moore (Prof. B.), Biochemistry: A Study of the Origin, Reactions, and Equilibria of Living Matter, 639; [death], 315; [obituary article], 348
- Moore (H.), and S. Beckinsale, Season-cracking and its Prevention: Condenser Tubes, 397
- Moore (H. F.), and J. B. Koppers, Endurance Limits of Metals, 219
- Moore (Prof. H. L.), Cycles in the Yield of Crops, 261
- Moore (Sir Norman), elected President of Honour of the International Congress of the History of Medicine, 21
- Mordell (L. J.), Three Lectures on Fermat's Last Theorem, 4
- Morley (W. M.), Alternating-current Mineral Separation, 556
- Morecroft (Prof. J. H.), assisted by A. Pinto and W. A. Curry, Principles of Radio-communication, 38
- Morgan (Prof. T. H.), elected an Honorary Member of the Royal Irish Academy, 487; conferment upon, of an Honorary Degree by Edinburgh University; Old and New Ideas about Heredity, 797; The Mechanism of Heredity, 241, 275, 312, 830
- Morris (E. H.), Chronology of the San Juan Area, 158
- Morris (R. T.), Nut Growing, 337
- Morshead (Major), Mount Everest Maps, 319
- Mottram (Dr. J. C.), Structures and Habits associated with Courtship, 77
- Moulton (Major J. C.), Malaysian Butterflies, 23
- Moureu (Prof. C.), translated by W. T. K. Braunholtz, Fundamental Principles of Organic Chemistry, 505; and C. Dufraisse, Anti-oxidation, 320; and A. Lepape, The Estimation of Krypton and Xenon in Absolute Value by Spectrophotometry, 599
- Moye (Prof. M.), Land and Sea Breezes in the Gulf of Lions, 489
- Moynihan (Sir Berkeley G. A.), elected a Member of the Athenæum Club, 526; endowment of a Gold Medal at Leeds University, 288
- Muguet (M.), Lead in the Uranium Minerals of Madagascar, 158
- Muir (F.), A New Genus of Australian Cixiidae (Homoptera), 832
- Muir (Sir Thomas), conferment upon, by the University of Cape Town of the Honorary Degree of D.Sc., 394
- Muirhead (Miss C. M. M.), and Dr. W. E. S. Turner, Effect of Magnesia on the Durability of Glass, 157
- Murray (Dr. J. A.), Cancer Research, 311
- Murray (J. A.), The Composition of Ensilage, 25
- Murray (Miss M. A.), Knots in Ancient Egypt, 726; Recent Excavations in Malta, 27; The Witch-cult in Western Europe: A Study in Anthropology, 572
- Muscio (Prof. B.), Vocational Selection, 222



- Musgrave (H.), Bequest to Queen's University, Belfast, 597, 798; bequest to the Royal Academical Institution, Belfast, 798
- Musters (J. C. Chaworth), The Flora of Jan Mayen Island, 194
- Muttele (C. F.), A New Method for the Detection of Coco-fat in Butter, 194
- M'Whae (J.), The Importance of White Settlement of the Heart of Australia, 559
- Myers (Dr. C. S.), and others, The National Institute of Industrial Psychology, 459
- Myers (J. G.), The Australian Apple Leafhopper, 95
- Nakamura (S.), The Direction of the First Movement in an Earthquake, 593
- Naumann (Prof. A.), [obituary], 485
- Negretti and Zambra, A Thermometer for Measuring Rock Temperatures, 562
- Négris (P.), Atlantis and the Quaternary Regression, 94
- Němec (A.), and F. Duchoň, A New Indicating Method of Evaluating the Vitality of Seeds by the Biochemical Method, 399
- Nernst (Prof. W.), Das Weltgebäude im Lichte der Neueren Forschung, 766; Director of the Physikalisch-Technische Reichsanstalt, 487; 2<sup>e</sup> édition française, complément refondue d'après la 10<sup>e</sup> édition allemande par Prof. A. Corvisy. Traité de chimie générale. première partie, 574
- Nettleton (H. R.), A Special Apparatus for the Measurement at Various Temperatures of the Thomson Effect, 225
- Neuburger (M. C.), Das Problem der Genesis des Actiniums, 809
- Newman (F. H.), Active Hydrogen and Nitrogen, 749
- Newsholme (Sir Arthur), Current Values in Preventive Medicine: Relation between Prevention and Treatment, 487; Methods of Evaluating Public Health Activities, 487; Values in Preventive Medicine Historically considered: General and Specific Sanitation, 487
- Newton (A.), The Position of Neptune's Equator, 528
- Newton and Wright, Ltd., Catalogue of the Snook Apparatus, 88; Deep Therapy Apparatus, Section 26, 150
- Nichols (E. L.), and D. T. Wilbur, Luminescence at High Temperatures, 31
- Nicholson (J. H.), awarded the Albert Kahn Travelling Fellowship, 823
- Nicholson (Prof. J. W.), Problems Relating to a Thin Plane Annulus, 224
- Nicloux (M.), and G. Welter, The Gravimetric Quantitative Micro-analysis of Urea, 63
- Nicoll (M.), appointed Lecturer in Psychotherapy in Birmingham University, 125
- Nicolle (C.), and E. Conseil, Preventive Vaccination by the Digestive Tract in Man, 534
- Noble (Sir W.), Science at the Post Office, 609
- Nolan (J. J.), and J. Enright, The Electrification Produced by Breaking up Water, with Special Application to Simpson's Theory of the Electricity of Thunderstorms, 462
- Nopcsa (Baron F.), The Geological Importance of the Primitive Reptilian Fauna in the Upper Cretaceous of Hungary, 430
- Nordmann (C.), Einstein and the Universe: A Popular Exposition of the Famous Theory. Translated by J. McCabe, 770
- Nordmann (C.), and Le Morvan, A Singular Phenomenon presented by the Star  $\theta$  of the Great Bear, 463; Observation of an Abnormal Star by the Heterochrome Photometer of the Paris Observatory, 127
- North (J. L.), The Possible Successful Growth of *Glycine soja*, Sieb. and Zucc., as a Profitable Crop in Great Britain, 290
- Norton (A. P.), A Star Atlas and Telescopic Hand-book (Epoch 1920) for Students and Amateurs, 269
- Noüy (P. Lecompte du), The Superficial Equilibrium of the Serum and of Some Colloidal Solutions, 599
- Noyes (A.), The Torch-bearers, 638
- Nuttall (Mrs. Zelia), Archaeological Investigations in Mexico, 59
- Obata (J.), Standard Cells of Low Voltage, 251
- Ogilvie (A.), The Wilbur Wright Memorial Lecture, 822
- Oldham (R. D.), The Cause and Characters of Earth-quakes, 361, 650, 685
- Ormsby (Mrs.), Connections between Original Contours and Drainage of London and Westminster, 91
- Orton (Dr. J. H.), The Blood-cells of the Oyster, 612
- Osborn (Prof. H. F.), Hesperopithecus, the First Anthropoid Primate found in America, 750
- Osborne (Dr. T. B.), awarded a John Scott Medal, etc., 558
- Osburn (W. J.), Reports on Education by English, French, and German Observers, 829
- Osgood (Prof. W. F.), Elementary Calculus, 574
- Ostenfeld (Dr. C. H.), Apogamous Reproduction, 218
- Ostwald (Prof. W.), Das System der Kriminologie, 86
- Owen (E. A.), and Bertha Naylor, The Measurement of the Radium Content of Sealed Metal Tubes, 256
- Owen (L.), The Phosphate Deposit of Ocean Island, 62
- Owens (Dr. J. S.), Suspended Impurity in the Air, 289
- Oxley (Dr. A. E.), Magnetism and Atomic Structure, II, 290
- Pacotte (Dr. J.), La Physique théorique nouvelle, 739
- Paget (Sir R. A. S.), Dr. J. F. Bottomley, 212; Nature of Vowel Sounds, 341
- Painlevé (P.), The Classical and the Einstein Theory of Gravitation, 699
- Painton (E. T.), Small Single-phase Transformers, 135
- Palladin (Prof. V. I.), [obituary], 419
- Palmer (A. H.), The Weather in Death Valley, California, 757
- Palmer (A. R.), A Short Course in Commercial Arithmetic and Accounts: The Use of Graphs in Commerce and Industry, 644
- Palmer (W. G.), The Catalytic Activity of Copper. Part 3, 326
- Pannett (Dr. C. A.), appointed Professor of Surgery at St. Mary's Hospital Medical School, 429
- Pantin (C. F. A.), Statistical Studies of Evolution, 273
- Paris (E. T.), Doubly Resonated Hot-wire Microphones, 698
- Park (Prof. J.), Western Southland, New Zealand, 657; and others, Geology in New Zealand, 624
- Parry (E. J.), The Raw Materials of Perfumery: their Nature, Occurrence, and Employment, 305
- Parsons (Sir Charles), Gift to the British Association, 590
- Parsons (Prof. F. G.), Craniometry in the British Isles, 250; The Long Barrow Race and its Relationship to the Modern Inhabitants of London, 86
- Partington (Prof. J. R.), The Energy of Gaseous Molecules, 256; The Oxidation of Ammonia, 137
- Pascal (P.), The Magneto-chemical Investigation of Constitution in Mineral Chemistry, 326
- Pasteur (Louis), The Centenary of the Birth of, 486
- Paton (H. J.), Plato's Theory of *eikasia*, 224
- Patterson (Dr. A. M.), A French-English Dictionary for Chemists, 73
- Peake (H. J. E.), Bronze Swords and the Aryan Problem, 563; The Ice Age and Man, 529
- Pear (Prof.), Mental Tests and Mentality, 657
- Pearce (E. K.), Typical Flies: A Photographic Atlas; Second Series, 677
- Pearson (S. O.), and H. St. G. Anson, Some Electrical Properties of Neon-filled Lamps, 730
- Pedde (C. J.), The Manufacture of Optical Glass, 157
- Peirce (F. T.), Electromagnetic Valency and the Radiation Hypothesis, 290
- Pélabon (H.), The Action of Selenium on Gold, 258; The Constitution of Selenium, 63
- Pell (C. E.), The Law of Births and Deaths: Being a Study of the Variation in the Degree of Animal Fertility under the Influence of the Environment, 267
- Pellegrin (J.), A New Blind Fish from the Fresh Waters of Western Africa, 567
- Penard (Dr. E.), Études sur les Infusoires d'eau douce, 441
- Penfold (A. R.), The Essential Oil obtained of the Leaves of *Doryphora sassafras*, Endlicher, 226

- Penrose (H. E.), The Trend of Radio-development, 599  
 Perceval (S. G.), Bequest to the Fitzwilliam Museum, Cambridge, 697  
 Percival (Prof. J.), The Wheat Plant: A Monograph, 366  
 Perot (A.), The Measurement of Pressure in the Atmosphere of the Sun, 599; The Variation in the Wavelength of the Telluric Lines, 194  
 Perrett (Dr. W.), The Resonance Theory of Hearing, 176  
 Perrier (G.), The Differences of Altitude of the Stations of the Meridian Arc of the Equator, 362  
 Petch (Mr.), Fungi-parasitic on Scale-insects, 154  
 Petersen (Dr. W. F.), Protein Therapy and Non-specific Resistance, 717  
 Petit (A.), The "Awakening" of Arable Earth, 631  
 Petrovitch (Prof. M.), Mécanismes communs aux phénomènes disparates, 739  
 Philip (A.), The Calendar: Its History, Structure, and Improvement, 203  
 Phillips (E. G.), Pneumatic Conveying, 135  
 Pickering (J. W.), and J. A. Hewitt, The Action of "Peptone" on Blood and Immunity thereto, 430  
 Pickering (Prof. W. H.), Changes on the Moon, 690  
 Pickett (F. N.), Gift for a New Medical Research Laboratory, 789  
 Pictet (A.), and J. H. Ross, The Polymerisation of Lævo-glucosane, 667  
 Pidduck (F. B.), The Kinetic Theory of a Special Type of Rigid Molecule, 224  
 Pilsbry (Dr. H. A.), Tertiary Mollusca of Santo Domingo, 692  
 Place (J.), A Phenomenon at the Solfatara of Pozzuoli, near Naples, 559  
 Planck (Prof. M.), elected a Foreign Member of the Swedish Academy of Sciences, 384; Physikalische Rundblicke. Gesammelte Reden und Aufsätze, 739  
 Planiol (A.), Friction Losses in Internal Combustion Motors, 566  
 Plantefol (L.), The Toxicity of Various Nitrophenols for *Sterigmatocystis nigra*, 127  
 Plaskett (Prof.), A Very Massive Star, 791  
 Plimmer (Dr. R. H. A.), Analyses and Energy Values of Foods, 608  
 Plotz (H.), Study of the Culture *in vitro* of the Vaccine Virus, 732  
 Poincaré (R.), Prime Minister of France, 84  
 Policard (A.), and Mlle. J. Tritchkovitch, The Direct Fixation of Fats by the Sebaceous Glands, 800  
 Pollard (Prof. A.), The Mechanical Construction of the Microscope from a Historical Point of View, 754  
 Pommereau (H. de), The Reduction of Ethyl Benzoate and of some other Benzene Compounds by Sodium and Absolute Alcohol, 463  
 Poole (H. E.), High-tension Switchgear, 7  
 Poole (H. H.), Isotopes, 699; The Distribution of Activity in Radium Therapy under Different Conditions of Screening, 225; The Distribution of Activity in Radium Therapy, 831  
 Porter (Prof. A. W.), The Vapour-pressure of Ternary Mixtures, 257  
 Portier (P.), and M. Duval, The Variation of the Osmotic Pressure of the Blood of the Freshwater Teleostean Fishes under the Influence of the Increased Salinity of the Surrounding Water, 800  
 Potts (F. A.), Parasitism and Symbiosis, 643; Symbiotic Bacteria and Phosphorescence, 814; The Food of Tereido, the Ship-worm, 290; Patents and Chemical Research, 338  
 Poulton (Prof. E. B.), elected President of the Association of Economic Biologists, 317; presented with the Gold Medal of the Linnean Society of London, 754  
 Poulton (Dr. E. P.), and Dr. W. W. Payne, Epigastric Pain, 123  
 Praeger (Prof. R. L.), Aspects of Plant Life, with Special Reference to the British Flora, 513  
 Prain (Sir David), Impending Retirement of, from the Directorship of the Royal Botanic Gardens, Kew, 51  
 Pratt-Chadwick (Mara L.), and L. Lamprey, The Alo Man: Stories from the Congo, 710  
 Price (Dr. T. S.), and Dr. D. F. Twiss, A Course of Practical Organic Chemistry. Third edition, 305  
 Priestley (Prof. J. H.), The Toxic Action of Illuminating Gas on Plants, 731  
 Priestley (Major R. E.), The Signal Service in the European War of 1914 to 1918 (France), 336  
 Pring (Dr. J. N.), The Electric Furnace, 99  
 Pringsheim (Dr. P.), Fluoreszenz und Phosphoreszenz im Lichte der neueren Atomtheorie, 739  
 Procopiu (M. St.), An Electro- and Magneto-optical Effect in Liquids holding Metallic Powders in Suspension, 700  
 Procter (W. C.), Foundation of a Visiting Fellowship at Princeton University, 254  
 Pruvot (Mme. A.), A New and Remarkable Type of Gymnosome (Loginiopsis), 463  
 Puchner (Prof. H.), Der Torf, 608  
 Punnett (Prof. R. C.), Animal Breeding, 57  
 Pye and Co., Catalogue of Scientific Apparatus, 421  
 Quincke (Dr. Fr.), appointed Professor of Technical Chemistry at the Technische Hochschule, Hanover, 798  
 Radio Supplies, a Wireless Telephone Receiving Set, 819  
 Raison (C. A.), appointed Part-time Assistant in Anatomy in Birmingham University, 498  
 Ramamurty (S. V.), Space and Ether, 75  
 Raman (Prof. C. V.), Anisotropy of Molecules, 75; Diffraction by Molecular Clusters and the Quantum Structure of Light, 444; Einstein's Aberration Experiment, 477; Molecular Structure of Amorphous Solids, 138; Optical Observation of the Thermal Agitation of the Atoms in Crystals, 42; The Colours of Tempered Steel, 105; The Radiant Spectrum, 175  
 Ramanujam (S. M.), Self-Fertilisation in Mollusca, 593  
 Ramsay (the late Sir William), A Memorial Tablet of, to be placed in Westminster Abbey, 85  
 Ramsbottom (Mr.), "Californian Bees," 155  
 Ranvier (L.), [obituary article], 620  
 Rasmussen (K.), translated by A. and R. Kenney, Greenland by the Polar Sea: The Story of the Thule Expedition from Melville Bay to Cape Morris Jesup, 702  
 Rathbun (Miss Mary J.), The Brachyuran Crabs collected by the American Museum Congo Expedition, 87  
 Ravaz (L.), and G. Vergé, The Germination of the Spores of Vine Mildew, 30  
 Raven (Sir Vincent), The Electrification of Railways, 88  
 Rayleigh (Lord), A Photographic Spectrum of the Aurora of May 13-15, 1921; A Study of the Presence or Absence of Nitrogen Bands in the Auroral Spectrum, 698; A Study of the Glow of Phosphorous: Periodic Luminosity and Action of Inhibiting Substances, 93; The Aurora Line in the Spectrum of the Night Sky, 93  
 Raymond (Prof. P. C.), "The History of Corals and the 'Limeless Oceans,'" 657  
 Rayner (E. H.), J. W. T. Walsh, and H. Buckley, The Lighting of Public Buildings, 490  
 Reade (W. H. V.), A Criticism of Einstein and his Problem, 770  
 Redway (J. W.), Handbook of Meteorology: A Manual for Co-operative Observers and Students, 440  
 Redwood (Sir Boverton), Petroleum. Fourth edition. In three volumes, 403  
 Reed (W. H.), Gift for a Site of the University College of the South-West of England, 629  
 Reese (Dr. C. L.), The Benefits of Research to Corporations, 124  
 Reeves (E. A.), Hints to Travellers. Scientific and General. Tenth edition. 2 Vols., 268  
 Reeves (F.), The Cement Oilfield, Oklahoma, 489  
 Reg (O.), Edited and with an Introduction by W. Gamble, Byeways of Colour Photography, 547  
 Reiche (F.), Die Quantentheorie: ihr Ursprung und ihre Entwicklung, 234  
 Reid (Mrs. Eleanor M.), Fossil Buttercups, 136; The Hollow Curve as shown by Pliocene Floras, 256  
 Reid (Sir G. Archdall), Man, 579; Memory, 551; Mind, 515; Some Biological Problems, 307; Some Problems in Evolution, 104  
 Reid (Miss J. M.), appointed Demonstrator in Zoology in St. Andrews University, 829  
 Reid (W.), Discovery of Comet 1922a, 186



- Rendle (Dr. A. B.), A Seedling of the Red Horse-Chestnut in which a new Terminal Bud had been developed, 534; Specimen of Wood of *Orites excelsa*, R. Br. (family Proteaceæ), one of the Australian Silky Oaks, 194
- Rennie (J.), The Present Position of Bee-Disease Research; Polyhedral Disease of Tipula Species, 396
- Renouf (L. P. W.), appointed Professor of Zoology in University College, Cork, 254
- Rey (J.), Range obtained by a Beacon Light of Great Power fitted with Metallic Reflectors, 226
- Reynolds (Prof. S. H.), Guide to a Geological Relief Map of the Bristol District, 53
- Rhodes (E. C.), On the Relationship of Condition of the Teeth in Children to Factors of Health and Home Environment, 409
- Rhynehart (J. G.), The Life-History and Bionomics of the Flax Flea-Beetle (*Longitarsus parvulus*, Payk.), 398; 825
- Richards (Prof. T. W.), and A. W. Rowe, Electrolytic Dissociation, 658
- Richardson (L.), The Illumination of the Eclipsed Moon, 318
- Richardson (L. F.), The Speckled Wave Front of Light, 683; Thermo-Electric Instrument for Measuring Radiation from the Sky, 240
- Richardson (N. M.), The Weathering of Mortar, 310
- Richardson (W. A.), A Simplification of the Rosiwal Method of Micro-Analysis, 127; The Distribution of Oxides in Washington's Collected Analyses of Igneous Rocks, 126
- Richet (C.), E. Bachrach, and H. Cardot, Studies on the Lactic Fermentation, 566; The Tolerance of the Lactic Ferment to Poisons, 258
- Richter (V. von), edited by Prof. R. Anschütz and Dr. R. Meerwein. Translated by Dr. E. E. Fournier D'Albe. Organic Chemistry, or Chemistry of the Carbon Compounds. Vol. 2: Chemistry of the Carbocyclic Compounds, 709
- Rideal (Dr. S.), and Dr. E. K. Rideal, Chemical Disinfection and Sterilisation, 674
- Ridewood (the late Dr. W. G.), The Skull in Foetal Specimens of Whales of the General Megaptera and Balænoptera, 499
- Riley (J.), The Age of Power: A First Book of Energy, its Sources, Transformations, and Uses, 269
- Ritchie (Dr. J.), The Riddle of Bird Migration, 573
- Rivers (Dr. W. H. R.), elected a Member of the Athenæum Club, 247; The Unity of Anthropology, 323; [death], 753; [obituary article], 786
- Rivière (G.), and G. Pichard, The Partial Sterilisation of the Soil, 327
- Roaf (Dr. H. E.), Biological Chemistry, 704; The Acidity of Muscle during Maintained Contraction, 499
- Roberts (Prof. J. B.), and Dr. J. A. Kelly, Treatise on Fractures in General, Industrial, and Military Practice. Second edition, 304
- Robertson (Prof. B.), Factors of Growth and Multiplication, 187
- Robertson (Prof. J. K.), The Absorption of Fluorescing Sodium Vapour, 43
- Robertson (Sir Robert), The Work and Scope of a Scientific Society, 420
- Robertson (W.), The Message of Science, 9
- Robinson (Prof. B. L.), elected a Foreign Member of the Linnean Society, 655
- Robinson (J. J.), The Message of Science, 43
- Robinson (Prof. R.), appointed Professor of Organic Chemistry in Manchester University, 664; The Atomic Vibrations in the Molecules of Benzenoid Substances, 476
- Robson (G. C.), Self-Fertilisation in Mollusca, 12
- Roderick (Dr.), re-appointed Demonstrator in Surgery in Cambridge University, 797
- Roesler (M.), The Iron-Ore Resources of Europe, 794
- Roget (S. R.), A First Book of Applied Electricity, 271
- Röhmman (Prof. F.), Über künstliche Ernährung und Vitamine, 741
- Rohr (Prof. M. von), Die Brille als optisches Instrument. Dritte Auflage, 772
- Rolleston (Sir Humphry), elected President of the Röntgen Society, 824; elected President of the Royal College of Physicians of London, 526
- Ronaldshay (Lord), elected President of the Royal Geographical Society, 724
- Rordame (A.), Observations of Venus, 592
- Rose (Prof. H. J.), Animals on the Roof, 529
- Rose-Innes (A.), Reform of the Calendar: Mean Value of the Year, 44
- Rosenbusch (H.), Mikroskopische Physiographie der petrographisch-wichtigen Mineralien. Band 1. Erste Hälfte. Untersuchungsmethoden, Fünfte Auflage, Prof. E. A. Wülfing. Lief. 1, 303
- Rosengarten (G.), The Effect of Temperature on the Absorption Spectra of Glasses, 529
- Rosenhain (Dr. W.), Some Cases of Failure in "Aluminium Alloys," 397
- Ross (Sir Ronald), elected a Member of the Athenæum Club, 526
- Rothenstein (Prof. W.), Education and Industry, 223
- Rougier (Prof. L.), La Matière et l'énergie: selon la Théorie de la Relativité et la Théorie des Quanta. Nouvelle édition, 339; translated by Prof. M. Masius, Philosophy and the New Physics: An Essay on the Relativity Theory and the Theory of Quanta, 339
- Roule (L.), The Ontogenesis of the Scombriform Fishes belonging to the Family of the Luvardes, 732; The Periodic Changes of Habitat of the Common Tunny Fish, 30
- Rowan (W.), Breeding Habits of the Merlin, 423
- Rowell (H. S.), The Elliptic Logarithmic Spiral—A New Curve, 716; Units in Aeronautics, 44
- Roy (Rai Bahadur Sarat Chandra), Principles and Methods of Physical Anthropology, 408
- Rusher (E. A.), Statistics of Industrial Morbidity in Great Britain, 21
- Rushton (W.), The Biology of Freshwater Fishes, 731
- Russell (Dr. A.), elected President of the Physical Society of London, 217; The Design of Electric Power Stations, 570; The Induction Motor, 545
- Russell (A.), A Discovery of Pitchblende at Kingswood Mine, Buckfastleigh, 126; and A. Hutchinson: Laurionite and Paralaurionite from Cornwall, 126
- Russell (B.), The Analysis of Mind, 513
- Russell (Dr. E. J.), Photo-Synthesis in Plants, 153
- Russell (Prof. H. N.), A Criticism of Majorana's Theory of Gravitation, 352; Deduction of Star-Distances from Proper Motions, 121; Eccentricity of Double-Star Orbits, 560
- Russell (T. F.), The Constitution of Chromium Steels, 23
- Russell (W. T.), The Relationship between Rainfall and Temperature as shown by the Correlation Coefficient, 598
- Rutherford (Sir Ernest), Artificial Disintegration of the Elements, 418, 584, 601, 614; elected President of the Science Masters' Association, 57; Identification of a Missing Element, 781; to be President of the Liverpool Meeting of the British Association, 384
- Ryland (H. S.), An Improved Subjective Test for Astigmatism, 830; Motor Headlights without Glare, 793
- Saccheri (G.), Euclides Vindicatus, Edited and Translated by G. B. Halsted, 232
- Sadler (Sir Michael), and others, Residential Accommodation for Students in Universities, 759
- Saleeby (Dr. C. W.), The Action of Sunlight, 11, 274; The Advance of Heliotherapy, 663
- Salet (P.), The Pressures of the Atmospheres of the Stars and the Sun, 158
- Salmon (Prof. C. E.), *Sagina filicaulis* Jord., *Cerastium subtetrandrum* Murbeck, *Arum italicum* Mill, 431
- Salter (M. de Carle S.), The Rainfall of the British Isles, 440
- Sambon (Dr. L. W.), Discoveries in Tropical Medicine, 681
- Sampson (Prof.), Wireless Time Signals, 422
- Sanderson (F. W.), [obituary article], 822
- Sandmeyer (T.), [obituary article], 720
- Sargeant (R.), retirement, from the Meteorological Office, 454
- Sarkar (B. B.), The Depressor Nerve of the Rabbit, 255
- Sarolea (Prof. C.), The Royal Academy of Belgium, 684

- Sars (Prof. G. O.), elected a foreign member of the Zoological Society of London, 21
- Sartory (A.), and L. Moinson, A case of Bronchial Moniliaris, 94
- Savile (Sir Henry), The Tercentenary of the death of, 214
- Sazerac (R.), and C. Levaditi, The Use of Bismuth in the Prophylaxy of Syphilis, 127
- Schafer (Sir E. Sharpey), Experimental Physiology, Third edition, 710; presentation to, 122; and others, Physiology, 122
- Schaumasse (A.), Observations of Skjellerup's Comet, 799
- Schenker (W.), Fuel and Lubricating Oils for Diesel Engines, 270
- Schereschewsky (P.), and P. Wehrle, The Significance of Cirrus Clouds in the Prediction of Weather, 226
- Schilt (J.), Determination of Star Magnitudes by a Thermopile, 528
- Schlesinger (Prof. F.), Progressive Latitude Changes, 560
- Schlumberger (C. and M.), Electrical Phenomena produced by Metallic Deposits, 326
- Schmidt (Dr. H.), Translated by Dr. K. Wichmann, Relativity and the Universe: A Popular Introduction into Einstein's Theory of Space and Time, 544
- Schmidt (Dr. J.), The Breeding-Places of the Eel, 193; Oceanography of the Gibraltar Region, 45
- Schoep (A.), Dewindite, a New Radioactive Mineral, 399; Kasolite, a New Radioactive Mineral, 63; Sodidite, a New Radioactive Mineral, 631; Stasite, a New Mineral, Dimorphous with Dewindite, 567; The Absence of Cobalt in Cornetite from Katanga, Belgian Congo, 127
- Schott (Prof. G. A.), Some Terrestrial Experiments on Gravitation and Einstein's Theory, 106
- Schuchert (Dr. C.), Climates of the Past, 424
- Scott (Dr. A.), Report of Laboratory for the Cleaning, etc., of Antiquities, 119
- Scott (P. W.), Elements of Practical Geometry: A Two Years' Course for Day and Evening Technical Students, 574
- Scott-Taggart (J.), Thermionic Tubes in Radio-Telegraphy and Telephony, 38
- Scripture (Dr. E. W.), The Helmholtz Theory of Hearing, 518; The English Ph.D., 780; The 700th Anniversary of the University of Padua, 752
- Seyewetz and Vignat, The Action of Sodium Sulphite on Nitrobenzene, 226
- Searle (Dr. G. F. C.), reappointed University lecturer in Experimental Physics in Cambridge University, 728; The conservation of Angular Momentum; A Focal Line Method of Determining the Elastic Constants of Glass, 397
- Senderens (J. B.), and J. Aboulenc, The Catalytic Hydrogenation of the Polyphenols in the Wet Way, 30; The Catalytic Preparation of the Cyclohexanetriols, 399
- Setchell (W. A.), T. H. Goodspeed, and R. E. Clausen, Results of Crossing certain Varieties of *Nicotiana Tabacum*, 159
- Seward (Prof. A. C.), A Collection of Carboniferous Plants from Peru, 598; A Study in Contrasts: The Past and Present Distribution of certain Ferns, 830; elected President of the Geological Society, 317; Geological Notes on Western Greenland, 830; and R. E. Holthum, Jurassic Plants from Ceylon, 193
- Shackleton (Sir Ernest), [obituary article], 143; Memorial Service at St. Paul's Cathedral, 315
- Shamel (A. D.), Bud Mutations, 282
- Shaner (E. W.), The Teaching of Natural History in Schools, 747
- Shapley (Dr. H.), The Distances of the Short Period Cepheid Variables, 488; and Miss Annie J. Cannon, Relation of Spectral Type to Magnitude, 281; Stars of Class A in the Solar Cluster, 386; and B. Lindblad, Spectroscopic Parallaxes with Objective Prism Spectrograms, 422
- Sharp (Dr. P.), Improved Means and Methods of Education, 288
- Shaw (Sir Napier), Cloud Forms, 301; Dr. Edward Hopkinson, M.P., 82; Mont Blanc Meteorological Observations, 190; The Antitrades, 206; Turbulence as a Meteorological Agency, 469
- Shaw (P. E.), and N. Davy, The Effect of Temperature on Gravitational Attraction, 462
- Shaxby (Dr.), An Instrument by which the Spectra are Formed in Reversed Order, 123
- Shaxby (J. H.), A Curious Physiological Phenomenon, 77
- Shearer (Prof. C.), The Heat Production and Oxidation Processes of the Echinoderm Egg during Fertilisation and Early Development, 193, 666
- Sheehy (E. J.), The Influence of Feeding on Milk Fat, 398
- Sheppard (T.), Papers Bearing upon the Zoology, Botany, and Prehistoric Archaeology of the British Isles, 622; Tin Plague and Arctic Relics, 78, 209
- Sherrington (Sir Charles), Some Points regarding Present-day Views of Reflex Action, 463
- Siegbahn (M.), The Degree of Exactitude of Bragg's Law for the X-rays, 535
- Siegfried (Prof. M.), Über partielle Eiweisshydrolyse, 741
- Sieverts (Prof. A.), appointed Professor of Chemistry at the University of Frankfurt-on-Main, 798
- Silberstein (Dr. L.), appointed an Associate Editor of the Journal of the Optical Society of America, 724
- Simpson (Dr. G. C.), elected a Member of the Athenæum Club, 420; The South-West Monsoon, 109
- Simroth (Prof. H.), Die Pendulations-Theorie, Zweite Auflage, 809
- Singer (Dr. C.), elected President of the International Congress of the History of Medicine, 21; Greek and Arab in Medicine, 438
- Skinner (S.), Boyle's Experiments on Capillarity, 518
- Skjellerup (Mr.), A New Comet, 690
- Slipher (V. M.), Spectral Evidence of a Persistent Aurora, 55; The Spectrum of the Corona in 1918, 656
- Smith (Miss Annie Lorrain), Lichens; A Handbook of the British Lichens, 5
- Smith (B.), Lead and Zinc Ores in the Carboniferous Rocks of North Wales, 6; H. Dewey and B. Smith, Lead and Zinc Ores in the Pre-Carboniferous Rocks of West Shropshire and North Wales, 2 parts, 546
- Smith (C. J.), The Viscous Properties of (a) Carbon Dioxide and Nitrous Oxide, and (b) Nitrogen and Carbon Monoxide, 666
- Smith (Lt.-Col. D. J.), elected President of the Institution of Automobile Engineers, 216
- Smith (D. P.), Experiments on the Electrical Conduction of a Hydrogen Alloy, 158
- Smith (Eng.-Cdr. E. C.), The Centenary of Naval Engineering, 596
- Smith (F. E.), An Electromagnetic Method for the Measurement of the Horizontal Intensity of the Earth's Magnetic Field, 533
- Smith (Prof. G. Elliot), The Brain of Rhodesian Man, 355; and Prof. Hunter, The Piltdown Skull, 726
- Smith (Prof. G. McP.), A Course of Instruction in Quantitative Chemical Analysis for Beginning Students: With Explanatory Notes, Questions, and Analytical Problems, Revised edition, 709
- Smith (Prof. J. W.), impending Resignation of the Chair of Systematic Surgery in Manchester University, 498
- Smith (T.), A Projective Treatment of the Submarine Periscope, 431; Optical Resolving Power and Definition, 745; The Changes in Aberrations when the Object and Stop are Moved, 830; The Classification of Optical Instruments, 830; The Optical Three-apertures Problem, 157; The Position of Best Focus in the Presence of Spherical Aberration, 666; and J. S. Anderson, A Criticism of the Nodal Slide as an Aid in Testing Photographical Lenses, 430; and L. M. Gillman, Achromatism with one Glass, 830
- Smith (W. B.), Elements of Natural Science, Part I, 641
- Smith (Dr. W. G.), Methods of Grassland Analyses, 25; and Dr. A. Lander, Results of a Soil Survey in the Lothians, 25
- Smith (W. W.), to succeed Sir I. Bayley Balfour, 526
- Smithells (Prof. A.), A Searchlight on Solids, 262; The Blue Flame produced by Common Salt on a Coal Fire, 745
- Smith-Rose (A. L.), The Electromagnetic Screening of a Triode Oscillator, 462
- Smyth (L. B.), A variety of Pinite occurring at Ballycorus, Co. Dublin, 398
- Snell (Sir J. F. C.), Power House Design, 570



- Soddy (Prof. F.), Calcium Carbide and the Board of Trade, 342
- Sollas (Prof. W. J.), Shell-Structure in Foraminifera, 424
- Sommelet (M.), and J. Guioth, The Formic Hydrogenation of the Quaternary Salts of Hexamethylenetetramine, 463
- Southern (R.), Indian Marine Polychæta, 187
- Southerns (L.), An Outline of Physics, 641
- Southwell (R. V.), The Free Transverse Vibrations of a Uniform Circular Disc Clamped at its Centre; and on the Effects of Rotation, 289
- Sauvageau (C.), and G. Denigès, The Efflorescences of *Rhodymenia palmata*, 535
- Speak (D. J.), The Institution of Mining and Metallurgy and Technical Education, 597
- Spearmen (C.), Correlation between Arrays in a Table of Correlations, 533
- Spezzazzini (C.), The Argentine Laboulbeniales, 61
- Speight (R.), Changes of Climate in Australasia, 825
- Spitaler (Prof. R.), Das Klima des Eiszeitalters, 512
- Staley (R.), Town Gas Manufacture, 774
- Stapf (Dr. O.), Retirement of, 384
- Starling (Prof. E. H.), The Law of the Heart, 13
- Start (Laura E.), Sea Dayak Fabrics and their Decoration, 291
- Stead (G.), and E. C. Stoner, Low Voltage Glows in Mercury Vapour, 397
- Stevenson (Dr. W. H.), Recent Magnitudes of Novæ, 455
- Stebbing (Prof. E. G.), History of Indian Forestry, 189; The Importance of Scientific Research in Forestry and its Position in the Empire, 225
- Stebbing (Rev. T. R. R.), Tribal Name of the Raninidæ, 108
- Stefansson (V.), The Friendly Arctic: The Story of Five Years in Polar Regions, 636
- Steinriede (Dr. F.), Anleitung zur mineralogischen Bodenanalyse, Zweite Auflage, 643
- Stenhouse (E.), Simple Lessons on the Weather for School Use and General Reading, 440
- Step (E.), Animal Life of the British Isles: A Pocket Guide to the Mammals, Reptiles, and Batrachians of Wayside and Woodland, 514; British Insect Life: A Popular Introduction to Entomology, 514
- Stephens (Dr. G. A.), Walæus and the Circulation of the Blood, 552
- Stephenson (Dr. J.), Non-Specific Therapy, 717; The Morphology, Classification, and Zoogeography of Indian Oligochæta, iv., v., vi., 256
- Stephenson (Marjory), and Margaret Whetham, The Fat Metabolism of the Timothy Grass *Bacillus*, 126
- Steward (G. C.), awarded a Smith's Prize at Cambridge University, 360
- Stewart (Major F. H.), Parasitic Worms of Man and Methods of Suppressing them, 379
- Stiasny (Dr. G.), Studien über Rhizostomeen mit besonderer Berücksichtigung der Fauna des Malaiischen Archipels nebst einer Revision des Systems, 513
- St. John (Prof.), Observations of Venus, 592
- Stoklasa (J.), The Influence of Selenium and of Radium on the Germination of Seeds, 632; The Influence of Selenium on Plant Evolution, in the Presence or Absence of Radioactivity, 732
- Stone (E. H.), Stonehenge: Concerning the Four Stations, 410
- Störmer (Prof. C.), Photographic Studies of the Aurora, 47
- Strachan (Dr. P. D.), and Dr. R. S. Clay, The Tuning of Pianos, 591
- Stradling (R. E.), appointed Head of the Department of Civil Engineering at the Bradford Technical College, 664
- Strachling (C.), The Radioactivity of the Uranium Oxides, 63
- Strasburger (Dr. E.), Textbook of Botany, Rewritten by Dr. H. Fitting, Dr. L. Jost, Dr. H. Schenck, Dr. G. Karsten. Fifth English Edition Revised with the Fourteenth German Edition by Prof. W. H. Lang, 740
- Strong (C. A.), The Wisdom of the Beasts, 608
- Stuart (C. M.), Presidential Address to the Incorporated Association of Head Masters, 61
- Stumper (R.), New Observations on the Poison of Ants, 258
- Sudeley (Lord), and Lord Hylton, The Educational Use of Museums, 688
- Sumner (Dr. F. B.), The Organism and Environment, 456
- Sussmilch (C. A.), The Geology of the Gloucester District, N.S.W., 226
- Sutcliffe (G. E.), A Bright Fireball, 55
- Sutermeister (E.), Chemistry of Pulp and Paper Making, 271
- Sutherland (J.), The Past and Present Position of Forestry in Great Britain, 189
- Svedberg (Prof. T.), The Grain of the Photographic Plate, 221; The Interpretation of Light Sensitivity in Photography, 795
- Sverdrup (H. V.), New Surveys on the Arctic Coast of Asia, 423; The Chuchki Natives of North-Eastern Siberia, 792
- Swick (C. H.), Gravity Observations, 188
- Swift and Son, Ltd., Catalogue of Petrological Microscopes, 658
- Swinton (A. A. Campbell), David Hughes' Electrical Experiments, 315, 485
- Taffara (L.), Le Nubi, Parte 1, Testo; Parte 2, Atlante, 301
- Taffin (M.), Annealing and the Mechanical Properties of Glass, 158; Annealing of Glass, 94
- Tanret (G.), The Chemical Composition of Ergot of Diss and the Ergot of Oats, 535
- Tata (the late Sir Ratan), Continuance of Benefaction to the Ratan Tata Foundation of London University, 155
- Tattersall (Dr. W. M.), The Sound-Producing Mechanisms of Crustacea, 431
- Taylor (E. G. R.), A Sketch Map Geography: A Text-book of World and Regional Geography for the Middle and Upper School, 135
- Taylor (E. W.), Effect of Changes of Surface Curvature at the Focus of an Astronomical Object Glass, 566
- Taylor (G. I.), Stability of a Viscous Liquid contained between two Rotating Cylinders, 533
- Taylor (J. L. B.), The American Indians' Knowledge of the Mastodon, 387
- Taylor (W.), Cohesion, 10
- Taylor (Dr. W.), and A. D. Husband, The Varying Rates of Secretion of Milk on its Percentage Composition, 25
- Taylor (Dr. W. W.), The Chemistry of Colloids and some Technical Applications. Second edition, 204
- Termier (P.), and L. Joleaud, The Suzette Layer: The Question of its Origin, 29
- Terroine (E. F.), and R. Wurmser, The Energy Yield in the Growth of *Aspergillus Niger*, 831
- Thirring (Prof. J. H.), Translated by R. A. B. Russell, The Ideas of Einstein's Theory: A Theory of Relativity in Simple Language, 544
- Thomas (Major E. R.), Post-Certificate Science for the Non-Specialist, 57
- Thomas (Prof. G.), The Development of Institutions under Irrigation; with Special Reference to Early Utah Conditions, 577
- Thomas (H. H.), Structure of some Angiospermous Fruits, 190; Some New and Rare Jurassic Plants from Yorkshire (V.), 290; and E. G. Radley, The So-called "Avanturine" from India, with an Analysis of the Contained Mica, 126
- Thomas (N. W.), The Week in West Africa, 124
- Thomas (V.), A Mixed Organometallic Compound of Aluminium, 326
- Thompson (A. H.), appointed Reader in Mediæval History in Leeds University, 697
- Thompson (Prof. D'Arcy W.), Greek Mathematics, 330
- Thompson (F. C.), and E. Whitehead, Some Mechanical Properties of the Nickel-silvers, 397
- Thompson (Prof. M'Lean), The Floral Development of the Cannon-Ball Tree, 190; the Floral Structure of *Napoleona imperialis*, Beauv., 257
- Thompson (R. L.), The Teaching of History and Geography, 91
- Thompson (T. W.), The Taboo of Women among Gypsies, 319

- Thomson (Dr. A. L.), The Migration of British Swallows, 346
- Thomson (Sir Courtauld), The National Council for Mental Hygiene, 565
- Thomson (J.), Dr. Frank Bottomley, 240
- Thomson (Prof. J. A.), Mountain and Moorland, 513; The Haunts of Life: Being Six Lectures delivered at the Royal Institution, Christmas Holidays, 1920-1921, 710
- Thomson (Sir J. J.), elected President of the Institute of Physics: Address to the Institute of Physics, 723; Rays of Positive Electricity and their Application to Chemical Analyses. Second edition, 671
- Thorpe (Sir T. E.), A History of Chemistry, 603; Chemical Warfare, 40; Prof. G. Ciamician, 245; Prof. P. A. Guye, 523; and others, A Dictionary of Applied Chemistry. Vol. 1. Revised and enlarged edition, 100; Vol. 2. Revised and enlarged edition, 266
- Thoulet (J.), Deep Submarine Volcanic Eruptions, 632; The Distribution of the Chalk in Deep-Sea Sediments, 732; The Neutral Lines of Submarine Coast Sediments, 399
- Thuillier (Col. Sir Henry), [obituary article], 452
- Thurn (Sir Everard im), Presidential Address to the Royal Anthropological Institute, 53
- Tilley (C. E.), Density, Refractivity, and Composition Relations of Some Natural Glosses, 126
- Timmermans (J.), Mlle. H. Van der Host, and H. K. Onnes, The Melting Points of Pure Organic Liquids as Thermometric Standards for Temperatures below 0°C., 258
- Tocher (Dr.), The Citric Solubility of Manurial Phosphates, 25
- Todd (Prof.), and Mr. McAfee, Proposed 50-Foot Reflector, 592
- Todman (Mr. and Mrs. G. F.), Gift for Cancer Research, 789
- Toit (A. L. du), Former Land-Connections; the Glaciation of South Africa, 757
- Tompkins (A. E.), Turbines. Third edition, 171
- Toothaker (C. R.), The Educational Work of the Philadelphia Commercial Museum, 53
- Toporescu (E.), The Preparation of Sodium Bicarbonate, 567
- Torr (C.), Small Talk at Wreyland. Second Series, 678
- Tozzer (A. M.), Maya Hieroglyphs, 282; Mexican Archaeology, 624
- Trivelli (A. P. H.), and S. E. Sheppard, The Silver Bromide Grain of Photographic Emulsions, 304
- Trousset (J.), The Laws of Kepler and the Relativist Orbits, 699
- Truesdale and Hayes, The Examination of Textiles by X-rays, 283
- Trumpler (R.), The Pleiades, 152
- Truscott (Prof. S. J.), Alternating-Current Mineral Separation, 556
- Turner (Prof. H. H.), Biographical Address at the Centenary of the Royal Astronomical Society, 761
- Turner (L. B.), Wireless Telegraphy and Telephony: An Outline for Electrical Engineers and Others, 38
- Turner (Prof. W. E. S.), elected President of the Society of Glass Technology; The British Glass Industry: Its Development and Outlook, 590; The Methods of Determining the Durability of Glass, 157
- Turrill (W. B.), Vallentin's Illustrations of the Flowering Plants and Ferns of the Falkland Islands, 370
- Tutton (Dr. A. E. H.), Monoclinic Double Selenates of the Manganese Group; Monoclinic Double Selenates of the Cadmium Group, 461
- Twyman (F.), An Optical Sonometer, 666; and J. Perry, The Determination of the Absolute Stress-Variation of Refractive Index, 666
- Tyler (Prof. J. M.), The New Stone Age in Northern Europe, 302
- Tyrrell (G. W.), The Pre-Devonian Basement Complex of Central Spitzbergen, 257
- Urbain (Prof. G.), The Atomic Numbers of Ytterbium, Lutecium, and Celtium, 781; The Atomic Numbers of Neo-Ytterbium, Lutecium, and Celtium, 799
- Urbain (P.), and Prof. G. Urbain, The Extraction and Purification of Scandium from Thorveitite of Madagascar, 799
- Underhill (Prof. F. P.), A Manual of Selected Biochemical Methods as Applied to Urine, Blood, and Gastric Analysis, 645; and M. Ringer, Blood Concentration Changes in Influenza, 30
- Van Cleef (E.), Rainfall Maps of Latin America, 424
- Van Maanen (Dr. A.), Internal Motion in the Spiral Nebula Messier, 33, 158
- Vallentin (Mrs. E. F.), with Descriptions by Mrs. E. M. Cotton, Illustrations of the Flowering Plants and Ferns of the Falkland Islands, 370
- Varney (W. D.), The Drainage of the Vale of Pewsey, 23
- Veil (Mlle. C.), The Relation between the Chlorine Index and the Nitrogen Content of Plant-Soil, 226
- Veitch (R.), and W. Greenwood, The Food-Plants or Hosts of some Fijian Insects, 95
- Venkataramaiah (Y.), Change of Colour of a Crystal of Sodium Thiosulphate by the Addition of Colloidal Gold or Platinum Solution, 590; Wendt and Landauer, Active Hydrogen, 696
- Venn (Dr. J.), and J. A. Venn, Alumni Cantabrigienses: A Biographical List of all known Students, Graduates, and Holders of Office at the University of Cambridge, from the Earliest Times to 1900. Part 1, From the Earliest Times to 1751. Vol. 1, 742
- Veno (Sir William), Offer of a Prize for the Discovery of a Cure for Cancer, 147; Gift for Research Work in Cancer, 184
- Verner (Col. W.), [obituary article], 213
- Vernon (Dr. H. M.), Industrial Fatigue and Efficiency, 511
- Vernon (W. S.), appointed Assistant Lecturer in Physics in Manchester University, 155
- Verworn (Prof. Max), [obituary article], 213
- Vickers (Prof. K. H.), appointed Principal of University College, Southampton, 429
- Vila (A.), The Influence of Heat and of some Solvents on the Viscosity of Horse Serum, 667
- Villedieu (M. and Mme. G.), Contribution to the Study of Anticryptogamic Copper Mixtures, 464
- Villey (J.), Physique élémentaire et théories modernes. Première Partie, Molécules et Atomes: États d'équilibre et mouvements de la matière, 739; The Adiabatic Liquefaction of Fluids, 62
- Vines (T. H.), The Palæolithic Age in India, 387
- Visser (Dr. S. W.), Propagation of Earthquake Waves, 283
- Vlies (L. E.), elected Chairman of the Chemical Section of the Manchester Literary and Philosophical Society, 690
- Voigtländer (Dr. F.), [death], 654
- Vredenburg (E.), Palæontology of the Burma Oilfields, 825; Tertiary Fossils of Burma, 594
- Wade (C. F.), The Fireman's Handbook and Guide to Fuel Economy, 204
- Wahl (A.), G. Normand, and G. Vermeylen, The Monochlorotoluenes, 599
- Waidner (Dr. C. W.), [obituary], 654
- Wailes (G. H.), Heliozoa (The British Freshwater Rhizopoda and Heliozoa). Vol. 5, 441
- Walcott (Dr. C. D.), The Limbs of Trilobites, 562
- Walker (E. W. A.), Studies in Bacterial Variability, 126
- Walker (Prof. M.), The Diagnosing of Troubles in Electrical Machines, 674
- Waller (Dr. A. D.), [death], 348; [obituary article], 418
- Wallis (J. S.), The Carboniferous Limestone (Avonian) of Broadfield Down (Somerset), 193
- Wallis (P.), and A. Wallis, Prices and Wages: An Investigation of the Dynamic Forces in Social Economics, 101
- Walsh (J. W. T.), and others, Motor Headlights, 694
- Walter (L. H.), Directive Wireless Telegraphy: Direction and Position Finding, etc., 270
- Walters, Jr. (F. M.), and R. Davis, Colour Sensitive Photographic Plates, 529
- Walters (R. C. S.), Greek and Roman Engineering Instruments, 23
- Walton (Lt.-Col. H. J.), Entomology and Malaria, 334
- Walton (J.), The Ecology of the Flora of Spitzbergen, 396



- Waran (H. P.), A New Form of Direct-reading Barometer, 763; A New Form of High Vacuum Automatic Mercury Pump, 462; A New Form of Interferometer, 94
- Warburg (Comdr. H. D.), Tides and Tidal Streams: A Manual compiled for the Use of Seamen, 767
- Ward (Prof. R. de C.), United States Temperatures, 490
- Wark (J. W.), Energy Charges Involved in Transmutation, 108
- Warner (C. A.), Field-mapping for the Oil Geologist, 474
- Waterhouse (G. A.), The Need for a Zoological Survey of Australia, 831; Breeding Experiments with the Satyrine Genus *Tisiphone*, 832
- Waterhouse (W. L.), The Production in Australia of the Aecial Stage of *Puccinia graminis*, Pers., 226
- Waters (H. H.), Astronomical Photography for Amateurs, 339
- Waterston (Dr. J.), The Systematics of the Parasitic Hymenoptera, 119
- Watson (Dr. M.), with Contributions by P. S. Hunter and A. R. Wellington, The Prevention of Malaria in the Federated Malay States: A Record of Twenty Years' Progress, 334
- Wayland (E. J.), and Dr. A. M. Davies, The Miocene of Ceylon, 730
- Webster (A. G.), Some New Methods in Interior Ballistics, 30
- Wedderburn (Dr. E. M.), Seiches; and the Effect of Wind and Atmospheric Pressure on Inland Lakes, 462
- Wegener (Prof. A.), Die Entstehung der Kontinente und Ozeane, 202; The Flotation of Continents, 757
- Weimarn (Prof. P. P. von), appointed Research Associate of the Imperial Institute of Osaka, 622
- Weinstein (A.), Homologous Genes and Linear Linkage in *Drosophila virilis*, 30
- Weiss (Prof.), Graft-Hybrids, 27
- Weiss (H.), and P. Henry, The Influence of Temperature on the Velocity of Interpenetration of Solids, 226; The Influence of the Time Factor on the Interpenetration of Solids by Chemical Reaction, 831
- Weitz (B. O.), Some Illustrative Types of Latin-American Rainfall, 424
- Welch (M. B.), Occurrence of Oil Ducts in certain Eucalypts and Angophoras, 95
- Wells (H. G.), The Importance of Science, 728
- Wendell (Dr. G. V.), [obituary], 485
- Wendt (Dr. G.), and C. E. Iron, Disintegration of Elements, 418
- Wendt (Dr. G. L.), Active Hydrogen and Nitrogen, 749
- Wertheimer (E.), The Entero-hepatic circulation of the Bile Acids, 363
- Wesenberg-Lund (Dr. C.), The Biology of Danish Calicidæ, 325
- Westermarck (Prof. E.), The History of Human Marriage. Fifth edition. 3 Vols., 502
- Westgren (Dr.), and Mr. Phragmen, X-ray Crystallographic Investigations on Iron and Steel, 817
- Westwood (A.), The Assay of Gold Bullion, 397
- Wetmore (A.), Fossil Birds from Porto Rico, 792
- Weyl (Prof.), Translated by H. L. Brose, Space—Time—Matter, 634
- Whatmough (J.), Rehtia, the Venetic Goddess of Healing, 154
- Wheeler (Eng. Lt.-Commr. S. G.), Entropy as a Tangible Conception: An Elementary Treatise on the Physical Aspects of Heat, Entropy, and Thermal Inertia for Designers, Students, and Engineers, and particularly for Users of Steam and Steam Charts, 404
- White (Dr. I. C.), and Mrs. White, gift to the University of West Virginia, 316
- Whitehead (S. E.), Benzol: Its Recovery, Rectification, and Uses, 513
- Whitlock (Dr. H. P.), A List of New Crystal Forms of Minerals, 793
- Whyte (F.), appointed lecturer in Engineering in University College, Dundee, 829
- Widal (F.), P. Abrami, and J. Hutinel, Researches on the Proteopexic Insufficiency of the Liver in Dysenteric Hepatitis, 258
- Wightman's Secondary School Mathematical Tables. Edited by F. Sandon, 737
- Wild (F.), The *Quest* expedition, 790; 622
- Wildeman (E. de), Contribution à l'étude de la flore du Katangar, 548
- Willets (Dr. D. G.), [obituary], 654
- Williams (J. Lloyd), The Life-histories of Laminaria and Chorda, 699
- Williams (S.), A New Variable in Cygnus, 656
- Willis (Dr. J. C.), and G. U. Yule, Some Statistics of Evolution and Geographical Distribution in Plants and Animals, and their Significance, 177, 256, 274, 413
- Wilson (Prof. E.), The Susceptibility of Feebly Magnetic Bodies as affected by Compression, 762
- Wilson (Prof. G. M.), and Prof. K. J. Hoke, How to Measure, 472
- Wirtz (C.), Radial Motions of Spirals and Clusters, 791
- Wissler (Dr. C.), Man in the Pacific, 387; The American Indian's Knowledge of the Mastodon, 387
- Witherby (H. F.), Progress of Bird-marking in 1921, 527
- Wollaston (Sir Arthur Naylor), [obituary], 246
- Womersley (W. D.), The Energy in Air, Steam, and Carbon Dioxide from 100° C. to 2000° C., 93
- Wood (H. E.), Reid's Comet, 1922 (a), 422
- Wood (H. O.), Seismological Stations of the World, 489
- Wood (Prof. T. B.), and Prof. J. W. Capstick, The Progress of Metabolism after food in Swine, 730
- Woods (H.), T. W. Vaughan, and J. A. Cushman, Tertiary Fossils of Peru, 561
- Woods (Miss), Nova Puppis 1902, 217
- Woodcock (Dr. H. M.), and Miss Olive Lodge, Parasitic Protozoa collected by the British (*Terra Nova*) Expedition, 530
- Woodhead (Sir German Sims), [obituary article], 19
- Woodhead (T. W.), Junior Botany, 773
- Woodruff (L. L.), The present Status of the long-continued Pedigree culture of *Paramecium aurelia* at Yale University, 159
- Woodward (Dr. A. Smith), A supposed Ancestral Man in North America, 750; elected President of the Linnean Society of London, 754
- Woog (S.), Velocity of Extension of Thin Layers of Oil on the Surface of a Sheet of Water, 158
- Woolley (J.), Sons and Co., Ltd., The Scientist's Reference Book and Diary for 1922, 88
- Woolley (the late H.), gift by executors for a lectureship in Pharmaceutics in Manchester University, 155
- Wordie (J. M.), A Summer Visit to Jan Mayen Island, 15; Antarctic Geology, 218; Grant to, in aid of an Expedition to Greenland, 697
- Wormall (A.), appointed demonstrator in Bio-chemistry in Leeds University, 254
- Wright (W. H.), on the Continuous Radiation found in some Celestial Spectra beyond the Limit of the Balmer Series of Hydrogen, 810
- Wright (Dr. W. H.), Spectrum of  $\alpha$  Cygni, 89
- Wrinch (Dr. Dorothy), The Theory of Relativity in Relation to Scientific Method, 381; and others, Recent Developments of Relativity Theory, 90
- Wulff (A.), Bibliographia Agrogeologica: Essays of a Systematic Bibliography of Agro-Geology, 338
- Yancey (H. F.), and T. Fraser, Sulphur in Illinois Coalbeds, 354
- Young (R.), The Work of Timothy Hackworth, 350
- Young (Prof. S.), The Vapour Pressures and Boiling Points of Non-miscible and Miscible Liquids and the Composition of the Vapours (distillates) from such Heterogeneous and Homogeneous Mixtures, 431; with the collaboration of various authors, Distillation Principles and Processes, 434
- Younghusband (Sir F.), the Need for Intensive Geographical Examination of the Homeland, 753
- Zaepffel (E.), The Mechanism of the Orientation of Leaves, 127
- Zanetti (Prof. C. V.), [death], 788
- Zeeman (Dr. P.), Verhandeligen van, over Magneto-Optische Verschijseleng, 66
- Zimmern (A.), The Influence of Temperature on the Sensibility of Emulsions in Radiography, 326

# TITLE INDEX.

- Aberdeen University, Carnival on Behalf of the Local Hospitals, 729; Conferment of Doctorates, 460
- Aberrations, The Changes in, when the Object and Stop are moved, T. Smith, 830
- Aberystwyth, Agricultural Research at, 795
- Absolute Measurements in Electricity and Magnetism, Prof. A. Gray. Second edition, 166
- Acetylene, The Action of, on the Sodium Derivatives of Ketones and the Preparation of the Dialkylethynylcarbinols, R. Locquin and S. Wouseng, 831
- Achromatism with one Glass, T. Smith and L. M. Gillman, 830
- Actiniums, Genesis des, Das Problem der, M. C. Neuburger, 809
- Admiralty Chemical Laboratories, Co-ordination of the Work of the various, 215
- Aeration of Quiescent Columns of Distilled Water and of Solutions of Sodium Chloride, W. E. Adeney, A. G. G. Leonard, and Miss A. M. Richardson, 667
- Aerial Navigation, The Use of Light as an Aid to, Lt.-Col. L. F. Blandy, 286
- Aeronautical Engineering: A Text-book of, The Problem of Flight, Prof. H. Chatley. Third edition, 808
- Aeronautics: Principles and Problems of, Prof. G. H. Bryan, 296; Units in, A. R. Low, 12, 139; H. S. Rowell, 44; Sir George Greenhill, 74
- Aeroplane: Crashes: The "Hole in the Air," the "Spin," Dr. W. Galloway; Prof. L. Bairstow, 612; The Mechanical Principles of the, Dr. S. Brodetsky, 296
- Aeroplanes, The Noise caused by, C. Dévé, 631
- Africa, East, The Structure of, 233
- African Lakes, Fauna of, Dr. W. A. Cunningham, 28
- Agricultural: Atlas of Wales, An, J. P. Howell, 304; Botany, National Institute of, First Election of Fellows of the, 249; Experiments at Ithaca, N.Y., 393; Research at Aberystwyth, 795
- Agriculture at the British Association, Dr. A. Lauder, 25; Research Work in, 383
- Agrogeologica: Bibliographia, Essay of a Systematic Bibliography of Agro-Geology, Dr. A. Wulff, 338
- Air: Bubbles in various Liquids, Cataphoresis of, T. A. McLaughlin, 667; Conference, The, 220; Ministry, Safeguarding the Applied Scientific Research of the, 149; Steam, and Carbon Dioxide, The Energy in, from 100° C. to 2000° C., W. D. Womersley, 93; Suspended Impurity in the, Dr. J. S. Owens, 289
- Alaska, The Petroleum Resources in, 87
- Albert Medal of the Royal Society of Arts, The, awarded to Sir Dugald Clerk, 823
- Alchemy, Contemporary, 601
- Alcohol: as a Motor Spirit, 219; Industrial and Power, Dr. R. C. Farmer, 577
- Algebra: A First Book in, Dr. F. Durell and E. E. Arnold, 737; A Second Book in, Dr. F. Durell and E. E. Arnold, 737; Elementary, Part 2, C. V. Durell and R. M. Wright, 574; The School (Matriculation Edition), A. G. Cracknell. Sixth impression (Second edition), 737
- Algeria: Among the Hill Folk of, Journeys among the Shawia of the Aurès Mountains, M. W. Hilton-Simpson, 336
- Allen, W. H., and Sons, Ltd., The Laboratory of, 151
- Alo Man, The: Stories from the Congo, Mara L. Pratt-Chadwick and L. Lamprey, 710
- Alternating-Current Mineral Separation, Prof. S. J. Truscott, 556
- Alternating Currents, G. C. Lamb, 2 Parts, 710
- Altitude of the Stations of the Meridian Arc of the Equator, The Differences of, G. Perrier, 362
- Aluminium: A Mixed Organo-metallic Compound of, M. Faillebin, 127; A Mixed Organo-metallic Compound of, V. Thomas, 326; and Zinc, The Alloys of, D. Hanson and Miss M. L. V. Gayler, 397; "Alloys," Some Cases of Failure in, Dr. W. Rosenhain, 397
- America, Results of Research in, The Universities and the Publication of the, 664
- American: Academy of Arts and Sciences, Prof. A. S. Eddington and Sir T. Clifford Allbutt elected Honorary Foreign Members of the, 788; Association at Toronto, The, Dr. B. E. Livingston, 285; Presidential Address to the, Dr. L. O. Howard, 79; Colleges and Universities, Facilities for Foreign Students in, 497; Museum of Natural History, A Study of the, 81; Organic Chemicals, 162; Pitt Rivers Museum, An, 423; Research Chemicals, List of, 151; Universities, Doctorates in Science conferred by, in 1920-21, 532
- Amino-naphthenes, A New Preparation of, A. Mailhe, 326
- Ammonia: into Urea, The Transformation of, C. Matignon and M. Fréjacques, 326; Oxidation, C. S. Imison and W. Russell, 388; The Oxidation of, Prof. J. R. Partington, 137; The Role of Gaseous Impurities in the Catalytic Oxidation of, E. Decarrière, 535
- Ammoniacal Nitrogen in Nitrogenous Organic Material, Estimation of, J. Froidevaux, 731
- Ammonium: Chloride, The Preparation of, P. M. Monval, 631; Molybdo-malate, The Action of Acids on, E. Darmois, 631; Two New Molybdo-malates of, E. Darmois, 226
- Amorphous Solids, Molecular Structure of, Prof. C. V. Raman, 138
- Amphibian Metamorphosis and Pigment Responses in relation to Internal Secretions, Experiments on, J. S. Huxley and L. T. Hogben, 193
- Amundsen's Arctic Expedition: The Missing Men of, 248; Plans for, 420
- Amylases of Different Origins, The Distinctive Properties of, J. Effront, 94
- Amylocellulose considered as a Compound of Silicic Acid and Amylose, G. Malfitano and M. Catoire, 667
- Analysis, Elementary, Prof. C. M. Jessop, 737
- Anaphylactic and Anaphylactoid Shock, The Resistance of Females during Pregnancy to, A. Lumière and H. Couturier, 327
- Anaphylaxis and Anaphylatoxins, Dr. H. H. Dale and C. H. Kellaway, 430
- Ancestral Man in North America, A Supposed, Dr. A. Smith Woodward, 750
- Ancient Tales from Many Lands: A Collection of Folk Stories, R. N. Fleming, 269
- Angami Nagas, The, with some Notes on Neighbouring Tribes, J. H. Hutton, 539
- Angiospermous Fruits discovered in the Middle Jurassic Rocks of Yorkshire, Structure of some, H. H. Thomas, 190
- Angle Comparators of High Precision for the Goniometry of Prisms, J. Guild, 830
- Anglo-: Egyptian Sudan, Geological Survey of the, G. V. Colchester appointed a Geologist on the, 216; Swedish Society, Travelling Scholarships of the, awarded to Miss Joan Evans and W. N. Edwards, 384
- Angular Momentum, The, Conservation of, G. F. C. Searle, 397
- Animal: Breeding, Problems of, Prof. R. C. Punnett, 57; Life of the British Isles: A Pocket Guide to the Mammals, Reptiles, and Batrachians of Wayside and Woodland, E. Step, 514
- Animals: on the Roof, Prof. H. J. Rose, 529; with Composite Spinal Cords, Functional Regulations in, S. R. Detwiler, 31
- Annulus, Thin Plane, Problems relating to a, Prof. J. W. Nicholson, 224
- Antarctic Geology, J. M. Wordie, 218
- Anthocyanic Pigments, Formation of, R. Combes, 194
- Anthocyanidines in Plant Tissues, The Detection of the Pseudo Bases of, R. Combes, 94
- Anthrax Infection in Man, 119
- Anthropology: Physical, Principles and Methods of, Rai Bahadur Sarat Chandra Roy, 408; The Unity of, Dr. W. H. R. Rivers, 323
- Anti-Oxidation, C. Moureu and C. Dufraisse, 320
- Antiquities: in the Neighbourhood of Dunect House, Aberdeenshire, On Some, Rt. Rev. Dr. G. F. Browne,



- 265; Laboratory for the Cleaning, etc., of, Report of a, Dr. A. Scott, 119
- Antiseptic Action and Chemical Constitution, Relationships between, Prof. J. B. Cohen, Prof. C. H. Browning, R. Gaunt, and R. Gulbrandsen, 255
- Antitrades, The, Dr. W. van Bemmelen, 172; Sir Napier Shaw, 206
- Antityphoid Vaccination by Scarification, A. Lumière and J. Chevrotier, 632
- Ants, The Poison of, New Observations on, R. Stumper, 258
- Apogamous Reproduction, Dr. C. H. Ostenfeld, 218
- Apparatus for determining the Standard Deviation Mechanically, Dr. W. L. Balls, 534
- Apple Industry of North America, The Commercial, J. C. Folger and S. M. Thomson, 645
- Apples in Storage, Diseases of, Mrs. M. N. Kidd, 462
- Arabia, New Surveys in, D. Carruthers, 756
- Arabian Medicine: Being the FitzPatrick Lectures delivered at the College of Physicians in November 1919 and November 1920, Prof. E. G. Browne, 438
- Arabic Chemistry, E. J. Holmyard, 778
- Araucaria imbricata*, Raising of Plants from Seeds of, J. Anderson; W. J. Bean, 87; Sir Herbert Maxwell, 209
- Archer's Bow in the Homeric Poems, The, H. Balfour, 91
- Archæology: European, Prof. R. A. S. Macalister. Vol. 1, The Palæolithic Period, 605; in Mexico, 59
- Arctic: Basalts, The Magnetic State of, P. L. Mercanton, 667; Coast of Asia, New Surveys on the, H. U. Sverdrup, 423; Expedition, Capt. R. Amundsen to co-operate with the Dept. of Terrestrial Magnetism of the Carnegie Institution of Washington in his, 280; Exploration, New Methods of, Dr. H. R. Mill, 636; Seas, Ice in the, in 1921, 489; The Friendly, The Story of Five Years in Polar Regions, V. Stefansson, 636
- Argentine Republic, Botany of the, 60
- Aristotelian Society, Proceedings of the. New Series—Vol. xxi., 371
- Arithmetic and Accounts, Commercial, A Short Course in, A. R. Palmer, 644
- Arsenic, Colloidal Sulphide of, The Flocculation of, A. Boutaric and M. Vuillaume, 799
- Art, Standards and Principles in, A. H. Hannay, 256
- Arthropoda, Studies on, Dr. H. J. Hansen, 456
- Aryan Problem, Bronze Swords and the, H. Peake, 563
- Aspergillus Niger*, The Energy Yield in the Growth of, E. F. Terroine and R. Wurmser, 831
- Assam, Native Life in the Highlands of, H. Balfour, 539
- Astigmatism, An Improved Subjective Test for, H. S. Ryland, 830
- Astrographic Catalogue, The, 24; The Perth Section of the, 386
- Astronomical: Chronography of Precision, An, H. Abraham and R. Planiol, 29; Photography for Amateurs, H. H. Waters, 339; Union, International, Dr. A. C. D. Crommelin; Prof. W. W. Campbell elected President, 727

#### ASTRONOMICAL NOTES.

##### Comets:

- Comet Notes, 186; Reid's Comet, 1922 (a), H. E. Wood, 422; New Comet, Skjellerup, 690; Comets, Dr. Steavenson, and others, 725

##### Instruments:

- A Printing Chronograph, 217; Proposed 50-foot Reflector, Prof. Todd and Mr. McAfee, 592

##### Meteors:

- The Shower of January Meteors, W. F. Denning, 55; A Bright Fireball, G. E. Sutcliffe, 55; Meteoric Shower of December 4-5, 1921, W. F. Denning, 121; Fireball observed in Sunshine, W. F. Denning, 217; Detonating Fireball in Sunshine, W. F. Denning, 249; Meteoric Fireballs, 318; The Shower of Lyrids, 528; The April Meteors, W. F. Denning, 560; Large Fireball, 725; The Meteors of Pons-Winnecke's Comet, W. F. Denning, 824

##### Observatories:

- The Einstein Tower, 24

##### Planets:

- Conjunction of Mars with a Star, W. F. Denning, 186; Saturn, W. F. Denning, 318; The Illumination of the Eclipsed Moon, L. Richardson, 318; The Stellar Magnitude of the Ringless Saturn, J. van der Bilt, 352; Planetary Observations at Sétif, Jarry-Desloges, 386; The Approaching Opposition of Mars, 386; Ratios of Planetary Distances, F. A. Black, 422; The Position of Neptune's Equator, A. Newton, 528; Jupiter and his Markings, W. F. Denning, 591; Observations of Venus, A. Rordame, Prof. St. John, 592; The Planet Mercury, W. F. Denning, 623; Changes on the Moon, Prof. W. H. Pickering, 690; Prof. Brown's New Lunar Tables, 690

##### Stars:

- Changes in the Crab Nebula, J. C. Duncan, 24; Movements in Spiral Nebulæ, Dr. J. H. Jeans, 55; The Origin of Binary Stars, Dr. J. H. Jeans, 89; The Orbit of Castor, Dr. W. Doberck, 89; Spectrum of a Cygni, Dr. W. H. Wright, 89; Deduction of Star-distances from Proper Motions, Prof. H. N. Russell, 121; The Pleiades, R. Trumpler, 152; Internal Motions in the Spiral Nebula M 81, Dr. van Maanen, 186; Nova Puppis, 1902, Miss Woods, 217; Movements in Spiral Nebulæ, Dr. van Maanen, 249; Relation of Spectral Type to Magnitude, Dr. H. Shapley and Miss Annie J. Cannon, 281; Comparison of Speed of Blue and Yellow Light, 318; Parallaxes and Proper Motions, Dr. van Maanen, 318; The Definition of a Nova, Rev. J. G. Hagen, 352; Stars of Class A in the Solar Cluster, Dr. H. Shapley and Miss Annie J. Cannon, 386; The Light-Curve of Nova Cygni, 1920, 386; Stars of the  $\beta$  Canis Majoris Type, F. Henroteau, 422; A Study of Obscure Nebulæ, Rev. J. G. Hagen, 455; Recent Magnitudes of Novæ, Dr. W. H. Steavenson, 455; Evening Stars, 488; The Distances of the Short-Period Cepheid Variables, Prof. J. C. Kapteyn and P. J. van Rhijn; Dr. Shapley, 488; Determination of Star Magnitudes by a Thermopile, J. Schilt, 528; Eccentricity of Double-Star Orbits, Prof. H. N. Russell, 560; Effective Temperatures of Stars, Dr. W. W. Coblentz, 560; Progressive Latitude Changes, Prof. F. Schlesinger, 560; A New Variable in Cygnus, S. Williams, 656; The Search for New Stars, 824; Colours of Binary Stars, P. Doig, 824

##### Sun

- The Total Solar Eclipse of next September, 152; The Partial Solar Eclipse of March 28, 352; Photography of the Ultra-violet Solar Spectrum, C. Fabry and H. Buisson, 352; The Sun's Rotation from Spectroheliograms, 422; Total Eclipse of the Sun, 591; Solar Researches, 592; The Spectrum of the Corona in 1918, 656

##### Miscellaneous:

- The Astrographic Catalogue, H. B. Curlew, T. P. Bhaskaran, L. Herrero, 24; Spectral Evidence of a Persistent Aurora, V. M. Slipher, 55; Popular Astronomy in Sweden, 121; A Criticism of Majorana's Theory of Gravitation, Prof. H. N. Russell, 352; The Perth Section of the Astrographic Catalogue, 386; Slides of Photographs taken at Yerkes Observatory, 386; Wireless Time-Signals, Prof. Sampson, 422; Spectroscopic Parallaxes with Objective Prism Spectrograms, Dr. H. Shapley and B. Lindblad, 422; Spectroscopic Study of Procyon's Orbit, Dr. Lunt, 455; A Catalogue of Double Stars, 592; Advances in Astronomy, 623; Determination of Luminosities by Spectrophotometry, B. Lindblad, 656

- Astronomy: A Century of, Prof. A. S. Eddington, 815; Advances in, 623; Popular, in Sweden, 121

- Asymmetry, The Notion of, T. Iredale, 779

- Athenæum Club, Prof. F. G. Hopkins and Dr. W. H. R. Rivers elected Members of the, 247; Drs. E. Barker, A. E. Cowley, and G. C. Simpson elected Members of the, 420; Sir F. W. Duke, Sir Berkeley G. A. Moynihan, and Sir Ronald Ross elected Members of the, 526

- Äther and Uräther, Über, Prof. P. Lenard, 739

- Atlantis and the Quaternary Regression, P. Négis, 94

- Atmosphäre, Die Zirkulation der, in den gemässigten

- Breiten der Erde. Grundzüge einer Theorie der Klimaschwankungen, Prof. A. Defant, 469
- Atmospheric: Nitrogen, The Fixation of, Dr. J. Knox, 73; Pollution by Smoke, Discussion on, 153; Pressure and Refractive Indices, with a Corresponding Table of Indices of Optical Glass, J. W. Gifford, 94; Refraction, Dr. J. Ball, 8, 444; Instr.-Comdr. T. Y. Baker, 8, 105, 550; Dr. J. de Graaff Hunter, 549
- Atom: The Constitution of the, 383; The Structure of the, Notes on some Recent Theories, Dr. S. Miall, 710
- Atomic: Constitution, A Magnetic Model of, J. K. Marsh and Prof. A. W. Stewart, 340; Numbers of Neoytterbium, Lutecium, and Celtium, The, G. Urbain, 799; Physics, The Present State of, E. Bauer, 591; Structure, Magnetism and, II., Dr. A. E. Oxley, 290; Valency and, 170; Theories, F. H. Loring, 372
- Atoms in Crystals, Optical Observation of the Thermal Agitation of the, Prof. C. V. Raman, 42
- Audition, The Resonance Hypothesis of, C. R. G. Cosens and Dr. H. Hartridge, 11
- Aurelia, Variations in Organs of, J. W. Low, 320
- Aurora: a Persistent, Spectral Evidence of, V. M. Slipher, 55; Borealis of January 30, C. S. Leaf, 176; Heights of, Photographic Studies of, Prof. C. Störmer; Dr. C. Chree, 47; Line in the Spectrum of the Night Sky, The, Lord Rayleigh, 93; of May 13-15, 1921, A Photographic Spectrum of the, Lord Rayleigh, 698
- Auroral Spectrum, A Study of the Presence or Absence of Nitrogen Bands in the, Lord Rayleigh, 698
- Auscultation, Electrical, of Respiration at the Commencement of Tuberculosis, J. Glover, 363
- Australasia: Changes of Climate in, R. Speight, 825; The Philosophical Society of, Centenary of, 148
- Australasian Natural History, 692
- Australia: a Zoological Survey of, The Need for, G. A. Waterhouse, 831; Coleoptera: Notes and New Species. No. II., H. J. Carter, 832; Importance of White Settlement of the Heart of, J. McWhae, 559; The Loranthaceæ of. Pt. I., W. F. Blakely, 832
- Australian: Apple Leafhopper, The, J. G. Myers, 95; Bombyliidae and Cyrtidae (Diptera), G. H. Hardy, 692; Cixiidae (Homoptera), A New Genus of, F. Muir, 832; Fishes, New Gyrodactylid Trematodes from, T. H. Johnston and O. W. Tiegs, 832; Notes on, and Descriptions of, A. R. McCulloch (2), 95; Meteorology, 251
- Autonomic Nervous System, The. Part I., Prof. J. N. Langley, 773
- Auxiliary International Languages, Prof. F. G. Donnan, 491
- "Avanturine" from India, The So-called, with an Analysis of the Contained Mica, H. H. Thomas and E. G. Radley, 126
- Awards for Discovery and Invention, 293
- Bacillus abortus*, The Isolation of the, 87
- Bacteria Associated with Rice and other Cereals, G. J. Fowler and D. Z. Sen, 756
- Bacteria, Life-cycles of, Dr. F. Löhnis, 252
- Bacterial Variability, Studies in, E. W. A. Walker, 126
- Bacteriolytic Element, A New, found in Tissues and Secretions, A. Fleming, 430
- Bakerian Lecture, The, Prof. T. R. Merton and S. Barratt, 430; Prof. T. M. Lowry and Dr. P. C. Austin, 447
- Balance, A Study of the, Prof. A. E. Conrady, 289
- Ballistics, Interior, Some New Methods in, A. G. Webster, 30
- Barnardiana, The Naming of the Minor Planet No. 907, Prof. E. E. Barnard, 176
- Barometer, Direct-reading, A New Form of, H. P. Waran, 763
- Barovariometers with Capillary Flow, Courtines and Villey, 362
- Bartholomew's General Map of Europe, showing Boundaries of States according to Treaties, 1921, 204
- Baryta, A New Method for the Industrial Manufacture of, for the Treatment of Sugar Molasses, C. Deguide and P. Baud, 700
- Basal: Metabolic Rate Determinations, Laboratory Manual of the Technic of, Dr. W. M. Boothby and Dr. Irene Sandiford, 514; Metabolism of Girls between Twelve to Seventeen Years of Age, F. G. Benedict, M. F. Hendry, and M. L. Baker, 158
- Beasts, The Wisdom of the, C. A. Strong, 608
- Bed-bug, Discovery of a Parasite in the Salivary Glands of the, Mrs. Aidie, 20
- Bee-disease Research, Present Position of, J. Rennie, 396
- Bees, Examination of, for Acarine Disease, 528
- Beet-sugar Industry, The British, 658
- Beit Memorial Fellowships for Medical Research, New Regulations for the, 565
- Belfast, Queen's University, Bequest to, by H. Musgrave, 597; and the Royal Academical Institution, Bequests to, by H. Musgrave, 798
- Belgium, Royal Academy of: Establishment of the Prix Joseph Schepkens, 395; Establishment of a van Ertborn Prize in Geology, 565; Prof. C. Sarolea, 684; The 150th Anniversary of the, 722
- Benzenoid Substances, Configurations of Molecules of, Dr. J. Kenner, 581; The Atomic Vibrations in the Molecules of, Prof. R. Robinson, 476
- Benzine Vapour, The Absorption Spectrum of, and the Fundamental Magnitudes of the Benzene Molecule, V. Henri, 535
- Benzl Ethers of Carbohydrates, Preparation of, M. Gomberg and C. C. Buchler, 24
- Benzol: Its Recovery, Rectification, and Uses, S. E. Whitehead, 513
- Berber Surgery and Sport in the Aurès Mountains, 336
- Berbers of the Aurès Mountains in South-East Algeria, Ethnographical Researches Among the, Capt. M. W. Hilton-Simpson, 699
- Beryllium Fluoride, Spectrum of, S. Datta, 326
- Bessemer Gold Medal of the Iron and Steel Institute, The, awarded to C. Fremont, 590
- Bile Acids, The Entero-hepatic Circulation of the, E. Wertheimer, 363
- Biochemical: Method, Prof. A. Harden, 291; Methods as Applied to Urine, Blood, and Gastric Analysis, A. Manual of Selected, Prof. F. P. Underhill, 645; Synthesis of *a*-methyl-*d*-mannoside, The, H. Hérissé, 30
- Biochemistry: A study of the Origin, Reactions, and Equilibria of Living Matter, Prof. B. Moore, 639; German Monographs on, Prof. A. Harden, 741
- Biological: Problems, Some, Sir G. Archdall Reid, 307; Terminology, 733
- Biologischen Arbeitsmethoden, Handbuch der, edited by Prof. E. Abderhalden. Abt. 5, Teil 7, Heft 1, Lief. 12, 171; Abt. 5, Methoden zum Studium der Funktionen der einzelnen Organe des tierischen Organismus. (1) Teil 3, Heft 1, Entwicklungsmechanik. (2) Teil 3, Heft 2, Entwicklungsmechanik. Abt. 9, Methoden zur Erforschung der Leistungen des tierischen Organismus. (3) Teil 1, Heft 1, Lief. 34, Allgemeine Methoden, 135; Lief. 45, Abt. 5, Teil 7, Heft 2, 395
- Biophysics, An Introduction to, Dr. D. Burns, 704
- Bird: -marking, Progress of, in 1921, H. F. Witherby, 527; Migration, The Riddle of, Dr. J. Ritchie, 573
- Birds: Migration Instinct in, Mrs. C. D. Langworthy, 756; Nectar-sipping, P. M. Debbarman, 489; Sir Herbert Maxwell, 612; The Periodic Nuptial Adornment in, The Physiological Conditions Relating to, J. Benoit, 463; The Sense of Smell in, a Debated Question, 783; J. H. Gurney, 784
- Birmingham University, Reports of the Council and the Principal; Prof. J. H. Muirhead to be proposed Emeritus Professor; M. Nicoll appointed Lecturer in Psychotherapy; The Prof. P. F. Frankland Fund; Bequest by R. Peyton, 125; Post-graduate Lectures on Medical Aspects of Crime and Punishment; A. Piney appointed Lecturer on Pathological Histology; Grants in aid of Research; Appointment of Representatives for the Conference of Universities, 254; Gift from the James Watt Memorial Fund; appointment of J. C. Brash to the Chair of Anatomy, 498
- Birth Control Movement, The, 755
- Birthday Honours, The King's, 573
- Birthdays in Relation to Intelligence, M. Fairgrieve, 218
- Births and Deaths: The Law of, being a Study of the Variation in the Degree of Animal Fertility under the Influence of the Environment, C. E. Pell, 267



- Bismuth: -compound of the Aromatic Series A and its Therapeutic Activity, H. Grenet and H. Drouin, 399; The Use of, in the Prophylaxis of Syphilis, R. Sazerac and C. Levaditi, 127
- Blackness District, The Geology of the, H. M. Cadell, 62
- Blind Fish, A New, from the Fresh Waters of Western Africa, J. Pellegrin, 567
- Blood-platelets, W. Cramer, A. H. Drew, and J. C. Mott-ram, 666
- Blue and Yellow Light, Comparison of Speed of, 318
- Blue: Flame produced by Common Salt on a Coal Fire, The, W. Hughes and Prof. T. R. Merton, 683; Prof. A. Smithells, 745
- Board of Education Summer Courses of Instruction, 665
- Bodenanalyse, mineralogischen, Anleitung zur, Dr. F. Steinriede. Zweite Auflage, 643
- Bohemia, Science in, Prof. B. Brauner, 625
- Borough Polytechnic Institute, J. W. Bispham appointed Principal of the, 665
- Botanists, Early British, and their Gardens, based on Unpublished Writings of Goodyer, Tradescant, and others, R. T. Gunther, 806
- Botany: at the British Association, 189; for Students of Medicine and Pharmacy, Prof. F. E. Fritch and Dr. E. J. Salisbury, 773; Junior, T. W. Woodhead, 773; National Institute of, Second Report of the, 185; of the Argentine Republic, 60; Strasburger's Text-book of, rewritten by Dr. Fitting, Dr. L. Jost, Dr. H. Schenck, Dr. G. Karsten. Fifth English edition revised with the Fourteenth German edition, by Prof. W. H. Lang, 740
- Bottomley, Dr. Frank, J. Thomson, 240
- Bow, The, in *Homeric Times*, H. Balfour, 91
- Boyle's Experiments on Capillarity, S. Skinner, 518
- Bradford Technical College, R. E. Stradling appointed Head of the Department of Civil Engineering, H. J. B. Chapple, Lecturer in Electrical Engineering at the, 664
- Bragg's Law for the X-rays, The degree of Exactitude of, M. Siegbahn, 535
- Brass, High-grade, Influence of Gases on, 755
- $\beta$ -ray: and  $\gamma$ -ray Spectra, Interpretation of the, C. D. Ellis, 667; Spectra and their Meaning, C. D. Ellis, 289
- $\beta$ -rays, The Scattering of, Dr. J. A. Crowther and B. J. Schonland, 156
- Bridge, Norman, Physics Laboratory of the Californian Institute of Technology, Opening of the, 559
- Bristol: District, Geological Relief Map of the, Explanatory Guide to a, Prof. S. H. Reynolds, 53; University, Establishment of Colston Research Fellowships, 325; Contributions for Colston Research Fellowships, 460
- British: and American, Associations, Ages of Presidents of the, Dr. L. O. Howard, 85; Association, Acceptance by Sir Ernest Rutherford of the Nomination as President at Liverpool, 384; Agriculture at the, 25; Botany at the, 189; Chemistry at the, 153; Gift to the, Sir Charles Parsons, 590; Physiology at the, 122; Reprints of Communications made to the Edinburgh Meeting of the, 455; The Hull Meeting of the, 784; Beet-sugar Industry, The, 658; Cotton Industry Research Institute, The, 457; Dyestuffs Industry, 501; Flora, Distribution of Certain Elements of the, Matthews, 190; Freshwater Rhizopoda and Heliozoa, The, J. Cash and G. H. Wailes, assisted by J. Hopkinson. Vol. 5, Heliozoa, G. H. Wailes, 441; Insect Life: A Popular Introduction to Entomology, E. Step, 514; Isles, The Population of the, Dr. J. Brownlee, 92; Medical Association, Award of the Gold Medal of the, to Sir T. Clifford Allbutt, 317; The Glasgow Meeting of the, 351; Mineral Resources, Prof. H. Louis, 6; Museum, Dr. W. Bateson elected a Trustee of the, 655; Mycology, 154; Mycological Society, The, 250; Non-Ferrous Metals Research Association, Report of the, 383; Rainfall Organisation, Removal of the, 454; Research Association for the Woollen and Worsted Industries, Annual Report of the, for 1921, 564; Research Chemicals, 597; Science Guild, Annual Dinner of the, 728; and the Geddes Recommendations Respecting Education, 498; Sir Arthur Mayo-Robson and Commander L. C. Bernacchi, 728; Scientific Instruments, 65; Prof. W. M. Bayliss, 106; Swallows, The Migration of, Dr. A. L. Thomson, 346; ("Terra Nova") Antarctic Expedition, 1910-1913. Terrestrial Magnetism, Dr. C. Chree, 508; University Problems, 407; Water Power and its Administration, 161
- Broken Hill, Rhodesia, The Bone-cave at, F. P. Mennell, 116
- Bronchial Moniliasis, A Case of, A. Sartory and L. Moinson, 94
- Brown Bast Disease of the Para Rubber-tree, The, Dr. S. E. Chandler, 357
- Buddhist Art, Catalogue of the Collection of, in the U.S. National Museum, J. M. Casanowicz, 53
- Bud Mutations, A. D. Shamel, 282
- Buffalo Ran, When, G. B. Grinnell, 7
- Building Materials and Heat Insulators, 222
- Burma: Oilfields, Palæontology of the, E. Vredenburg, 825; Tertiary Fossils of, E. Vredenburg, 594; Travel Film of, 420
- Burmese Amber, Fossils in, Prof. T. D. A. Cockerell, 713
- Buttercup, A Fossil, Prof. T. D. A. Cockerell, 42
- Calcium Carbide: and the Board of Trade, H. E. A., 230, 343; Prof. F. Soddy; not to be subject to Import Duty, 280
- Calculating Balances, S. Millot, 599
- Calculus: A First Course in the, Part 2, Trigonometric and Logarithmic Functions of  $x$ , etc., Prof. W. P. Milne and G. J. B. Westcott, 574; Elementary, Prof. W. F. Osgood, 574; for Beginners: A Text-book for Schools and Evening Classes, H. S. Jones, 574
- Calendar: of Industrial Pioneers, 29, 61, 93, 125, 156, 192, 223, 255, 289, 325, 361, 395, 429, 461, 499, 533, 566, 598, 630, 665, 698, 729, 762, 798, 829; Reform of the, Mean Value of the Year, A. Rose-Innes, 44; Its History, Structure, and Improvement, A. Philip, 203
- Callendar: Steam Tables, Abridged, Centigrade Units; Fahrenheit Units, Prof. H. L. Callendar, 171; Steam Diagram, Centigrade Units; Fahrenheit Units, 171
- Californian Bees, Mr. Ramsbottom, 155
- Cambridge: University, Dr. A. C. Haddon appointed Acting Curator of the Museum of Archaeology and Ethnology; H. F. Holden re-elected to the Benn W. Levy Studentship in Biochemistry; proposed Erection and Equipment of an Observation Building for Geodesy and Geodynamics; Foundation of the Alan Bodey Prize, 92; The War List of, 1914-18, 102; Report of a Special Syndicate on Possible Alterations in the Regulations for the Mathematical and Natural Sciences Tripos, 155; Offer of a Studentship by Emmanuel College; Grants from the Gordon-Wigan Fund; Annual Report of the General Board of Studies, 191; C. G. Lamb to be appointed Reader in Electrical Engineering; Sir Gerald Lenox-Conyngham proposed Reader in Geodesy; proposed Conferment of Honorary Degree of Sc.D. on Baron A. A. von Hügel; a visiting Fellowship at Princeton University founded by W. C. Procter; the Royal Commission for 1851 to establish Senior Studentships; Offer from the Royal Agricultural Society of the Income of the Hills Bequest for an Investigation, 254; Proposed Conferment of Honorary Degrees, 288; Smith's Prizes awarded to E. A. Milne and G. C. Steward; a Rayleigh Prize awarded to T. A. Brown; J. A. Carroll elected to an Isaac Newton Studentship; Renewal of a Studentship to W. M. H. Greaves, Regulations for M.Litt. and M.Sc. degrees, 360; J. C. Burkill awarded the Allen Scholarship; Annual Report of the Appointments Board, 394; Foundation of a J. M. Dodds Studentship, 498; Bequest to Girton College by Rosalind, Countess of Carlisle, 532; Report of the Financial Board; H. G. Carter appointed Curator of the Herbarium, 565; Bequest to the Fitzwilliam Museum by S. G. Perceval; Offer by W. W. Rouse Ball of Gift for Lectures on Mathematics; Offer by Dr. G. P. Bidder of Gift to the Stazione Zoologica at Naples; Dr. E. Lloyd Jones reappointed Demonstrator of Medicine;

- proposed to appoint E. A. Milne University Lecturer in Astrophysics; B. K. Martin nominated Princeton Visiting Fellow; Grant made to J. M. Wordie for an Expedition to Greenland, 697; Dr. Searle reappointed University Lecturer in Experimental Physics; S. Lees University Lecturer in Thermodynamics; F. Lavington Girdlers' University Lecturer in Economics; Financial Position of the University Botanic Garden, 728; Col. Sir Gerald Lenox-Conyngham appointed Reader in Geodesy; W. Dawson reappointed Reader in Forestry; C. Fox reappointed Principal of the Cambridge University Training College for Schoolmasters; Endowment by Sir Ernest Moir of a Memorial Prize in the Engineering Department, 797; Dr. Roderick reappointed Demonstrator in Surgery; E. A. Milne appointed University Lecturer in Astrophysics; Grant made to J. L. Evans; Approval of Statute giving power to confer Titles of Degrees upon Women Students of Recognised Institutions, 797; F. C. Bartlett appointed Reader in Experimental Psychology and Director of the Psychological Laboratory; H. A. Cox appointed Gurney University Lecturer in Forestry; G. S. Carter elected to a Research Studentship at Naples, 828; Oxford and Universities of, Report of the Royal Commission, 428, 465
- Camels, Surra in, Treatment of, Capt. H. E. Cross, 320
- Camping and Woodcraft: A Handbook for Vacation Campers and for Travellers in the Wilderness, H. Kephart. New edition, 268
- Canada, Proposed Co-operation of Universities to keep Medical Practitioners in touch with Recent Developments in Medicine, 155
- Canadian Arctic Expedition of 1913-18, The, F. Johansen, 256
- Cancer: Research, Dr. J. A. Murray, 311; Gift for, Mr. and Mrs. G. F. Todman, 789; Offer of Prizes for the Discovery of a Cure for, by Lord Atholstan and Sir William Veno, 147, 184
- Cannon-ball Tree, The Floral Development of the, Prof. McLean Thompson, 190
- Cantabrigenses: Alumni, A Biographical List of all known Students, Graduates, and Holders of Office at the University of Cambridge, from the Earliest Times to 1900, Dr. J. Venn and J. A. Venn. Part I., vol. 1, 742
- Cap Breton, The Temperatures at different depths in the chasm of, J. B. Charcot, 731
- Cape Town, University of, Conferment of the Honorary Degree of D.Sc. upon Sir Thomas Muir, 394
- Capillary Movement, Diffusion, and Displacement, L. Lumière, 667
- Capita Zoologica, Verhandelingen op Systematisch-Zoologisch gebied. Deel I., Afl. 1; Deel I., Afl. 2, 513
- Carboniferous: Limestone (Avonian) of Broadfield Down (Somerset), The, F. S. Wallis, 193; Rocks of the Deer Lake District of Newfoundland, The, T. Landell-Mills, Dr. A. Smith Woodward, and A. Gilligan, 361
- Carbon Monoxide in Gas, Prof. J. W. Cobb, 355
- Carcinus mœnas*, The Mouth Parts of, Dr. L. A. Borradaile, 534
- Carnegie: Foundation for the Advancement of Teaching, Sixteenth Annual Report of the, 531; Institution of Washington, Report of the President of the, 1921, 826; Research Fund, Award of Grants from the, 590; Trust, The, and Scientific Research, 797; United Kingdom Trust, Report of the, 395
- Cartography, Medieval, W. H. Barker, 803
- Cass, Sir John, Technical Institute, Annual Prize Distribution at the, 223
- Castor, The Orbit of, Dr. W. Doberck, 89
- Catalytic: Actions at Solid Surfaces, A Study of, Dr. E. F. Armstrong and T. P. Hilditch, vii., 93; Hydrogenation of the Polyphenols in the Wet Way, The, J. B. Senderens and J. Aboulenc, 30; Oxidation of Ammonia, The rôle of Gaseous Impurities in the, E. Decarrière, 326
- Caterpillars: Infected, Sterile Death in, S. Metchnikow, 158; Plagues of, 753
- Cathode-ray Corpuscles, The Mass Formula of, 406
- Celestial Spectra beyond the Limit of the Balmer Series of Hydrogen, On the Continuous Radiation found in some, W. H. Wright, 810
- Cells, Standard, of Low Voltage, J. Obata, 251
- Celluloses, Crude, Action of Mineral Acids on, G. Meunier, 326
- Cement Oilfield, The, Oklahoma, F. Reeves, 489
- Cephalic Index and Sex, Prof. W. Johannsen, 714; Miss R. M. Fleming, 715
- Cepheid Variables, Short-period, The Distances of the, J. C. Kapteyn and P. J. van Rhijn, Dr. Shapley, 488
- Ceramic Wares of China, The Early, A. L. Hetherington, 705
- Cerebral Vaccine: A pure, its Virulence for Man, C. Levaditi and S. Nicolau, 194
- Ceylon: The Development of, 394; The Miocene of, E. J. Wayland and Dr. A. M. Davies, 730
- Chadwick Lectures, Three, Sir Arthur Newsholme, 487
- Chalk in Deep-sea Sediments, The Distribution of the, J. Thoulet, 732
- Charcoal, A Study in, W. S. H. Cleghorne, 599
- Cheek-mole, Inheritance of a, G. W. Harris, 78
- Chemical: Analysis, Quantitative, for Beginning Students, A Course of Instruction in, with Explanatory Notes, Questions, and Analytical Problems, Prof. G. McP. Smith. Revised edition, 709; and Physical Constants, Dr. E. Griffiths, 369; Dictionary: A Popular, A Compendious Encyclopædia, C. T. Kingzett. Second edition, 338; Disinfection and Sterilisation, Dr. S. Rideal and Dr. E. K. Rideal, 674; Industry, Heavy, effect of the War on the, Dr. G. C. Clayton, 24; Laboratories, the furnishing and equipment of, 120; Microscopy, Elementary, Prof. E. M. Charnot. Second edition, 546; Reactions and their Equations: A Guide and Reference Book for Students of Chemistry, Prof. I. W. D. Hackh, 678; Society, Election of New Members of the Council of the, 488; Solubilities, Inorganic. Second edition, Dr. A. M. Comey and Prof. Dorothy A. Hahn, 505; Treatises, Some, 505; Warfare, Prof. F. Haber, Sir T. E. Thorpe, 40
- Chemicals: American Organic, 162; British Fine, 701; British Research, 597; Organic Medicinal (Synthetic and Natural), M. Barrowcliff and F. H. Carr, 37
- Chemie: Die geschichtliche Entwicklung der, Dr. E. Färber, 603; organischen, Geschichte der, Prof. C. Graebe. Erster Band, 806; anorganischen, Handbuch der, in vier Bänden. Edited by Prof. R. Abegg and Dr. F. Auerbach. Vierter Band. Erste Abteilung, zweite Hälfte. Die Elemente der sechsten Gruppe des periodischen Systems. Zweite Hälfte. Edited by Dr. F. Auerbach, 300
- Chemistry: A First Book of, for Students in Junior Technical Schools, Dr. A. Coulthard, 774; after the War, 100; A History of, Sir T. E. Thorpe, 603; and Physics, Handbook of, A Ready-Reference Pocket Book of Chemical and Physical Data, Prof. C. D. Hodgman, assisted by Prof. M. F. Coolbaugh and C. E. Senseman, 369; Applied, A Dictionary of, Sir Edward Thorpe, and others. Vol. 1. Revised and enlarged edition, 100; Vol. 2. Revised and enlarged edition, 266; Applied, Laboratory Exercises in, for Students in Technical Schools and Universities, Dr. W. Moldenhauer. Translated by Dr. L. Bradshaw, 710; Arabic, E. J. Holmyard, 778; at the British Association, 153; Biological, Dr. H. E. Roaf, 704; Forensic, A. Lucas, 470; Inorganic, as a Science, Prof. F. G. Donnan, 300; Inorganic, A Textbook of, Edited by Dr. J. N. Friend. Vol. 9. Part 2. Iron and its Compounds, Dr. J. N. Friend, 505; Inorganic, A Textbook of, Prof. A. F. Holleman. Issued in English in co-operation with H. C. Cooper. Sixth English edition, 677; Inorganic, Notes on, for First Year University Students, Prof. F. Francis, 707; Modern, 574; of Coal and its Products, The Practical, A. E. Findley and R. Wigginton, 678; of Coke-oven and By-product Works, E. V. Evans, 4; of the Garden: The, A Primer for Amateur and Young Gardeners, H. H. Cousins. Revised edition, 443; Organic, A Course of Practical, Dr. T. S. Price and Dr. D. F. Twiss. Third edition, 305; Organic, An Introduction to, D. L. Hammick, 39; Organic



- Fundamental Principles of, Prof. C. Moureu. Translated by W. T. K. Braunnholtz, 505; Organic, History of, 806; Organic, or Chemistry of the Carbon Compounds, V. von Richter. Edited by Prof. R. Anschütz and Dr. R. Meerwein. Translated by Dr. E. E. Fournier d'Albe. Vol. 2: Chemistry of the Carbocyclic Compounds, 709; Practical Physiological, Dr. J. A. Milroy and Prof. J. H. Milroy. Third edition, 704; Pure and Applied, International Conference of, 623; Textile, Introduction to, H. Harper, 268; The Profession of, A. Chaston Chapman, 322; The Solvay Institute of, 718
- Chile, Southern, Volcanic Eruptions in, 488
- Chimie générale, Traité de, Prof. W. Nernst. 2e édition française, Prof. A. Corvisy. Première Partie, 574
- Chlorine: Isotopes of, An Attempt to separate the, E. B. Ludlam, 398; Separation of the, by Diffusion, W. D. Harkins and A. Hayes, 120; The Atomic Weight of, Mlle. Ellen Gleditsch, and B. Samdahl, 456
- Cholesterol in the Animal Organism, The Origin and Destiny of, Part 12. J. A. Gardner and F. W. Fox, 126; Part 13, 730
- Chromium: and the Chrome-nickel Alloys, The Expansion of, over a Wide Temperature Interval, P. Chevenard, 127; Steels, Constitution of, T. F. Russell, 23
- Chronograph, A Printing, 217
- Chuchki Natives of North-eastern Siberia, The, H. V. Sverdrup, 792
- Ciliary Movement, The Mechanism of. Parts 1 and 2. J. Gray, 193
- Cinematograph Films, American, Exhibition of, 85
- Circular Cylinders in a Viscous Fluid, Rotation of two, G. B. Jeffery, 326
- Cirrus Clouds, The Significance of, in the Prediction of Weather. P. Schereschewsky and P. Wehrli, 226
- City and Guilds (Engineering) College, impending retirement of Prof. T. Mather, 192; Prof. C. L. Fortescue appointed Professor of Electrical Engineering in the, 664
- Civil: Aviation Advisory Board, terms of reference of the, 316; Engineers, Institution of, Awards of the, 527; Service, New Regulations relating to the Examination for the Clerical Class of the, 254; The Call for Economy in the, 349
- Cladocera, Selection Experiments with, Dr. A. M. Banta, 187
- Classics and Science, 33
- Claude Process, Burst Tubes in the, G. Claude, 219, 424
- Climates of the Past, Dr. C. Schuchert and others, 424
- Cloud-forms, Sir Napier Shaw, 301; Prof. W. J. Humphreys, 657
- Coal: Resources of South Africa, 564; Sampling and Analysis of, Appointment of a Committee to advise upon the, 216; Seams, the Study and Classification of, 118; the Chemistry of, Researches on, Prof. W. A. Bone, A. R. Pearson, E. Sinkinson, and W. E. Stockings. Part 2, 156; The Microstructure of, from an Industrial Standpoint, A. L. Booth, 290
- Cobalt, The Absence of, in Cornetite from Katanga, Belgian Congo, Dr. A. Schoep, 127
- Cocoa, Edith A. Browne, 269
- Coco-fat in Butter, A New Method for the Detection of, C. F. Muttelet, 194
- Coccidia of the Margarodes Group, The Metamorphosis of the Females and Hypermetamorphosis of the Males in the, P. Marchal, 667
- Cohesion, W. Taylor, 10; The Molecular Forces involved in, Prof. H. Chatley, 731
- Coke-oven and By-product Works Chemistry, T. Biddulph Smith, 4
- Colloidal: Solutions, The Physical Properties of, Prof. E. F. Burton. Second edition, 39; Content of Soils, The, T. B. Franklin, 225
- Colloids: Physics and Chemistry of, Report of Discussion on the, 150; Physics and Chemistry of, An Introduction to the, E. Hatschek. Fourth edition, 270; Protective: a pretty Lecture Experiment, Dr. J. N. Friend, 341; The Chemistry of, and Some Technical Applications, Dr. W. W. Taylor. Second edition, 204
- Colonial Scientific Services, The Universities and, 365
- Colour: -blindness, a New Method of Investigating, Dr. R. A. Houstoun, 225; The Proposed Standard of Rejection of Seamen for, Dr. F. W. Edridge-Green, 185; Photography, Byeways of, O. Reg. Edited and with an Introduction by W. Gamble, 547; Sensitive Photographic Plates, F. M. Walters, jun., and R. Davis, 529
- Colston University Research Society, 696
- Columnar Structure: in Sandstone Blocks, J. Currie, 763; in Sandstone Walls of a Glass Furnace, Dr. J. Weir French, 274
- Combustibles liquides et leurs applications, Les, 577
- Combustion, The Chemistry of, Dr. J. N. Friend, 709
- Comet: New, Mr. Skjellerup, 690; Notes, H. Mahnkopf, W. Reid, 186
- Comets: M. Kamensky, H. M. Jeffers, 725; Observation of, W. F. Denning, 613
- Compression, the Susceptibility of Feebly Magnetic Bodies as Affected by, Prof. E. Wilson, 762
- Concrete: Expansion of, The Effect of Moisture Content upon the, T. Matsumoto, 320; Mirrors for Astronomical Work, Suggested, F. J. W. Crowe and Dr. J. W. French, 185
- Condenser Tubes, Season-cracking and its Prevention, H. Moore and S. Beckinsale, 397; the Corrosion and Protection of, G. D. Bengough, 396
- Conductors, the Flow of Heavy Currents in, Dr. C. Hering, 119
- Confectioners' Raw Materials: Their Sources, Modes of Preparation, Chemical Composition, the Chief Impurities and Adulterations, their more Important Uses, and other Points of Interest, 269
- Confucius, The Tomb of, C. W. Bishop, 319
- Connecticut, Geological Research and Education in, 757
- Continents, The Flotation of, Prof. Wegener; A. L. du Toit, 757
- Copper: and Phosphorus at Various Temperatures, Rate of Combination of, C. A. Edwards and A. J. Murphy, 397; The Catalytic Activity of, Part III. W. G. Palmer, 326; Mixtures, Anticryptogamic, the Study of, M. and Mme. G. Villedieu, 464
- Corals, The Origin of Existing, Prof. P. C. Raymond, 657
- Cork, University College, L. P. W. Renouf elected Professor of Zoology in, 254
- Corona in 1918, The Spectrum of the, Slipher, 656
- Correlations, Correlation between Arrays in a Table of, C. Spearman, 533

## CORRESPONDENCE.

- Adaptations, Species and, J. T. Cunningham, 779
- Aeronautics, Units in, A. R. Low, 12, 139; H. S. Rowell, 44; Sir George Greenhill, 74
- Aeroplane Crashes: The "Hole in the Air," the "Spin," Dr. W. Galloway; Prof. L. Bairstow, 612
- Æther, Space and, S. V. Ramamurty, 75
- Ammonia, The Oxidation of, Prof. J. R. Partington, 137
- Antitrades, The, Dr. W. van Bemmelen, 172; Sir Napier Shaw, 206
- Arabic Chemistry, E. J. Holmyard, 778
- Araucaria imbricata, Sir Herbert Maxwell, 209
- Asymmetry, The Notion of, T. Iredale, 779
- Atmospheric Refraction, Dr. J. Ball, 8, 444; Instr. Comdr. T. Y. Baker, 8, 105, 550; Dr. J. de Graaff Hunter, 549
- Atomic Constitution, A Magnetic Model of, J. K. Marsh and Prof. A. W. Stewart, 340
- Atoms in Crystals, Optical Observation of the Thermal Agitation of the, Prof. C. V. Raman, 42
- Audition, The Resonance Hypothesis of, C. R. G. Cosens and Dr. H. Hartridge, 11
- Aurora Borealis of January 30, C. S. Leaf, 176
- Barnardiana, the Minor Planet No. 907, The Naming of, Prof. E. E. Barnard, 176
- Benzenoid Substances, Atomic Vibrations in the Molecules of, Prof. R. Robinson, 476; Configurations of Molecules of, Dr. J. Kenner, 581
- Biological Problems, Some, Sir G. Archibald Reid, 307
- Blue Flame produced by Common Salt on a Coal Fire, The,

- W. Hughes; Prof. T. R. Merton, 683; Prof. A. Smithells, 745
- Bottomley, Dr. Frank, J. Thomson, 240
- Boyle's Experiments on Capillarity, S. Skinner, 518
- British Scientific Instruments, Prof. W. M. Bayliss, 106
- Buttercup, A Fossil, Prof. T. D. A. Cockerell, 42; Mrs. E. M. Reid, 136
- Calcium Carbide and the Board of Trade, Prof. F. Soddy; H. E. A., 343
- Calendar: Reform of the, Mean Value of the Year, A. Rose-Innes, 44
- Cephalic Index and Sex, Prof. W. Johannsen, 714; Miss R. M. Fleming, 715
- Cheek-Mole, Inheritance of a, G. W. Harris, 78
- Chemical Warfare, Prof. F. Haber; Sir T. E. Thorpe, 40
- Chemistry, Arabic, E. J. Holmyard, 778
- Cohesion, W. Taylor, 10
- Colloids, Protective, A Pretty Lecture Experiment, Dr. J. N. Friend, 341
- Columnar Structure in Sandstone Walls of a Glass Furnace, Dr. J. Weir French, 274
- Comets, Observation of, W. F. Denning, 613
- Continuous Radiation found in some Celestial Spectra beyond the Limit of the Balance Series of Hydrogen, On the, W. H. Wright, 810
- Courtship, Structures and Habits associated with, Dr. J. C. Mottram, 77
- Definition, Resolving Power, and Accuracy, A. Mallock, 678; T. Smith, 745
- Diffraction by Molecular Clusters and the Quantum Structure of Light, Prof. C. V. Raman, 444
- Dynamic Problems, On Immediate Solutions of some, Prof. A. Gray, 645; Sir G. Greenhill, 778
- Earthquake Focus, The Depth of, Prof. S. K. Banerji, 108
- Economics, A Problem in, E. G. Bilham, 341
- Einstein's Aberration Experiment, Prof. C. V. Raman, 477
- Elliptic Logarithmic Spiral, The, a New Curve, H. S. Rowell, 716
- Elongated Bodies, The Directive Tendency of, W. D. Lambert, 271
- Evolution: Some Problems in, J. T. Cunningham, 41, 173; Sir G. Archdall Reid, 104; Prof. R. R. Gates, 174; Dr. S. C. Harland, 175; Statistical Studies of, C. F. A. Pantin, 273, 413; Dr. J. C. Willis and G. U. Yule, 274, 413
- Evolutionary Faith and Modern Doubts, C. R. Crowther, 777
- Flowering Dates of Trees, W. L. Fox, 310
- Force, Generalised Lines of, Sir Oliver Lodge, 74
- Fossils in Burmese Amber, Prof. T. D. A. Cockerell, 713
- "G. B. M.," Prof. A. Gray, 712
- Geology and the Nebular Theory, Prof. A. P. Coleman, 775
- Gid Parasite, The Name of the, Prof. T. D. A. Cockerell, 310
- Globular Lightning Discharge, Prof. A. P. Chattock, 106
- Gold in Devonshire, Discovery of, Prof. W. T. Gordon, 583
- Gravitation and Einstein's Theory, Some Terrestrial Experiments on, Prof. G. A. Schott, 106
- Haloes: and Earth History: A New Radioactive Element, Prof. J. Joly, 517, 578; of Ytterby, The Small, Prof. J. Joly, 711
- Hearing: The Helmholtz Theory of, Dr. E. W. Scripture, 518; A. S. E. Ackermann, 649; Dr. H. Hartridge, 649; The Resonance Theory of, Dr. H. Hartridge, 76, 374; Dr. W. Perrett, 176
- Heredity, The Hormone Theory of, J. T. Cunningham, 343
- Hydrogen, Active, and Nitrogen, Dr. G. L. Wendt; Dr. F. H. Newman, 749
- Hydroids, Cyclic Conditions and Rejuvenation in, R. Elmhirst, 208
- Hymenoptera Aculeata, The Spiracular Muscles of, Miss Annie D. Betts, 813
- Ice at Low Temperatures, The Brittleness of, L. Hawkes, 240
- Influenza, Age Incidence of, Miss Annie D. Betts, 240; G. W. Butler, 342
- Intelligence Statistics, Dr. R. W. Lawson, 716
- Isotopes, Series Spectra of, The Difference between, Prof. P. Ehrenfest, 745; Prof. N. Bohr, 746
- Knowledge, The Organisation of, W. W. Leisenring, 715; Miss F. E. Cave; The Writer of the Article, 716
- Land Snails of the Madeira Islands, Prof. T. D. A. Cockerell, 446
- Langley Machine, The, and the Hammondsport Trials, G. Brewer, 305; The Writer of the Article, 307
- Light, The Speckled Wave Front of, L. F. Richardson, 683; The Speed of, Dr. E. H. Kennard, 581
- Lunar Periodicity in Reproduction, H. M. Fox, 237
- Malaria, The Conquest of, Col. W. G. King, 647
- Man, Sir G. Archdall Reid, 579
- Memory, Sir G. Archdall Reid, 551
- Mercury: from Different Sources, The Atomic Weight of, Prof. J. N. Brönsted and Prof. G. Hevesy, 780; The Isotopes of, Prof. T. H. Laby and W. Mepharm, 207
- Metchnikoff (Měchnikov) and Russian Science in 1883, Prof. B. Brauner, 478
- Microscope Illumination and Fatigue, H. J. Denham, 78
- Microscopes and Microscopic Definition, Test-plates for, A. Mallock, 205
- Mind, Sir G. Archdall Reid, 515
- Molecular Structure of Amorphous Solids, Prof. C. V. Raman, 138
- Molecules, Anisotropy of, Prof. C. V. Raman, 75
- Mollusca, Self-fertilisation in, G. C. Robson, 12
- Mortar, The Weathering of, N. M. Richardson, 310; C. Carus-Wilson, 478
- Mosquito Larvæ, The Destruction of, in Salt or Brackish Water, J. F. Marshall, 746
- Muscular Efficiency, A. Mallock, 711
- Natural History in Schools, The Teaching of, E. W. Shann, 747; A. G. Lowndes, 748
- Nectar-sipping Birds, Sir Herbert Maxwell, 612
- Neon Lamps, W. E. Curtis, 343
- Optical Resolving Power and Definition, T. Smith, 745
- Organic Substances in Plants, Transport of, Prof. H. H. Dixon and N. G. Ball, 236; S. Mangham, 476
- Oscillation Circuits for the Determination of Di-electric Constants at Radio Frequencies, P. A. Cooper, 814
- Oyster, The Blood-cells of the, Dr. J. H. Orton, 612
- $\alpha$ -Particles as Detonators, G. H. Henderson, 749
- Pencil Markings in the Bodleian Library, C. Ainsworth Mitchell, 516
- Ph.D., The English, Prof. E. W. Scripture, 780
- Phenological Observations, L. C. W. Bonacina, 373
- Physiological Phenomenon, A Curious, R. M. Deeley, 44; J. H. Shaxby, 77
- Pilot Lamps in Laboratories, H. J. Denham, 683
- Plumage, The Evolution of, Prof. J. Cossar Ewart, 779; H. F. G., 778
- Pricked Letters and Ultimate Ratios, Prof. F. Cajori, 477
- Pythagoras's Theorem as a Repeating Pattern, Major P. A. MacMahon, 479; J. R. Cotter, 579
- Quanta, Half, W. E. Curtis, 713
- Radiant Spectrum, The, Prof. C. V. Raman, 175; Dr. H. Hartridge, 445
- Radiation from the Sky, Thermo-electric Instrument for Measuring, L. F. Richardson, 240
- Radio-telemetry, Long-distance, Some Problems of, Dr. J. A. Fleming, 209
- Radium Synthesis of Carbon Compounds from Air, F. H. Glew, 714
- Rainbow Peculiarity, A, Major W. J. S. Lockyer, 309; Prof. J. P. Dalton, 716
- Rainfall and Drainage: at Rothamsted in 1921, W. D. Christmas, 107; in 1921, Prof. J. Hendrick, 207
- Rainfalls, Forecasting Annual, Prof. A. McAdie, 139
- Raninide, Tribal Name of the, Rev. T. R. R. Stebbing; Prof. G. C. Bourne, 108
- Rat, The, and its Repression, Lord Aberconway, 744
- Relativity, the Theory of, A Proposed Laboratory Test of, Dr. H. S. King, 582; Dr. R. W. Lawson, 613
- Research Degrees and the University of London, Dr. A. M. Davies, 238; Prof. P. G. H. Boswell, 373
- Russia, Scientific Literature for, Sir Richard Gregory and Dr. C. Hagberg Wright, 208
- Russian Names, Transcription of, Prof. B. Brauner, 552; Major-Gen. Lord Edward Gleichen, 648; J. G. F. Druce, 777
- Safeguarding of Industries Act, 1921, Major A. G. Church, 583
- Schizophyllum commune*, Fr., Revival of Sporophores of, F. A. Mason, 272
- Science: at the Post Office, Sir W. Noble, 609; The Writer



of the Article, 610; The Message of, W. Robertson, 9;  
J. J. Robinson, 43  
Snow Furrows and Ripples, E. C. Barton; Dr. V. Cornish,  
374  
Sodium Vapour, Fluorescing, The Absorption of, Prof. J.  
K. Robertson, 43  
Space and Æther, S. V. Ramamurty, 75  
Species and Adaptations, J. T. Cunningham, 775  
Spontaneous Ignition of Peaty Soils, E. A. Andrews, 77  
Steel, Tempered, The Colours of, Prof. C. V. Raman, 105  
Stonehenge: Concerning the Four Stations, E. H. Stone,  
410  
Stone Preservation, Dr. A. P. Laurie, 814  
Sun-fish, The Buoyancy of the, Capt. G. C. C. Damant and  
Prof. A. E. Boycott, 578  
Sunlight, The Action of, Dr. C. W. Saleeby, 11, 274  
Symbiotic Bacteria and Phosphorescence, F. A. Potts, 814  
Temperature Functions of certain Properties of the Metals,  
Periodical Phenomena in the, Dr. G. Borelius, 613  
Terrestrial: Life Begin? Where did, Dr. R. C. Macfie; Prof.  
J. W. Gregory, 107, 310; J. S. Dines; Dr. F. J. Allen,  
207; Magnetic Disturbances and Sunspots, Father  
A. L. Cortie, 44  
Tide-predicting Machines, The Accuracy of, H. A. Marmer,  
136, 479; The Writer of the Article, 137; Dr. A. T.  
Doodson, 239, 479  
Tin: Plague and Arctic Relics, T. Sheppard, 78, 209;  
The Isotopes of, Dr. F. W. Aston, 813  
Transmutation, Energy Changes involved in, J. W. Wark,  
108  
Tropical Medicine, Discoveries in, Sir E. Ray Lankester,  
549, 812; Lt.-Col. A. Alcock, 611; Dr. L. W. Sambon, 681  
Visibility of Distant Objects, Improvement of, Prof. H.  
Bénard, 412  
Vowel Sounds, Nature of, Sir R. A. S. Paget, 341  
Walaus and the Circulation of the Blood, Dr. G. A.  
Stephens, 552  
Wireless Telegraphy, Precursors of, Sir Joseph Larmor,  
410  
Wrought-iron Currency from the Kisi Country, Sierra  
Leone Protectorate, West Africa, A Specimen of, R. C.  
Gale and Capt. E. R. Macpherson, 138  
X-Ray Spectra, On the N-Series in, V. Dolejšek, 582  
Ytterby, The Small Haloes of, Prof. J. Joly, 711

Corrosion of Ferrous Metals, the, Sir Robert Hadfield,  
527  
Cotton: Growing, Some Aspects of, 392; Hairs, Cell-  
wall Structure as seen in, Dr. W. L. Balls, 499; in  
the French Sudan, 218; Industry Research Institute,  
The British, 457  
Courtship, Structures and Habits associated with, Dr.  
J. C. Mottram, 77  
Crab Nebula, Changes in the, J. C. Duncan, 24  
Crabs, Brachyuran, collected by the American Museum  
Congo Expedition, Miss Mary J. Rathbun, 87  
Cranimetry in the British Isles, Prof. F. G. Parsons, 250  
Crepis, Inter-specific Hybrids in, E. E. Babcock and J. L.  
Collins, 30  
*Crocidura Stampflii*, The Shrew, and the Plague in Senegal,  
M. Léger and A. Baur, 259  
Croonian Lecture, The, Prof. T. H. Morgan, 830  
Crops, Cycles in the Yield of, Prof. H. L. Moore; Sir  
William Beveridge, 261  
Crossing over a Function of Distance? Is, J. A. Detlefsen,  
30  
Crustacea, The Sound-producing Mechanisms of, Dr.  
W. M. Tattersall, 431  
Crystal: Forms of Minerals, New, A List of, Dr. H. P.  
Whitlock, 793; Structure of Common Elements,  
A. W. Hull, 490  
Cupro-nickel, The Internal Mechanism of Cold-work and  
recrystallisation in, F. Adcock, 396  
Cyclohexane and Ortho-methylcyclohexanol, The Oxide  
of, M. Godehot and P. Bédos, 326  
Cyclohexanetriols, The Catalytic Preparation of the,  
J. B. Senderens and J. A. Coulenc, 399  
Cyclone, A, which crossed the Korean Peninsula and the  
Vibrations of its Polar Front, T. Kobayasi, 257  
α Cygni, Spectrum of, Dr. W. H. Wright, 89

Cygnus, A New Variable in, S. Williams, 656  
Cytoplasmic Inclusions of the Germ-cells, Prof. J. B.  
Gatenby, 529

Dairy Cattle and Milk Production, 360  
Danish Culicidae, Biology of, Dr. C. Wesenberg-Lund, 323  
Dark Ages: The, A Survival in Kentucky, 669  
Date Cultivation in the Iraq, V. H. W. Dowson, 250  
Death: -rates as a Measure of Hygienic Conditions, Use of,  
Dr. Brownlee, 389; Valley, California, the Weather  
at, A. H. Palmer, 757

## DEATHS.

Bacot (A.), 525, 618  
Baskerville (Dr. C.), 315  
Beale (Sir W. Phipson), 589  
Benoit (Dr. J. René), 820  
Bottomley (Dr. J. F.), 212  
Bottomley (Prof. W. B.), 419, 524  
Boulger (Prof. G. S.), 653  
Brady (Prof. G. S.), 19  
Branner (Prof. J. C.), 557  
Bruce-Low (Dr. R.), 721  
Bryce (Lord), 113  
Carter (Sir George), 314  
Cassal (Col. C. E.), 83  
Chapin (Dr. H. E.), 558  
Chapman (Dr. T. A.), 50  
Christie (Sir William), 116, 145  
Ciamician (Prof. G.), 245  
Cotterill (Prof. J. H.), 84, 115  
Cussons (George), 315  
Dickson (Dr. H. N.), 525  
Ebler (Prof. E.), 246  
Eddy (Prof. H. T.), 50  
Foord-Kelcey (Prof. W.), 84  
Giuffrida-Ruggeri (Prof. V.), 183  
Gonner (Sir Edward), 314  
Gould (Sir Alfred Pearce), 558, 589  
Graham (Dr. H.), 485  
Green (Prof. J. A.), 452  
Guye (Prof. P. A.), 523  
Hadrill (C. F. T.), 147  
Heyn (Prof. E.), 419  
Hollis (Dr. W. A.), 558  
Hopkinson (Dr. E.), 82  
Howe (Prof. H. M.), 721  
Jameson (Dr. H. Lyster), 314  
Jones (Sir Henry), 182  
Jordan (C.), 349  
Kapteyn (Prof. J. C.), 822  
Kempe (Sir Alfred Bray), 558, 588  
Kirk (Sir John), 84, 114  
Lais (Father G.), 84  
Lascelles (B. P.), 83  
Laveran (Prof. C. L. F.), 722, 819  
Liebisch (Prof. T.), 315  
Longworth-Dames (M.), 147  
Manson (Sir Patrick), 485, 587  
Mathews (Dr. G. B.), 384, 450  
Matthews (Sir William), 83  
McClure (Sir John), 246  
McConnel (J. W.), 821  
McWilliam (Dr. A.), 557  
Merz (Dr. J. T.), 419, 451  
Moore (Prof. B.), 315, 348  
Naumann (Prof. A.), 485  
Palladin (Prof. V. I.), 419  
Ranvier (L.), 620  
Rivers (Dr. W. H. R.), 753  
Sanderson (F. W.), 822  
Sandmeyer (T.), 720  
Shackleton (Sir Ernest), 143  
Thuillier (Col. Sir Henry), 452  
Verner (Col. W.), 213  
Verworn (Prof. Max), 213  
Voigtländer (Dr. F.), 654

- Waidner (Dr. C. W.), 654  
 Waller (Prof. A. D.), 348, 418  
 Wendell (Dr. G. V.), 485  
 Willets (Dr. D. G.), 654  
 Wollaston (Sir Arthur Naylor), 246  
 Woodward (Sir German Sims), 19
- Decimal Association, Sir Richard Gregory elected President of the, 655  
 Definition, Resolving Power, and Accuracy, A. Mallock, 678  
 Dehydration of 2-methyl-2-phenyl-1-propanol and of 2,2-dimethyl-3-phenyl-1-propanol, A. Haller and Mme. Ramart, 731  
 Depressor Nerve of the Rabbit, The, B. B. Sarkar, 255  
 Desensitiser, A New, "Pinakryptol," Dr. E. König, 658  
 Deutschen Reiches, 40 Blätter der Karte des, 1 : 100,000 ausgewählt für Unterrichtszwecke, Zweite Auflage, 548  
 Development Fund, The, 433  
 Dewindtite, a New Radioactive Mineral, A. Schoep, 399  
 Diabetics, Intestinal Flora of, Presence of Acetone-producing Micro-organisms in the, A. Berthelot and Mme. St. Danyesz-Michel, 764  
 Diastases of the Tissues, the Physiological and Therapeutic Properties of the, F. Maignon, 363  
 Diatomic Molecules, The Dynamics of Collision of, J. E. Jones, 258  
 Diesel Engines, Fuel and Lubricating Oils for, W. Schenker, 270  
 Diffraction: by Molecular Clusters and the Quantum Structure of Light, Prof. C. V. Raman, 444; Haloes in Normal and Glaucomatous Eyes, H. H. Emsley and E. F. Fincham, 566  
 Dinoflagellata, Unarmored, The Free-living, Prof. C. A. Kofoid and Olive Swezy, 130  
 Dinosaur, The Smallest Horned, C. W. Gilmore, 792  
 Diphenylsulphone, E. Grandmougin, 158  
 Discovery and Invention, Awards for, 293  
 Disease: The Origins of, 708; Resistance in Plants, F. T. Brooks, 155  
 Dispersion Formulæ and the Polarisation of Scattered Light; with Application to Hydrogen, Prof. T. H. Havelock, 533  
 Distillation Principles and Processes, Sir Sydney Young, with the collaboration of various authors, 434  
 Dog-tooth Breast Ornament, A, 792  
 Dominion Students in Universities and University Colleges of the United Kingdom, 288  
*Doryphora sassafras*, Endlicher, The Essential Oil obtained of the Leaves of, A. R. Penfold, 226  
 Double Star Orbits, Eccentricity of, Prof. H. N. Russell, 560  
 Dove Marine Laboratory, The, Cullercoats, 353  
*Drosophila virilis*, Homologous Genes and Linear Linkage in, A. Weinstein, 30  
 Drought of 1921, The, C. E. P. Brooks and J. Glasspoole, 257  
 Drugs: and Medicines, The Chemistry and Analysis of, H. C. Fuller, 509; The Analysis of, 509  
 Dye Industry, The Modern, Prof. H. E. Fierz, 153  
 Dyes, Synthetic, as Antiseptics and Chemotherapeutic Agents, Prof. C. H. Browning, 750  
 Dyestuff Industry, British, 501  
 Dynamic Symmetry in Ancient Architecture, Further Evidence for, J. Hambridge, 22  
 Dynamical Problems, On Immediate Solutions of some, Prof. A. Gray, 645; Sir G. Greenhill, 778  
 Dysenteric Hepatitis, Researches on the Proteopexic Insufficiency of the Liver in, F. Widal, P. Abrami, and J. Hutinel, 258
- Earth: arable, the "awakening" of, A. Petit, 631; Smoking-pipes, H. Balfour, 691; The Age of the, Prof. J. Joly, 480; Thrust of, The Problem of the, E. Goursat, 631  
 Earth's: Interior, The, 594; Magnetic Field, An Electromagnetic Method for the Measurement of the Horizontal Intensity of the, F. E. Smith, 533
- Earthquake: Focus, The Depth of, Prof. S. K. Banerji, 108; of January 31, 184; The Direction of the First Movement in an, S. Nakamura, 593; Waves, Propagation of, Dr. S. W. Visser, 283  
 Earthquakes: The Cause and Character of, R. D. Oldham, 361, 650, 685; The Study of, 368  
 Earthworms, Enteronephric Excretory Organs in, Dr. K. N. Bahl, 529  
 East: Africa, The Fauna of, and its Future, C. W. Hobley, 256; Carelia and Kola Lapmark. Described by Finnish Scientists and Philologists, T. Homén, 372  
 Eastman Organic Chemicals, Price-list of the, 690  
 Echinoderm Egg during Fertilisation, The Oxidation Processes of the, Prof. C. Shearer, 193; and Early Development, The Heat Production and Oxidation Processes of the, Prof. C. Shearer, 666  
 Echinoderms as Aberrant Arthropods, The, A. H. Clark, 640  
 Economic Biologists, Association of, Election of Officers and Council of the, 317; Biology, Team Work in, Advantages and Disadvantages of, Dr. W. L. Balls, 534  
 Economics, A Problem in, E. G. Bilham, 341  
 Edinburgh University, Conferment of an honorary degree upon Prof. T. H. Morgan, 797  
 Education: and Industry, Prof. W. Rothenstein, 223; and the Nation, 1; Bearing of Improved Means and Methods of, Dr. P. Sharp, 288; Estimates, The, 537; in England, France, and Germany, Reports on, W. J. Osburn, 829; Research and, in the Geddes Report, 197; The Channels of, E. H. Dance, 597  
 Eel, The Breeding-places of the, Dr. J. Schmidt, 193  
 Egg-collector, the Modern, The Ways and Methods of, Earl Buxton, 623; -production in Poultry, The Genetics of, Major C. C. Hirst, 26  
 Egypt: Knots in Ancient, Miss M. A. Murray, 726; Naturalistic Art in, Dr. A. M. Blackmann, 319  
 Einstein: and his Problem, A Criticism of, W. H. V. Reade, 770; and the Universe: A Popular Exposition of the Famous Theory, C. Nordmann. Translated by J. M'Cabe, 770; The Ideas of, A Theory of Relativity in Simple Language, Prof. J. H. Thirring. Translated by R. A. B. Russell, 544; Tower, The, 24  
 Einstein's: Aberration Experiment, Prof. C. V. Raman, 477; Theory, Gravitation and, Some Terrestrial Experiments on, Prof. G. A. Schott, 106  
 Einsteinsche Gravitationstheorie: Die, Versuch einer allgemein verständlichen Darstellung der Theorie, Prof. G. Mie, 544  
 Eiszeitalters, Das Klima des, Prof. R. Spitaler, 512  
 Eiweisshydrolyse, Über partielle, Prof. M. Siegfried, 741  
 Eiweisskörper, Die Einwirkung von Mikroorganismen auf die, Dr. P. Hirsch, 741  
 Electric: Furnace, The, Dr. J. N. Pring, 99; Furnaces, 99; Power Stations, The Design of, Dr. A. Russell, 570; Traction on Railways, Sir Vincent Raven, 88  
 Electrical: Diagnosis, 674; Engineers, Institution of, Jubilee of the, 284; Election of Officers and Council of the, 690; Awards of the, 755; Machines, The Diagnosing of Troubles in, Prof. M. Walker, 674; Measurements, 166; Phenomena produced by Metallic Deposits, C. and M. Schlumberger, 326; Precipitation in Industry, Dr. H. J. Bush, 388; Resistance Furnaces, Gallenkamp and Co.'s catalogue of, 455; Science, Fifty Years of, 3; Workshop, My, F. T. Addyman, 372  
 Electrician's Pocket-book for 1922, The Practical. Edited by H. T. Crewe, 269  
 Electricity: Applied, A First Book of, S. R. Roget, 271; Fifty Years of, The Memories of an Electrical Engineer, Prof. J. A. Fleming, 3  
 Electrification: of Phosphorus Smoke Nuclei, J. J. Dowling and C. J. Haughey, 562; produced by Breaking, with special application to Simpson's Theory of the Electricity of Thunderstorms, J. J. Nolan and J. Enright, 462  
 Electrified Electrolytes, Surface Tension of, G. Gony, 29  
 Electro-: Chemistry, A Textbook of, Prof. M. le Blanc. Translated from the fourth enlarged German edition by Drs. W. R. Whitney and J. W. Brown, 100;



- Thermic Effect, The Homogeneous (including the Thomson Effect as a special case), C. Benedicks, 608
- Electrolytic Dissociation, Prof. T. W. Richards and A. W. Rowe, 658
- Electromagnetic Valency and the Radiation Hypothesis, F. T. Peirce, 290
- Électromagnétisme et l'Électrodynamique, Mémoires sur, André-Marie Ampère, 677
- Electronic Structures in Unsaturated Molecules, E. D. Eastman, 629
- Electrons: Attachment of, to Neutral Molecules in Air, L. B. Loeb, 158; from Metal Surfaces, Reflection and Re-emission of, R. A. Millikan and J. G. Barber, 158; in Atoms, The Distribution of the, R. W. James, 257
- Element, a Missing, Identification of, Sir Ernest Rutherford; A. Dauvillier; Prof. G. Urbain, 781
- Elements: and Isotopes, 736; Artificial Disintegration of the, Sir Ernest Rutherford, 584, 601, 614; Disintegration of, Dr. G. Wendt and C. E. Iron; Sir Ernest Rutherford, 418
- Ellipsoidal Particles immersed in a Viscous Fluid, Motion of, G. B. Jeffery, 326
- Elliptic Logarithmic Spiral, The, a New Curve, H. S. Rowell, 716
- Elongated Bodies, The Directive Tendency of, W. D. Lambert, 271
- Encephalitis of the Ox, Acute Contagious, A. Donatien and R. Bosselut, 194
- Encke's Division in Saturn's Ring, The Cause of, G. R. Goldsbrough, 533
- Endocrines in Excelsis, Sir Arthur Keith, 670
- Engine Lubrication, E. L. Bass, 216
- Engineer, The College-trained, Prof. F. Bacon, 722
- Engineering, Municipal, H. P. Boulnois, 135
- England and Wales, Physical Map of, 1:1,000,000, 548
- English, The Function of, in Scientific Education, 229
- Ensilage, The Composition of, J. A. Murray, 25
- Entomology and Malaria, Lt.-Col. W. J. Walton, 334
- Entropy as a Tangible Conception: An Elementary Treatise on the Physical Aspects of Heat, Entropy, and Thermal Inertia for Designers, Students, and Engineers, and particularly for users of steam and steam charts, Eng. Lt.-Com. S. G. Wheeler, 404
- Enzyme Action and X-rays, R. D. Lawrence, 320
- Epigastric Pain, Drs. E. P. Poulton and W. W. Payne, 123
- Equations, Theory of, First Course in the, Prof. L. E. Dickson, 773
- Ergot of Diss and the Ergot of Oats, The Chemical Composition of, G. Tanret, 535
- Ernährung und Vitamine, Über künstliche, Prof. F. Röhmman, 741
- Ethyl Benzoate, The Reduction of, and of some other Benzene Compounds by Sodium and Absolute Alcohol, H. de Pommereau, 463
- Eucalypts and Angophoras, Occurrence of Oil Ducts in certain, M. B. Welch, 95
- "Euclides Vindicatus," Girolamo Saccheri's. Edited and translated by G. B. Halsted, 232
- Europe: and Algeria: Shooting Trips in, Being a Record of Sport in the Alps, Pyrenees, Norway, Sweden, Corsica, and Algeria, H. P. Highton, 336; Iron Ore in, Prof. J. W. Gregory, 794; The Iron-ore Resources of, M. Roesler, 794
- European: Archaeology, Prof. R. A. S. Macalister. Vol. 1. The Palæolithic Period, 605; Civilisation, The First, Prof. R. C. Bosanquet, 466
- Evaporation from Large Expanses of Water, Dr. H. Jeffreys, 354
- Everest, Mount, Expedition, The, 184, 317, 590, 789, 822; Maps, Major Morshed, 319
- Evolution: Factors of, Dr. J. P. Lotsy, 190; Some Problems in, J. T. Cunningham, 41, 173; Sir G. Archdall Reid, 104; Prof. R. R. Gates, 174; S. C. Harland, 175; and Geographical Distribution in Plants and Animals, and their Significance, Some Statistics of, Dr. J. C. Willis and G. U. Yule, 177, 256; Statistical Studies of, C. F. A. Pantin, 273; Dr. J. C. Willis and G. U. Yule, 274, 413
- Evolutionary Faith and Modern Doubts, Dr. W. Bateson, 356, 553; C. R. Crowther, 777
- Explosives: The Manufacture of, 541; with Notes on their Characteristics and Testing, Dr. R. C. Farmer, 270; Supply, Technical Records of, 1915-1918, Nos. 1-4, 541
- Exponentials Made Easy, or the story of "Epsilon," M. E. J. Gheury de Bray, 574
- Falkland Islands, Illustrations of the Flowering Plants and Ferns of the, Mrs. E. F. Vallentin, with descriptions by Mrs. E. M. Cotton, 370
- Falmouth, Meteorology at, 692
- Faraday: Medal of the Institution of Electrical Engineers, The, 755; Tube Theory of Electromagnetism, The, and other Notes, W. G. Brown, 225
- Fat-soluble Vitamins in Marine Animals and Plants, The Distribution of, Dr. J. Hjort, 666
- Fats, The Direct Fixation of, by the Sebaceous Glands, A. Policard and Mlle. J. Tritchkovitch, 800
- Fatty Acids, The Determination of, by the Formation of Complex Compounds with Uranyl and Sodium, J. Barlot and Mlle. M. T. Brenet, 127
- Fauna of African Lakes, Dr. W. A. Cunningham, 28
- Fermat's Last Theorem: Proofs by Elementary Algebra, M. Cashmore. Third edition, 39; Three Lectures on, L. J. Mordell, 4
- Ferns, The Past and Present Distribution of certain, A Study in Contrasts, Prof. A. C. Seward, 830
- Ferromagnetic Induction: Models of, Sir J. Alfred Ewing, 321; The Atomic Process in, Sir J. Alfred Ewing, 224
- Fertiliser Experiments, A Critical Study of, C. B. Lipman and G. A. Linhart, 30
- Fertility, A New View of, 267
- Field Museum of Natural History, Chicago, Report of the, 150; New Collecting Expeditions of the, 349
- Fight against Disease, The, January, 385
- Fijian Insects, The Food-plants of Hosts of some, R. Veitch and W. Greenwood, 95
- Films, Thin, The Properties and Molecular Structure of, Pts. II. and III., N. K. Adam, 762
- Filosofia Botanica, Problemi di, A. Borzi, 547
- Fireball: A Bright, G. E. Sutcliffe, 55; Detonating, in Sunshine, W. F. Denning, 249; Large, 725; Observed in Sunshine, W. F. Denning, 217
- Fireman's Handbook, The, and Guide to Fuel Economy, C. F. Wade, 204
- Fish: Canning in England, 71; Preservation, Prof. J. Stanley Gardiner, 71
- Fishery Investigations, The International, 390
- Fishes: Freshwater, the Biology of, W. Rushton, 731; Rains of, Dr. E. W. Gudger, 423
- Fishing Industry, The, and Scientific Research, 201
- Flax Flea Beetle, The Life-history and Bionomics of the, J. G. Rhynhart, 398, 825
- Flies: The Dispersion of, by Flight, Bishopp and Laake, 561; Typical, A Photographic Atlas, E. K. Pearce. Second series, 677
- Flight, Soaring, An Experimental Investigation of, E. H. Hankin, 799
- Flints, Worked, Mr. Reid Moir's Discoveries of, Prof. Capitan, 185
- Florida, New Fossil Sea Cow from, O. P. Hay, 825
- Flower Size in Plants, The Inheritance of, Prof. R. R. Gates, 290
- Flowering Dates of Trees along Main British Railway Routes, J. E. Clark, 210; W. L. Fox, 310
- Fluids, The Adiabatic Liquefaction of, J. Villey, 62
- Fluoreszenz und Phosphoreszenz im Lichte der neueren Atomtheorie, Prof. P. Pringsheim, 739
- Foam Cells in Soap and other Foams, Measurements of, Prof. C. H. Desch, 153
- Focus, The Position of Best, in the Presence of Spherical Aberration, T. Smith, 666
- Foods, Analyses and Energy Values of, Dr. R. H. A. Plimmer, 608
- Foot-and-mouth Disease, Appointment of a Departmental Committee to inquire into the Recent Outbreak of, 454
- Foraminifera: Shallow Water, of the Tortugas Region, Dr. J. A. Cushman, 708; Shell Structure in, Prof. W. J. Sollas, 424

- Force, Generalised Lines of, Sir Oliver Lodge, 74
- Forestry: at Oxford, Report of the Delegates for, 385; for Woodmen, C. O. Hanson. Second edition, 547; Importance of Scientific Research in, and its Position in the Empire, Prof. E. P. Stebbing, 225; Indian, Prof. Stebbing, 189; in Great Britain, Position of, J. Sutherland, 189; in Sweden, 353; in relation to Stream-flow and Erosion, 417
- Formaldehyde: and Carbohydrates, The Synthesis of, Profs. Baly and Heilbron and Mr. Barker, 153; The Tendency of, to form Hydrocyanic Acid by Oxidation in an Ammoniacal Silver Solution, R. Fosse and A. Hieulle, 631
- Forme, La, et le Mouvement: essai de dynamique de la vie, G. Bohn, 675
- Formic Acid, Decomposition of, The Influence of Temperature on Two Alternative Modes of, C. N. Hinshelwood, H. Hartley, and B. Topley, 157
- Forrest, James, Lecture, Sir John Aspinall, 695
- Fossil: Buttercups, Mrs. Eleanor M. Reid, 136; Man, 624
- Fourier's Series: and Analytic Functions, T. Carleman and Prof. G. H. Hardy, 290; and Integrals and the Mathematical Theory of the Conduction of Heat, Introduction to the Theory of, Prof. H. S. Carslaw. Second edition, vol. 1, "Fourier's Series and Integrals," 435
- Fourth Dimension Simply Explained, The, Dr. S. Brodetsky, 474
- Fractures in General, Industrial, and Military Practice, Treatise on, Prof. J. B. Roberts and Dr. J. A. Kelly. Second edition, 304
- Frankfort-on-Main, University of, Prof. A. Sieverts appointed Professor of Chemistry at the, 798
- Frankland, Prof. P. F., the Memorial of, 148
- Frazer Memorial Lectures, 825
- Free Motion of a Sphere in a Rotating Liquid Parallel to the Axis of Rotation, S. F. Grace, 762
- French: Academy, Mme. Curie elected a Free Associate Member of the, 183; -English Dictionary for Chemists, A. Dr. A. M. Patterson, 73
- Freshwater: Ciliate Infusoria and Heliozoa, 441; Teleostean Fishes, The Variation of the Osmotic Pressure of the Blood of the, under the Influence of the Increased Salinity of the Surrounding Water, P. Portier and M. Duval, 800
- Fresnel's Formule for Reflection in Transparent Media, A Graphical Method of treating, Prof. C. H. Lees, 362
- Friction Losses in Internal Combustion Motors, Study of the, A. Planiol, 566
- Frost, a Severe, 453
- Fruit Storage, Problems of, F. Kidd, 534
- Fuels, Liquid and Gaseous, and the Part they play in Modern Power Production, Prof. V. B. Lewes. Second edition. Revised and edited by J. B. C. Kershaw, 73
- Functions of a Real Variable, The Theory of, and the Theory of Fourier's Series, Prof. E. W. Hobson. Second edition, vol. 1, 435
- Furnace, The Electric, Dr. J. N. Pring, 99
- Gale, A Violent, 349
- Galicia and its Petroleum Industry, A. Millar, 624
- Galton Laboratory, for National Eugenics: Eugenics Laboratory Memoirs, VII., 409
- Game-birds of India, The, F. and S. Baker. Vol. 1. Second edition. Vol. 2, 606
- Gametic and Zygotic Sterility, Dr. Bateson and others, 391
- Gardening, Practical School, P. Elford and S. Heaton. Second edition, 514
- Gas: a Comburimeter and a Controller for, Grebel-Velter System, A. Grebel, 763; Carbon Monoxide in, Prof. J. W. Cobb, 355; Cylinders Research, 460; Town, Manufacture: A Practical Introductory Treatment of the Equipment and Processes of an Average Gas Works, for Students, Junior Gas Engineers, and others connected with Gas Works, R. Staley, 774; Warfare, Science and, Col. C. H. Foulkes, 661
- Gaseous: Fuel, The Supply of, 199; Molecules, The Energy of, Prof. J. R. Partington, 256
- Gasoline from Oil Shale, Prof. R. H. McKee, 594
- Gasworks Practice, Modern, A. Meade. Second edition, 199
- "G. B. M.," Prof. A. Gray, 712
- Geddes Committee on National Expenditure, Some of the Proposals of the, 316; Research and Education in the, 197
- Geodesy and Geophysics, The International Union of, 758; Ch. Lallemand re-elected President, 759
- Geodetic Data, Some Geologic Conclusions from, W. Bowie, 158
- Geographical: Association, Annual Meeting of the, 91; Examination of the Homeland, the Need for, Sir F. Younghusband, 753; Outlooks, 91
- Geography: A Sketch-map, a Text-book of World and Regional Geography for the Middle and Upper School, E. G. R. Taylor, 135; and Peace, 91; Physical, Economic, Regional, J. F. Chamberlain, 102
- Geological Society: Awards, 51; Election of Officers and Council of the, 317
- Geologist, Recollections of a, 607
- Geology: and the Nebular Theory, Prof. A. P. Coleman, 775; for Townsmen, 562; Fundamental Problems of, Study of, Prof. T. C. Chamberlin, 594; of the Gloucester District, N.S.W., C. A. Sussmilch, 226
- Geometrical Optics, The Future of, 151
- Geometry: A Concise, C. V. Durell, 574; Co-ordinate (Plane and Solid), for Beginners, R. C. Fawdry, 574; Plane and Solid, Dr. F. Durell and E. E. Arnold, 737; Plane, for Schools, T. A. Beckett and F. E. Robinson, Part 1, 737; Plane, Practical and Theoretical, *Pari Passu*, V. Le Neve Foster, 737; Practical, Elements of, a Two Years' Course for Day and Evening Technical Students, P. W. Scott, 574; Projective, An Introduction to, Prof. L. N. G. Filon. Third edition, 737
- German: Course, A First, for Science Students, Profs. H. G. Fiedler and F. E. Sandbach. Second edition, 204; Periodical Publications, Certain, Exempt from the German Reparations (Recovery) Act, 247
- Gid Parasite, The Name of the, Prof. T. D. A. Cockerell, 310
- Giza Zoological Gardens, The, 54
- Glacial Climates, 512
- Glands regulating Personality, The: A Study of the Glands of Internal Secretion in Relation to the Types of Human Nature, Dr. L. Berman, 670
- Glasgow University, Appeal for Funds for the Social Side of, 192
- Glass, Annealing and the Mechanical Properties of, M. Taffin, 158; Elastic Constants of, Determining the, G. F. C. Searle, 397; Liquid Inclusions in, C. E. Benham, 456; Optical, The Manufacture of, C. J. Peddle, 157; Some Measurements of the Stresses produced at the Surfaces of, by Grinding with Loose Abrasives, A. J. Dalladay, 431; The Annealing of, M. Taffin, 94; The Durability of, Effect of Magnesia on, C. M. M. Muirhead and Dr. W. E. S. Turner, 157; The Durability of, Methods of Determining, Dr. W. E. S. Turner, 157; White, the Manufacture of, in a Tank Furnace, F. W. Adams, 763; Batches, Common, containing Soda Ash and Saltcake, The Relative Advantages and Disadvantages of Limestone, Burnt Lime, and Slaked Lime as Constituents of, F. W. Hodkin and Dr. W. E. S. Turner, 291; Industry: The British, its Development and Outlook, Dr. W. E. S. Turner, 590; Research Association, Second Annual Report of the, 454; Technology, Society of, Dr. W. E. S. Turner elected President of the, 590
- Glasses: Absorption Spectra of, The Effect on Temperature on the, G. Rosengarten, 529; Some Natural, Density, Refractivity, and Composition Relations of, C. E. Tilley, 126
- Globular Lightning Discharge, Prof. A. P. Chattock, 106
- Glucose and Levulose, The Attack of, by the Pyocyanic Bacillus, E. Aubel, 63
- Glycine Soja, Sieb., and Zucc., The Possible Successful Growth of, as a Profitable Crop in Great Britain, J. L. North, 290



- Gold: Bullion, The Assay of, A. Westwood, 397; in Devonshire, Discovery of, Prof. W. T. Gordon, 583
- Goldsmiths' Company, Prime Warden of the, C. T. Heycock appointed, 753
- Golgi, Reticular Apparatus of, The Signification of the, A. Guillermond and G. Mangenot, 463
- Gorgas Foundation Memorial, Initiation of the, 488
- "Gouf de Cap-Breton," The Formation of the, C. Gorceix, 363
- Government Scientific Services, 569
- Graft-Hybrids, Prof. Weiss, 27
- Grain Pests (War) Committee, Report of the, 119
- Granitic Intrusion, Mixed Products of, C. H. Clapp, 187
- Graphs in Commerce and Industry, The Use of, A. R. Palmer, 644
- Gravitation: and Einstein's Theory, Some Terrestrial Experiments on, Prof. G. A. Schott, 106; La Théorie einsteinienne de la, essai de vulgarisation de la théorie, Prof. J. Mie, Ouvrage traduit de l'allemand, 770; The Classical and the Einstein Theory of, P. Painlevé, 699
- Gravitative Attraction, The Effect of Temperature on, P. E. Shaw and N. Davy, 462
- Gravity Observations, C. H. Swick, 188
- Gray Gyroscopic Stabilisers, The, Prof. J. G. Gray and Capt. J. Gray, 398
- Greece: Ancient, The Science of, F. S. Marvin, 169; The Legacy of, edited by R. W. Livingstone, 169
- Greek: and Arab in Medicine, Dr. C. Singer, 438; and Latin Papyri, Exhibition of, at the British Museum, 280, 350; Roman Engineering Instruments, R. C. S. Walters, 23; Mathematics, A History of, Sir Thomas Heath, 2 Vols., 330; Prof. D'Arcy W. Thompson, 330; Medicine in Rome: The FitzPatrick Lectures on the History of Medicine, delivered at the Royal College of Physicians of London in 1909-10, with other Historical Essays, Sir T. Clifford Allbutt, 438
- Greenland: by the Polar Sea: The Story of the Thule Expedition from Melville Bay to Cape Morris Jesup, K. Rasmussen. Translated by A. and R. Kenney, 702; Northernmost, Dr. H. R. Mill, 702; The Flora of, R. E. Holtum, 396; Western, Geological Notes on, Prof. A. C. Seward, 830
- Gresham's School, Holt, Annual Report of the Natural History Society of, 22
- Growth: and Multiplication, Factors of, Prof. B. Robertson, 187; and Sex-factors of Racial Character, Miss R. M. Fleming, 388
- Guinea-pig, The Hypertrophy of the Interstitial Cells in the Testicle of the, under Different Experimental Conditions, A. Lipschütz, B. Ottow, C. Wagner, and F. Bormann, 255
- Gymnosome (Loginiopsis), a New and Remarkable Type of, Mme. A. Pruvot, 463
- Gypsies, The Taboo of Women among, T. W. Thompson, 319
- Gypsy Lore Society, Revival of the, 148
- Hackworth, Timothy, The Work of, R. Young, 350
- Haloes and Earth-History: A New Radioactive Element, Prof. J. Joly, 516, 578
- Hanover Technische Hochschule, Dr. Fr. Quincke appointed Professor of Technical Chemistry at the, 798
- Harvard Observatory Telescope, The, 117
- Hawthorn, The Free Flowering of the, Dr. C. J. Bond, 823
- Hazell Annual, The New, and Almanack for the Year 1922, Dr. T. A. Ingram, 103
- Head Masters, Incorporated Association of, Annual General Meeting of the, 61
- Hearing: Acuteness of, and Aptitude for Military Service, M. Marage, 158; The Resonance Theory of, Dr. H. Hartridge, 76; Dr. W. Perrett, 176
- Heart, The Law of the, Prof. E. H. Starling, 13
- Heating and Cooling of the Body by Local Application of Heat and Cold, Prof. L. Hill, D. A. Ash, and J. A. Campbell, 255
- Hejaz, Dr. Hogarth, 91
- Helianthus: New Researches on Grafts of, L. Daniel, 63; *annuus*, The Ultra-maximum Temperature supported by the Embryos of, P. Garrigou-Lagrange, 631
- Heliotherapy, The Advance of, Dr. C. W. Saleeby, 663
- Helium: and Argon in the Boiling Well at St. Edmondsbury, Lucan, A. G. G. Leonard and Miss A. M. Richardson, 831; Band Spectrum of, Structure of the, W. E. Curtis, 326; in Natural Gas, H. B. Milner, 112; the Spectra of, The Minimum Electron Energies associated with the Excitation of, Ann C. Davies, 156
- Hellenism and Christianity, E. Bevan, 409
- Helmholtz: Hermann v., Schriften zur Erkenntnistheorie, herausgegeben und erläutert von P. Hertz und M. Schlick, 409; Theory of Hearing, The, Dr. E. W. Scripture, 518; A. S. E. Ackermann; Dr. H. Hart-ridge, 649
- Herakleopolite Nome Tree, The Sacred, Dr. F. F. Bruijning, 756
- Heredity: Old and New Ideas about, Prof. T. H. Morgan, 797; The Mechanism of, Prof. T. H. Morgan, 241, 275, 312, 830; The Hormone Theory of, Prof. W. M. Bayliss, 35; J. T. Cunningham, 343
- Hesperopithecus*, The First Anthropoid Primate found in America, Prof. H. F. Osborn, 750
- Hexamethylenetetramine, The Formic Hydrogenation of the Quaternary Salts of, M. Sommelet and J. Guioth, 463
- High Tension Switchgear, H. E. Poole, 7
- Histamine, The Action of, on the Secretion of the Gastric Juice in Pigeons, W. Koskowski, 194
- Historians and Geographers, the Co-operation of, Dr. Fleure, 91
- History and Geography, The Teaching of, R. L. Thompson, 91
- Holiday Courses in England and Wales, 630
- Hollow Curve, The, as shown by Pliocene Floras, Mrs. E. M. Reid, 256
- Holz-Konservierung, Handbuch der, edited by E. Troschel, 73
- Hooker Lecture, The, Prof. A. C. Seward, 830
- Hookworm, A New Treatment for, 688
- Hormones and Heredity: A Discussion of the Evolution of Adaptations and the Evolution of Species, J. T. Cunningham, 33
- Horse Serum, the Viscosity of, The Influence of Heat and of some Solvents on, A. Vila, 667
- Hughes's Original Microphones and other Instruments of Historic Interest, Recovery of, A. A. Campbell Swinton, 485
- Hull, Gift to, for a Technical College, by Rt. Hon. T. R. Ferens, 395
- Human: Cranium dredged from the River Trent, A. Prof. L. Gladstone, 593; Effort in Industry, The Economy of, E. Farmer, 123; Marriage, The History of, Prof. E. Westermarck, Fifth edition, 3 vols., 502; Wastage, Economic Aspects of, 676
- Huxley: Memorial Lecture of the Royal Anthropological Institute, The, H. Balfour, 91; Memorial Medal of the Royal Anthropological Institute, The, presented to H. Balfour, 92
- Hydraulics of Pipe Lines, Prof. W. F. Durand, 606
- Hydrocyanic Acid, The Synthesis of, by Oxidation, in Ammonio-silver Solution, of Alcohols, Phenols, and Amines, R. Fosse and A. Hieulle, 94
- Hydrogen: Active, Y. Venkataramaiah, 696; Alloy, the Electrical Conduction of a, D. P. Smith, 158; and Nitrogen, Active, Dr. G. L. Wendt; Dr. F. H. Newman, 749; Halides, The Viscosities of, H. Harlé, 94; -ion Concentration of the Contents of the Small Intestine, J. F. McClendon, 30; Ions, Apparatus for the Determination of the Concentration of a Solution in, A. Kling and Mme. A. Lassieur, 158; The Spectrum of, Prof. T. R. Merton and S. Barratt, 430
- Hydrographic Bureau, The International, Capt. Spicer-Simson, 724
- Hydroids, Cyclic Conditions and Rejuvenation in, R. Elmhirst, 208
- Hygiene, School of, Appointment of a Committee upon the Site and Planning of the, 384
- Hygrometry, Discussion on, at the Physical Society, 456
- Hymenoptera aculeata*, The Spiracular Muscles of, Annie D. Betts, 813
- Hyperemia, Active, D. T. Harris, 255

*Ibérica*, January, 385

Ice: Age and Man, The, H. J. E. Peake and J. Reid Moir, 529; Establishment of an Institute for the Study of the, 383; at Low Temperatures, The Brittleness of, L. Hawkes, 240; Patrol Service, Work of the, 453; Relief Sculpture by, A. Allix, 194; The Crystal Structure of, Sir William Bragg, 256

Illuminating: Engineering Society, Report of the, 790; The Work of the, 248; Gas, The Toxic Action of, on Plants, Prof. J. H. Priestley, 731

Images in Kinematography, An Apparatus for the Rapid Dissociation of, by the Electric Spark, L. Bull, 631

Immunology, The Principles of, Prof. H. T. Karsner and Dr. E. E. Ecker, 7

Imperial: Aspects of Comparative Medicine, 633; College of Science and Technology, Sir Thomas H. Holland appointed Rector of the, 655; Institute, The, 403; Monographs on Mineral Resources with Special Reference to the British Empire: Petroleum, 475; Research Institute of Osaka, Prof. P. P. von Weimarn appointed Research Associate of the, 622

Index Kewensis Plantarum Phanerogamarum, Supplementum Quantum, 472

India: Agriculture in, 594; as a Centre of Anthropological Inquiry, Sir Arthur Keith, 408; Commercial Information for, Handbook of, C. W. E. Cotton, 809; Hydro-electric Survey of, vol. 3, J. W. Meares, 531; Iron Production in, 191; Jute and Silk in, 170; Meteorological Department of the Government of, Report of the, 215; The Palæolithic Age in, T. H. Vines, 387

Indian: Fishing Tribes in Vancouver's Island, Dr. F. Boas, 423; Game Birds, 606; Marine Polychæta, R. Southern, 187; Oligochæta, The Morphology, Classification, and Zoogeography of, iv., v., vi., Dr. J. Stephenson, 256; Science Congress: Handbook for the Use of Members attending the Ninth Meeting to be held at Madras from the Thirtieth of January to the Fourth of February 1922, 304

Indigo Situation in India, The, Prof. H. E. Armstrong, 790

Induction Motor, The, and other Alternating Current Motors, B. A. Behrend. Second edition, 545; Dr. A. Russell, 545

Industrial: Development, Scientific Research and, 124; Fatigue, Prof. B. Muscio, E. Farmer, and R. S. Brooke, 222; and Efficiency, Dr. H. M. Vernon, 511; Board, Second Annual Report of the, 351; Lighting, L. Gaster, 354; Morbidity in Great Britain, Statistics of, E. A. Rusher, 21; Motion Study, E. Farmer, 219; Pioneers, Calendar of, 29, 61, 93, 125, 156, 192, 223, 255, 289, 325, 361, 395, 429, 461, 499, 533, 566, 598, 630, 665, 698, 729, 762, 798, 829; Psychology, National Institute of, Journal of the, 184; Dr. C. S. Myers and others, 459; Research, Functions of, 807; The Basis of Economic Progress, A. P. M. Fleming and J. G. Pearce, 807

Industry, The Psychology of, Dr. J. Drever, 511

Influence Machines, Modern High-speed, V. E. Johnson, 103

Influenza: Age Incidence of, Annie D. Betts; The Writer of the Article, 240; G. W. Butler, 342; Blood Concentration Changes in, F. P. Underhill and M. Ringer, 30; Problem, The, 129; The Spread of, 52; Returns, The, 118, 148

Infusoirs d'eau douce, Études sur les, Dr. E. Penard, 441

Inner Impulse, The, 675

Insect: Fauna of Britain, Additions to the, 726; Pairing, The Geometry of, C. G. Lamb, 730; Transformation, Prof. G. H. Carpenter, 673

Insects: and Human Welfare, Prof. C. T. Brues, 710; Metamorphoses of, Dr. A. D. Imms, 673; War against, Dr. L. O. Howard, 79

Integral: Calculus, A Treatise on the, with Applications, Examples, and Problems, J. Edwards, vol. 1, 435; Equations, The Numerical Solution of, H. Bateman, 224

Intelligence Statistics, Dr. R. W. Lawson, 716

Interfacial Tension and Hydrogen Ion Concentration, Dr. H. Hartridge and R. A. Peters, 666

Interferometer, A New Form of, H. P. Waran, 94

Internal-combustion Engine, Barr and Stroud's, 120

International: Astronomical Union, Dr. A. C. D. Crommelin;

Prof. W. W. Campbell elected President, 727; Fishery Investigations, The, 390; Union of Geodesy and Geophysics, The, 759; Ch. Lallemand re-elected President, 759

Intestinal: Flora, The Transformation of the, with Special Reference to the Implantation of *Bacillus acidophilus*, II., Feeding Experiments on Man, H. A. Chaplin and L. J. Rettger, 31; Protozoa of Man, The, C. Dobell and F. W. O'Connor; Sir E. Ray Lankester, 98

Intradermic Injection of Micro-organisms, Reactions of Defence and Immunity provoked by the, Either Living or Killed by Heat, N. Breton and V. Grysez, 764

Invention, Discovery and, Awards for, 293

Iodine, The Kinetic Study of Alkaline Solutions of, O. Liévin, 567

Iona, The Geology of, Prof. Jehu, 62

Irish Eskers, J. de W. Hinch, 353

Iron: -Age Village near Devizes, An Early, Mrs. Cunningham, 593; and Steel, Crystal Structure of, X-ray Studies on the, Dr. Westgren and Mr. Phragmen, 817; Ore in Europe, Prof. J. W. Gregory, 794; Resources of Europe, The, M. Roesler, 794; Production in India, 191

Irons, Cast, The Thermal Treatment of some, J. Durand, 535

Irrigation, The Development of Institutions under, with Special Reference to Early Utah Conditions, Prof. G. Thomas, 577

Island Communities, The Sociology and Economics of some, Dr. Malinowski, 532

Isotopes: Dr. F. W. Aston, 736; Elements and, 736; H. H. Poole, 699; The Difference between Series Spectra of, Prof. P. Ehrenfest, 745; Prof. N. Bohr, 746

Italian Earthquake of September 7, 1920, The, P. Monnet, 326

Japan, Mathematics in, 287

Jellies, The Rigidity of, F. Michaud, 763

Jena University, Prof. A. Gutbier appointed Professor of Chemistry at, 729

Jenner Medal of the Royal Society of Medicine, The, awarded to Dr. J. C. McVail, 823

Johannesburg, Geological Map of, C. T. Mellor and A. L. Du Toit, 562

Johns Hopkins University School of Hygiene and Public Health, The, 486

Jupiter and his Markings, W. F. Denning, 591

Jurassic Plants: from Ceylon, Prof. A. C. Seward and R. E. Holttum, 193; from Yorkshire, Some New and Rare, (V), H. H. Thomas, 290

Jute and Silk, Reports on, Indian Trade Inquiry, 170

Juvenile Delinquency, Dr. C. Burt, 250

K Series of the Light Elements, The Complexity of the, and its Theoretical Interpretation, A. Dauvillier, 326

Kahn, Albert, Travelling Fellowship, The, awarded to J. H. Nicholson, 823

Kaiser Wilhelm Gesellschaft zur Förderung der Wissenschaften zu Ihrem zehnjährigen Jubiläum dargebracht von ihren Instituten, Festschrift der, 69

K $\alpha$  Lines of the Lighter Elements, The, V. Dolejšek, 326

Kaolins, Clays, Bauxites, etc., A. Bigot, 731

Karlsruhe Technische Hochschule, Prof. K. Freudenberg appointed Successor to Prof. Pfeiffer at the, 729

Kasolite, a New Radio-active Mineral, A. Schoep, 63

Katanga, Flore du, contribution à l'étude de la, E. de Wildeman, 548

Kata-thermometer, The, a Measure of Ventilation, Prof. L. Hill, Dr. H. M. Vernon, and D. H. Ash, 126

Kauri Pine, Preservation of the, 282

Kentucky, The House of Representatives of, and the Teaching of Evolution in Schools, 669

Kepler, The Laws of, and the Relativist Orbits, J. Troussset, 699

Kerguelen, New Surveys in, Capt. R. R. du Batz, 319

Kew, Royal Botanic Gardens: Impending Retirement of Sir David Prain; appointment of Dr. A. W. Hill as



- Director, 51; retirement of Dr. O. Stapf; appointment of A. D. Cotton as Keeper of the Herbarium and Library, 384
- Kidney, The Efficiency of the, Prof. A. R. Cushny and others, 122
- Kinetic Theory of Gases, Certain Integrals occurring in the, Prof. S. Chapman, 258
- Kinship, The Evolution of, Dr. E. S. Hartland, 825
- Knossus, The Bull Acrobats at, Sir Arthur Evans, 387
- Knowledge: Some Byways of the Theory of, Prof. R. F. A. Hoernlé, 431; The Organisation of, Dr. F. L. Hoffman, 596; W. W. Leisenring, 715; F. E. Cave; The Writer of the Article, 716
- Kontinente und Ozeane, Die Entstehung der, Prof. A. Wegener, 202
- Kosciusko, Mount, The Summit of, formerly covered by Glaciers, Sir T. Edgeworth David, and Profs. Skeats and Richards, 51
- Koster Caves, South Africa, Mummified Animals in the, H. S. Harger, 621
- "Kriminologie," "Das System der," Prof. W. Ostwald, 86
- Krypton and Xenon, The Estimation of, in Absolute Value, by Spectrophotometry, C. Moureu and A. Lepape, 599
- Labrador and New Quebec, Prof. A. P. Coleman, 353
- Lachaise, The Père, Cemetery in Paris, 116
- Lactic: Ferment to Poisons, The Tolerance of the, C. Richet, E. Bachrach, and H. Cardot, 258; Fermentation, Studies on the, C. Richet, E. Bachrach, and H. Cardot, 566
- Lævoglucothane, The Polymerisation of, A. Pictet and J. H. Ross, 667
- La Matière et l'Énergie: Selon la Théorie de la Relativité et la Théorie des Quanta, Prof. L. Rougier. Nouvelle édition, 339
- Laminaria and Chorda, The Life-histories of, C. Lloyd Williams, 699
- Land and Sea Breezes in the Gulf of Lions, Prof. M. Moye, 489
- Langley Aeroplane, The, and the Hammondsport Trials, 97; G. Brewer, 305; The Writer of the Articles, 307
- Languages, Auxiliary International, Prof. F. G. Donnan, 491
- Latitude Changes, Progressive, Prof. F. Schlesinger, 560
- Latvia, English Books for, 92
- Laurionite and Paralaurionite from Cornwall, A. Russell and A. Hutchinson, 126
- Lead: Silver-lead, and Zinc Ores of Cornwall, Devon, and Somerset, H. Dewey, 6; Soluble Salts of, The Action of, on Plants, E. Bonnet, 327; and Zinc Ores in the Carboniferous Rocks of North Wales, B. Smith, 6
- Leaves, The Mechanism of the Orientation of, E. Zaepffel, 127
- Leeds University: A. Wormald appointed Demonstrator in Bio-chemistry in, 254; Endowment by Sir Berkeley Moynihan of a Gold Medal, 288; Impending Resignation of Prof. J. Goodman, 429; Forthcoming Conferment of Honorary Degrees, 597; Election of Dr. A. Gilligan to the Chair of Geology; S. Barratt appointed Assistant Lecturer and Demonstrator in Chemistry; A. H. Thompson appointed Reader in Mediæval History, 697
- Legendary Islands of the Atlantic: A Study in Mediæval Geography, W. H. Babcock, 803
- Leishmania donovani* parasite of Kala-azar, The, Lt.-Col. Christophers, 688
- Leonardo da Vinci as a Geologist, Sir Charles J. Holmes, 499
- L'Éther actuel et ses précurseurs (simple récit), E. M. Lémeray, 770
- Leucotermes lucifugus*, Rossi, the Social Habits of, Dr. J. Feytaud, 150
- Lhota Nagas of Assam, The, J. P. Mills, 393
- Lichens: A Handbook of the British Lichens, Annie Lorrain Smith, 5
- Life: The Haunts of, Being Six Lectures delivered at the Royal Institution, Christmas Holidays, 1920-1921, Prof. J. A. Thomson, 710
- Life Tables, The Scientific Value of, Dr. M. Greenwood, 691
- Light: as an Aid to Aerial Navigation, The Use of, Lt.-Col. L. F. Blandy, 286; Requirements in Hospitals, J. Darch and others, 657; Sensitivity in Photography, The Interpretation of, Prof. T. Svedberg, 795; The Biological Action of, Appointment of a Committee upon, 248; The Speed of, Dr. E. H. Kennard, 581
- Lighting of Public Buildings, The, E. H. Rayner, J. W. T. Walsh, and H. Buckley, 490
- Lightning Arresters, J. L. R. Hayden, 54
- Lignites of Cap-Bon (Tunis), The, A. Allemand-Martin, 94
- Lime carried down by Ferric Hydroxide Precipitates, The, A. Charriou, 30
- Linnean Society, Prof. L. Cuénot, G. Gilson, Prof. J. W. E. G. Leche, and Dr. B. L. Robinson elected Foreign Members of the, 655; Gold Medal of the, presented to Prof. E. B. Poulton; Election of Officers and Council of the, 754
- Lipobranchius intermedius*, Formation of myolytic spindles and their Phagocytosis in the coelom of, A. Dehorne, 763
- Liquids: holding Metallic Powders in Suspension, An Electro- and Magneto-optical Effect in, M. St. Procopiu, 700; Measuring the Surface Tension of, Prof. Jaeger, 153; Slightly Miscible, An Optical Method for the Determination of the Reciprocal Solubility of, C. Chéveneau, 535
- Lister, Lord, The Ward in the Royal Infirmary, Glasgow, of, 184
- Lithium, Isotopes of, The Structure of the line  $\lambda=6708$  Å of the, Prof. J. C. McLennan and D. S. Ainslie, 699
- Liverpool University, Conferment of Honorary Degrees, 761
- Living Organism, The Laboratory of the, Dr. M. O. Forster, 153
- Livingstone College, Report of, 385
- London: and Westminster, Original Contours and Drainage of, and their present Configuration, Mrs. Ormsby, 91; Geology and the History of, C. E. N. Bromehead, 324; South, Geology of, H. Dewey and C. C. A. Bromehead, 562; University, Continuance of Benefaction to the Ratan Tata Foundation; Conferment of Doctorates, 155; Research Degrees and, Dr. A. M. Davies, 238; Conferment of Doctorates, 254; Prof. H. R. Dean appointed Professor of Bacteriology at University College Hospital Medical School, 360; Dr. C. A. Pannett appointed Professor of Surgery at St. Mary's Hospital Medical School, Dr. C. A. Lovatt Evans Professor of Physiology at St. Bartholomew's Hospital Medical College, Dr. G. B. Jeffery Professor of Mathematics at King's College; Cutlers' Scholarships; award of Doctorates, 429; Conferment of Doctorates, 460, 532, 761; Report for 1921-22, 629; Dr. R. W. Chambers appointed Quain Professor of English Language and Literature at University College, N. B. Jopson University Reader in Comparative Slavonic Philology at King's College, R. B. Forrester Sir Ernest Cassel Lecturer in Commerce at the London School of Economics, 728; Scheme of Industrial Training, 798
- Long Barrow Race, The, and its Relationship to the Modern Inhabitants of London, Prof. F. G. Parsons, 86
- Lord Howe Island, Story of, A. R. McCulloch, 22
- Lorentz-Einstein, Vérification expérimentale de la formule de, Prof. Ch.-Eug. Guye en collaboration successive avec S. Ratnowsky et Ch. Lavanchy, 406
- Lower Carboniferous Succession in the Settle District, etc., Prof. E. Garwood and Miss E. Goodyear, 730
- Lubrication: Boundary, The Paraffin Series, W. B. Hardy and Ida Doubleday, 224
- Luminescence at High Temperatures, E. L. Nichols and D. T. Wilbur, 31
- Luminosities, Determination of, by Spectrophotometry, Lindblad, 656
- Lunar: Atmospheric Tide at Aberdeen, The, 1869-1919, Prof. S. Chapman and Miss E. Falshaw, 599; Periodicity in Reproduction, H. M. Fox, 237; Tables, New, Prof. Brown, 690
- Lyrids, The Shower of, 528
- Lyte's Library, A Relic of Henry, H. Downes, 699

- Macrocystis pyrifera*, Studies in, E. Marion Delf and M. Michell, 194
- Madagascar, Lead in the Uranium Minerals of, M. Muguet, 158
- Magnesium: in Organic Chemistry, H. Hepworth, 251; Positive-ray Analysis of, A. J. Dempster, 159
- Magnetic: Induction, Ewing's Theory of, 321; Susceptibilities at High Frequencies, The Measurement of, M. H. Belz, 398
- Magnetism and Atomic Structure, II., Dr. A. E. Oxley, 290
- Magneto: -chemical Investigation of Constitution in Mineral Chemistry, P. Pascal, 326; -optische Verschijnselen, Verhandeligen van Dr. P. Zeeman over, 66
- Maidstone Museum, Donations to the, 216
- Majorana's Theory of Gravitation, A Criticism of, Prof. H. N. Russell, 352
- Malacological Society of London, Election of Officers and Council of the, 249
- Malaria: in the Federated Malay States: The Prevention of, A Record of Twenty Years' Progress, Dr. M. Watson, with Contributions by P. S. Hunter and A. R. Wellington. Second edition, 334; The Conquest of, Col. W. G. King, 647
- Malaysian Butterflies, Major J. C. Moulton, 23
- Mallard, Nestling Feathers of the, Prof. J. Cossar Ewart, 662
- Malta, Recent Excavations in, Miss M. A. Murray, 27
- Maltese Cross shown by Wood that has undergone Traumatisms, J. Costantin, 799
- Man: Sir G. Archdall Reid, 579; and his Past, O. G. S. Crawford, 302; in *India*, No. 3, 558; in the Pacific, Dr. C. Wissler, 387
- Manchester: Literary and Philosophical Society, Election of Officers and Council of the, 590; L. E. Vlies elected Chairman of the Chemical Section of the, 690; University, Donation from the Executors of the late H. Woolley, Appointments in, 155; Resignation of Prof. H. R. Dean of the Proctor Chair of Pathology, 325; Prof. A. Lapworth appointed Sir Samuel Hall Professor of Chemistry, 429; Institution of a Fellowship in Memory of the late Prof. A. S. Delépine, 460; Impending Resignation of Prof. J. W. Smith; Appointments in, 498; Prof. R. Robinson appointed Professor of Organic Chemistry in, 664
- Manganese: Group, Monoclinic Double Selenates of the, Dr. A. E. H. Tutton, 461; Spectrum of, Series and other Regularities in the, M. A. Catalán, 461
- Manurial: Phosphates, The Citric Solubility of, Dr. Tocher, 25; Substances, The Absorption and Retention of, by Granitic Soils, Prof. Hendrick, 25
- Manuring Grassland, Effect of Long-continued, Dr. Winifred E. Brenchley, 25
- Map Projection, Elements of, C. H. Deetz and O. S. Adams, 88
- Marine: Borers in San Francisco Bay, 426; Invertebrates, C. H. Edmondson and others, 530; Molluscan Fauna of America, W. H. Dall, 282; Organisms, An Elusive Group of, Sir W. A. Herdman, 130
- Mars: Conjunction of, with a Star, W. F. Denning, 186; The Approaching Opposition of, 386; The Rotation Period of, 791
- Mary, Princess, and Viscount Lascelles, The Marriage of, 279
- Mastodon, The American Indians' Knowledge of the, J. L. B. Taylor, Dr. C. Wissler, 387
- Mathematical: Analysis, Prof. G. H. Hardy, 435; Association, Annual Meeting of the, Sir T. L. Heath elected President, 85; Pastimes, New, Major P. A. MacMahon, 200; Recreations, 200; Tables, Wightman's Secondary School, edited by F. Sandon, 737
- Mathematics: and Public Opinion, 520; Elementary, Text-books of, 574; for Technical Students: Junior Course, S. N. Forrest, 574; in Japan, 287; Pure, Elementary, Dr. S. Brodetsky, 737
- Maud* Arctic Expedition, The, 789
- Maxwell, The Tensions and Pressures of, in Magnets and Dielectrics, G. Gouy, 362
- Maya Hieroglyphs, A. M. Tozzer, 282
- Mayen Island, Jan, A Summer Visit to, J. M. Wordie, 15; The Flora of, J. L. C. Musters, 194
- Measure, How to, Profs. G. M. Wilson and K. J. Hoke, 472
- Measurements and Instruments, Physical, A Journal for, 182
- Mécanismes communs aux phénomènes disparates, Prof. M. Petrovitch, 739
- Mechanical Engineers, Institution of, Awards of the, 351; Work of the Research Committees of the, 351
- Mechanics and Engineering from the Time of Aristotle to that of Archimedes, T. E. Lones, 214
- Medicinal Chemicals, 37
- Medicine: Comparative, Imperial Aspects of, 633; History of, the Third International Congress of the, Election of Officers of, 21
- Mediterranean Fever, A New Method of Diagnosis of, E. Burnet, 259
- Megalithic Monuments of Malta, The, 27
- Melanesian Witchcraft, Dr. B. Malinowski, 827
- Melbourne University Bill, The, 329
- Meldola Medal, The, 49; awarded to Dr. C. K. Ingold, 249
- Melting Points of Pure Organic Liquids as Thermometric Standards for Temperatures below 0° C., The, J. Timmermans, Mlle. H. Van der Horst and H. K. Onnes, 258
- Memories of a Long Life, Rev. Canon T. G. Bonney, 607
- Memory, Sir G. Archdall Reid, 551
- Mendel, The Centenary of the Birth of, 486
- Mental: Hygiene, A National Council for, Sir Courtauld Thomson, 565; Inauguration of a, Sir Courtauld Thomson elected President, 621; Measurement, The Essentials of, Dr. W. Brown and Prof. G. H. Thomson, 472; Tests and Mentality, Prof. Pear, 657
- Mercury: from Different Sources, The Atomic Weight of, Prof. J. N. Brönsted and Dr. G. Hevesy, 780; Isotopes of, Separation of, Prof. W. D. Harkins and R. S. Mulliken, 388; Pump, A New Form of High Vacuum Automatic, H. P. Waran, 462; The Isotopes of, Prof. T. H. Laby and W. Mepharm, 206; Vapour, Low Voltage Glows in, G. Stead and E. C. Stoner, 397
- Mercury, The Planet, W. F. Denning, 623
- Merlin, Breeding Habits of the, W. Rowan, 423
- Mesopotamia, River Control in, E. Howell, 215
- Messier, 33, Internal Motion with Spiral Nebula, A. Van Maanen, 158
- Metallurgy, Industrial, Periodicals of Interest on, 724
- Metals: and Alloys at Low Temperatures, The Variations of the Mechanical Properties of, L. Guillet and J. Cournot, 258; Endurance Limits of, H. F. Moore and J. B. Koppers, 219; Institute of, The Journal of the, No. 2, 1921, vol. xxvi. Edited by G. Shaw Scott, 644
- Metchnikoff: (Měčnikov), and Russian Science in 1883, Prof. B. Brauner, 478; Elie, Life of, 1845-1916, Olga Metchnikoff, 163
- Meteoric Fireballs, 318; Shower of December 4-5, 1921, W. F. Denning, 121
- Meteorological: Observations, Mont Blanc, Sir Napier Shaw, 190; Office—Air Ministry: British Rainfall, 1920, 102
- Météorologie pratique, Études élémentaires de, A. Baldit, 440
- Meteorology: Elementary, C. J. P. Cave, 440; Handbook of, A Manual for Co-operative Observers and Students, J. W. Redway, 440; in Medicine, Dr. A. G. Macdonald, 354; in the Netherland Indies, 594
- Meteors, The April, 1922, W. F. Denning, 560; The Shower of January, W. F. Denning, 55
- Metres, Standard, Recent Fundamental Determinations and Verifications of the, C. E. Guillaume, 62
- Metric Gallon, suggested, 117
- Mexican Archaeology, A. M. Tozzer, 624
- Mexico, Archaeological Investigations in, Mrs. Zelia Nuttall, 59
- Microphones, Doubly Resonated Hot-wire, E. T. Paris, 698
- Microscope: A New Science, C. Baker, 562; Beck's Standard London Petrological, 58; Illumination and Fatigue, H. J. Denham, 78; Objectives, 320; The, Its Design, Construction, and Applications. A Symposium and General Discussion by many Authorities. Edited by F. S. Spiers, 370; The Mechanical Construction of the, from a Historical Point of View, Prof. A. Pollard, 754



- Microscopes: and Microscopic Definition, Test-plates for, A. Mallock, 205; Petrological, Catalogue of, James Swift and Son, Ltd., 658
- Microtome's Vade Mecum: The, A Handbook of the Methods of Microscopic Anatomy, A. B. Lee. Eighth edition. Edited by Prof. J. B. Gatenby and others, 72
- Mikroskopische Physiographie der petrographisch wichtigen Mineralien. H. Rosenbusch. Band 1. Erste Hälfte. Untersuchungsmethoden. Fünfte Auflage. Prof. E. A. Wülfing. Lief. 1., 303
- Milk: Fat, The Influence of Feeding on, E. J. Sheehy, 398; Production, Dairy Cattle and, 360; Secretion of, The Varying Rates of, on its Percentage Composition, Dr. W. Taylor and A. D. Husband, 25
- Mind: Sir G. Archdall Reid, 515; The Analysis of, B. Russell, 513
- Mineral: Industry of the British Empire, The, 754; Resources of Great Britain, Special Reports on the, vol. xxiii.; Lead and Zinc Ores in the Pre-Carboniferous Rocks of West Shropshire and North Wales. Part 1, West Shropshire, B. Smith; Part 2, North Wales, H. Dewey and B. Smith, 546; Separation, Alternating-current, Prof. S. J. Truscott, 556
- Mineralogical Society, Bequest to, by Sir W. Phipson Beale, 724
- Mineralogy, Determinative, A Manual of, Prof. J. V. Lewis. Third edition, 772
- Minerals: Introduction to the Study of, and Guide to the Mineral Collections in Kelvingrove Museum, Prof. P. MacNair. Second edition, 370; The Attack of, by Bacteria, A. Helbronner and W. Rudolfs, 800
- Miners' Lamps, 253
- Mining and Metallurgy, The Institution of, and Technical Education, S. J. Speak, 597
- Minos: The Palace of, A Comparative Account of the Successive Stages of the Early Cretan Civilisation as illustrated by the Discoveries at Knossos, Sir Arthur Evans. Vol. 1, The Neolithic and Early and Middle Minoan Ages, 466
- Miscellanea Physica, 739
- Missionaries as Anthropologists, Sir James Frazer, 593
- Molecular Diameters, A New Mode of Determination of the, by the Electromagnetic Rotation of the Discharge in the Gases, C. E. Guye and R. Rüdy, 258
- Molecule, A Special Type of Rigid, The Kinetic Theory of, F. B. Pidduck, 224
- Molecules, Anisotropy of, Prof. C. V. Raman, 75
- Mollusca, Self-fertilisation in, G. C. Robson, 12; S. M. Ramanujam, 593
- Monatomic Gas, Non-uniform Rarefied, The Velocity Distribution Function and the Stresses in a, J. E. Jones, 224
- Monochlorotoluenes, The, A. Wahl, G. Normand, and G. Vermeylen, 599
- Monsoon, The South-West, Dr. G. C. Simpson, 109; L. C. W. Bonacina, 109
- Mont Blanc: Meteorological Observations, Sir Napier Shaw, 190; Observations carried out on, A. Boutaric, 226
- Moon: Changes in the, Prof. W. H. Pickering, 690; Eclipsed, Illumination of the, L. Richardson, 318
- Morocco, The Climatology of, L. Gentil, 226
- Morphological Aberration, Dr. F. A. Bather, 640
- Mortality Tables, 389
- Mortar, The Weathering of, N. M. Richardson, 310; C. Carus-Wilson, 478
- Mosquito: Investigation, 792; Larvæ, The Destruction of, in Salt or Brackish Water, J. F. Marshall, 746
- Mosquitoes, Biology of, and the Disappearance of Malaria in Denmark, 323
- Moss: A Retarded Regeneration of, J. Maheu, 667; Rose, The Origin of the, Major Hurst, 190; Major Hurst and Miss M. S. G. Breeze, 283
- Motor: Car Practice, Modern, edited by W. H. Berry, 371; Headlights, J. W. T. Walsh and others, 694; without Glare, H. S. Ryland, 793
- Mould Growths on Cold Store Meat, F. T. Brooks and C. G. Hansford, 462
- Mound-builders of Dunstable, The, Col. T. C. Hodson, 21
- Mountain and Moorland, Prof. J. A. Thomson, 513
- Multenions and Differential Invariants, Pts. ii. and iii., Prof. A. McAulay, 290
- Mummified Animals in the Koster Caves, South Africa, H. S. Harger, 621
- Muscle, The Acidity of, during Maintained Contraction, Dr. H. E. Roaf, 499
- Muscular: Efficiency, A. Mallock, 711; Work, Heavy, Prof. E. P. Cathcart and others, 122
- Museum Specimens, Effect of Light on, Sir Sidney Harmer, 757
- Museums: Provincial, The Needs of, 118; The State and, 216; The Educational Use of, Lord Sudeley and Lord Hylton, 688
- Mutual Inductance, Calculation of a Standard of, and Comparison of it with the Similar Laboratory Standard, D. W. Dye, 461
- Mycology, British, 154
- Myriapods collected in Mesopotamia and N.-W. Persia by W. E. Evans, H. W. Brolemann, 398
- Napoleona imperialis*, Beauv., The Floral Structure of, J. McLean Thompson, 257
- Natal and Zululand, Flora of, An Introduction to the, Prof. J. W. Bews, 510
- Nation, Education and the, 1
- National: Expenditure, Committee on, Third Report of the, 279; Galleries and Museums, Protest against Proposed Charges for Admission to the, 722; Institute of Industrial Psychology, The, Dr. C. S. Myers and others, 459
- Natural History: in Schools, The Teaching of, Prof. Hickson and others, 628; E. W. Shann, 747; A. G. Lowndes, 748; Museum Staff Association, Scientific Reunion of the, 316
- NATURE, An Appreciation of, Prof. B. Brauner, 350
- Naval Engineering, The Centenary of, Eng.-Cdr. E. C. Smith, 596
- Navy, Education and Scientific Services in the, Expenditure on, 384
- Nebulæ, Obscure, A Study of, Rev. J. G. Hagen, 455
- Nebular Theory, Geology and the, Prof. A. P. Coleman, 775
- Nectar-sipping Birds: An Artifice of, P. M. Debbarman, 489; Sir Herbert Maxwell, 612
- Nematodes, Classification of, Dr. H. H. Cobb, 353
- Neon: -filled Lamps, Some Electrical Properties of, S. O. Pearson and H. H. G. Anson, 730; Lamps, W. E. Curtis, 343
- Neptune's Equator, The Position of, A. Newton, 528
- Nerve Exhaustion, Sir Maurice Craig, 744
- Netherland Indies, The Climate of the, Dr. C. Braak, 594
- New: Mexico, New Dinosaur from, C. W. Gilmore, 756; South Wales, The Freshwater Entomostraca of, Pt. I., Cladocera, Marguerite Henry, 832; Year Honours, 20; York, Metropolitan Museum of Art, Endowment of the, by G. F. Baker, 789; Zealand Astronomical Society, Election of Officers of the, 52; Geology in, Prof. J. Park and others, 624; Geology of Western Southland, Prof. J. Park, 657
- Newton, La Loi de, est la loi unique: théorie mécanique de l'univers, M. Franck, 739
- Nickel-silvers, Some Mechanical Properties of the, F. C. Thompson and E. Whitehead, 397
- Nicotiana Tabacum*, Results of crossing Certain Varieties of, W. A. Satchell, T. H. Goodspeed, and R. E. Clausen, 159
- Nicotine and the Inhibitory Nerves of the Heart, W. Koskowski, 631
- Nilgiri and Pulney Hill-tops, The Flora of the, Prof. P. F. Fyson. Vol. 3, 510
- Nitrogenous Principle of Plants, The Synthesis of a, R. Fosse, 30
- Nodal Slide, A Criticism of the, as an Aid in testing Photographic Lenses, T. Smith and J. S. Anderson, 430
- Non-Euclidean Geometry, The Pioneer of, 232
- Non-specific Therapy, Dr. J. Stephenson, 717
- Nottingham, University College, New Buildings of, 827
- Nova: Cygni, 1920, The Light Curve of, 386; Puppis, 1902, Miss Woods, 217; The Definition of a, Rev. J. G. Hagen, 352
- Novæ, Recent Magnitudes of, Dr. W. H. Steavenson, 455

- Nubi, Le, L. Taffara. Parte I., II., 301
- Nucleolus, Morphology and Physiology of the, R. S. Ludford, 666
- Nucleus, Shape of the, and the Mechanical Causes, Prof. Champy and H. M. Carleton, 22
- "Nurse-hound," The Term, E. Ford, 55
- Nut Growing, R. T. Morris, 337
- Nyasaland : A Handbook on Cotton and Tobacco Cultivation in, A Guide to Prospective Settlers, J. S. J. McCall, 337
- Ocean : Island, The Phosphate Deposit of, L. Owen, 62 ; Research and the Great Fisheries, G. C. L. Howell, 201
- Oceanography of the Gibraltar Region, Dr. Johs. Schmidt, 45
- Octet Theory, A Modified, 629
- Oil : *Engineering and Finance*, No. 1, 350 ; Firing for Ranges and Steam Boilers, E. C. Bowden-Smith, 204 ; Geologist, Field Mapping for the, C. A. Warner, 474 ; on the Surface of a Sheet of Water, Velocity of Extension of Thin Layers of, P. Woog, 158 ; Shale as a Source of Gasoline, 594
- Oils, Fats, and Fuels, T. Hull, 774
- Oleic Acid, The Catalytic Decomposition of, A. Mailhe, 567
- Oligocene Mosquitoes in the British Museum, J. W. Edwards, 598
- Opalescence, The Variations of Critical, with the Temperature and the Wave-length of the Incident Light, A. Andant, 799
- Opalina, Nuclear Division in, Prof. R. W. Hegner and Dr. Wu, 319
- Optical : Instruments, The Classification of, T. Smith, 830 ; The Photometry of, J. Guild, 431 ; Resolving Power and Definition, T. Smith, 745 ; Rotatory Dispersion, Prof. T. M. Lowry and Dr. P. C. Austin (Bakerian Lecture), 447 ; Society, Election of Officers of the, 385 ; of America, Journal of the, Dr. L. Silberstein appointed an Associate Editor of the, 724 ; Theories, Dr. S. Brodetsky, 706 ; Theories, Based on Lectures delivered before the Calcutta University, Prof. D. N. Mallik. Second edition, 706 ; Three-apertures Problem, The, T. Smith, 157
- Optics, Examples in, Compiled by Dr. T. J. I'A. Bromwich, 235\*
- Optik, Physikalischen, Die Prinzipien der, historisch und erkenntnispsychologisch entwickelt, E. Mach, 706
- Optisches Instrument, Die Brille als, Prof. M. von Rohr, Dritte Auflage, 772
- Oranges on Keeping, The Transformations undergone by, G. André, 30
- Organic : Dependence and Disease : Their Origin and Significance, Dr. J. M. Clarke, 708 ; Sulphur Compounds, The Auto-oxidation of, M. Delépine, 763 ; Syntheses : An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals, Vol. 1, 443
- Organism, The, and Environment, Dr. F. B. Sumner, 456
- Organo-metallic Compounds, An Attempt at the Systematic Extension of the Preparation of, A. Job and R. Reich, 800
- Orites excelsa*, R. Br. (family Proteaceæ), One of the Australian Silky Oaks, Specimens of Wood of, Dr. A. B. Rendle, 194
- Osage Tribe of American Indians, The, F. la Flesche, 756
- Oxford : and Cambridge and the Royal Commission, 465 ; Report of the Royal Commission, 428 ; University, A. L. Dixon appointed Professor of Pure Mathematics, 394 ; The Romanes Lecture to be delivered by Prof. A. S. Eddington ; Rejection of Preamble of a Statute to discontinue the Delegacy of the University Museum, 155 ; Press, Some Account of the, 1468-1921, 514
- Oxides : in Washington's Collected Analyses of Igneous Rocks, The Distribution of, W. A. Richardson, 126 ; The Reduction of, by Hydrogen, E. Berger, 799
- Oxygen Consumption, Apparatus for Measuring, Prof. A. Krogh, 123
- Oyster, The Blood-cells of the, Dr. J. H. Orton, 612
- Pacific, Problems of the, Sir Halford Mackinder, 91
- Padua, University of, The Seventh Centenary of the, 486 ; The 700th Anniversary of the, Prof. E. W. Scripture, 752
- Palæontological Research, Records of, 561
- Palm Pritchardia, The Geographical Distribution of the, the late Prof. O. Beccari and Prof. J. Rock, 392
- Palms, The Development and Morphology of the Leaves of, Agnes Arber, 499
- Para Rubber-tree, The Brown Bast Disease of the, Dr. S. E. Chandler, 357
- Parabolic Wage, The, C. Lallemand, 566
- Parallaxes and Proper Motions, Dr. Van Maanen, 318
- Paralysis, General, Histo-microbiological Researches on, Y. Manouélian, 667
- Paramecium aurelia* at Yale University, Present Status of the Long-continued Pedigree Culture of, L. L. Woodruff, 159
- Parasitic : Amœba with Pathogenic Capacities, A. Prof. C. A. Kofoid and Dr. Olive Swezy, 282 ; Worms from Animals, Dr. G. A. MacCallum, 187 ; of Man and Methods of suppressing them, Major F. H. Stewart, 379
- Parasitism and Symbiosis, F. A. Potts, 643
- Parasitisme, Le, et la symbiose, Prof. M. Caullery, 643
- Parfumerie, Manuel de, I. Lazennec, 774
- Particle Emission, Random Direction of a, An Attempt to influence the, G. H. Henderson, 398
- $\alpha$ -Particles as Detonators, G. H. Henderson, 749
- Passivity and Overpotential, U. R. Evans, 257
- Pasteur : and his Work, L. Descour. Translated by A. F. and Dr. B. H. Wedd, 805 ; the Centenary of the Birth of, 486
- Pasteur's Scientific Career, 805
- Patents and Chemical Research, H. E. Potts, 338
- Pathological and Bacteriological Laboratories, The Association of Assistants in, 488
- "Patternscape," The, 724
- Pearls, Cultivated Japanese, A Method of recognising, J. Galibourg and F. Ryziger, 631
- Peat, the Winning and the Utilisation of, A Handbook on, A. Hausding. Translated from the third German edition by Prof. H. Ryan, 774
- Peaty Soils, Spontaneous Ignition of, E. A. Andrews, 77
- Pébrine in Silkworms, C. M. Hutchinson, 253
- Peltier Effect, The, E. H. Hall, 159
- Pencil Markings in the Bodleian Library, C. Ainsworth Mitchell, 516
- Pendulations-Theorie, Die, Prof. H. Simroth, 809
- Pendulum and a Chronometer, Experiments relating to the Course of a, J. Lecarme, 831
- Penny, The Power of the, H. Allcock, 724
- Peoples of All Nations, Edited by J. A. Hammerton. No. 1, 475
- "Peptone," The Action of, on Blood and Immunity thereto, J. W. Pickering and J. A. Hewitt, 430
- Perfumery : The Raw Materials of, Their Nature, Occurrence, and Employment, E. J. Parry, 305
- Perfumes, Essential Oils and Fruit Essences used for Soap and other Toilet Articles, Dr. G. Martin, 271
- Personal Beauty and Racial Betterment, Prof. K. Dunlop, 339
- Peru : Ancient, Culture of, T. A. Joyce, 187 ; Carboniferous Plants from, Prof. A. C. Seward, 598 ; Tertiary Fossils of, H. Woods, T. W. Vaughan, and J. A. Cushman, 561
- Pétrole, Exploitation du, par puits et galeries, P. de Chambrier, 443
- Pétroles, Technique des, R. Courau, 548
- Petroleum : Sir Boverton Redwood. Fourth edition. In three volumes, 403 ; A Treatise on, Sir T. H. Holland, 403 ; Commission, The International, Prof. J. S. S. Brame, 497 ; Divining in France, Dr. H. Moineau and M. Régis, 247 ; Geology, Field Methods in, Dr. G. H. Cox, Prof. C. L. Dake, and Prof. G. A. Muilenburg, 474 ; Imperial Institute : Monographs on Mineral Resources, with special reference to the British Empire, 475 ; in a Well at Darcy, near Dalkeith, 654 ; Industry, The. Edited by A. E. Dunstan, 774 ; Resources of California, 188
- Petrological Microscope, A, 58



- Pewsey, Vale of, Drainage of the, W. D. Varney, 23  
 Pharmacology, A Manual of, Prof. W. E. Dixon. Fifth edition, 372  
*Phaseolus vulgaris*, The Vascular Anatomy of Normal and Variant Seedlings of, J. A. Harris and E. W. Sinnott, 159  
 Ph.D., The English, Prof. E. W. Scripture, 780  
 Phenol, The Ultra-violet Absorption of, in Different Solvents, F. W. Klingstedt, 535  
 Phenological Observations, L. C. W. Bonacina, 373  
 Philadelphia Commercial Museum, Educational Work of the, C. R. Toothaker, 53  
 Philosophy: and the New Physics: An Essay on the Relativity Theory and the Theory of Quanta, Prof. L. Rougier. Translated by Prof. M. Masius, 339; Congress of, in Paris, 90  
 Phosphates of Morocco, The Age of the, L. Gentil, 94  
 Phosphorus, A Study of the Glow of, Lord Rayleigh, 93  
 Photo-engraving Primer: Concise Instructions for Apprentice Engravers or for those seeking Simple yet Practical Knowledge of Line and Half-tone Engraving, S. H. Hoogan, 547  
 Photographic: Emulsions, A Property of, and the Registration of Stars during Total Eclipses of the Sun in View of the Verification of the Einstein Effect, M. Hamy, 534; The Silver Bromide Grain of, A. P. H. Trivelli and S. E. Sheppard, 304; Plate, The, 794; The Grain of the, Prof. T. Svedberg, 221; Plates, Increasing the Sensitiveness of, M. Clerc, 726; Studies of Heights of Aurora, Prof. C. Störmer, Dr. C. Chree, 47  
 Photographs, Telegraphic Transmission of, E. Belin, 686  
 Photography, The Right Way in, 385  
 Photosynthesis: Prof. E. C. C. Baly, 344; in Plants, Dr. E. J. Russell, 153  
 Physaloptera, Nematodes of the Genus, with special reference to those Parasitic in Reptiles, Vera Irwin-Smith, 95; Part 2, Vera Irwin-Smith, 832  
 Physical: Apparatus, A Notable Exhibition of, 56; Society of London, Election of Officers and Council of the, 217  
 Physico-Chemical Problems relating to the Soil: A General Discussion held by the Faraday Society, 808  
 Physics: An Outline of, L. Southern, 641; for Students, 641; for Technical Students, An Introduction to, P. J. Haler and A. H. Stuart, 641; General, and its Application to Industry and Everyday Life, Prof. E. S. Ferry, 641; Institute of, Election of Officers and Board of the, Sir J. J. Thomson President, 723; Report of the, 655; Laboratory Projects in, A Manual of Practical Experiments for Beginners, F. F. Good, 641; Radiology and, Dr. G. W. C. Kaye, 414; The New, Dr. A. C. Crehore, 39; The Teaching of, 433  
 Physikalisches-technische Reichsanstalt, Prof. W. Nernst, director of the, 487  
 Physikalische Rundblicke. Gesammelte Reden und Aufsätze, Prof. M. Planck, 739  
 Physiological Phenomenon, A Curious, R. M. Deeley, 44; J. H. Shaxby, 77  
 Physiology: Sir E. Sharpey Schafer, 122; at the British Association, 122; Experimental, Sir E. Sharpey Schafer. Third edition, 710; Modern Tendencies in, 704; Practical, A Course of, for Agricultural Students, J. Hammond and R. T. Halnan, 443  
 Physique élémentaire et théories modernes, J. Villey. Première Partie, Molécules et Atomes, 739  
 Physique, La, théorie nouvelle, Dr. J. Pacotte, 739  
 Phytophthora parasitic on Apples, A. H. A. Lafferty and G. H. Pethybridge, 831  
 Pianos, The Tuning of, Dr. P. D. Strachan; Dr. R. S. Clay, 591  
 Pickett-Thomson Research Laboratory, Gift for the Establishment of the, F. N. Pickett, 789  
 Pictish Stone Circles, Rev. J. Griffith, 265  
 Pigmentary Effector System, The, L. T. Hogben and F. R. Winton, 499  
 Pigments and Mediums of the Old Masters, Prof. A. P. Laurie, 421  
 Pigs, Feeding and Metabolic Experiments with, Dr. W. E. Elliot and A. Crichton, 26  
 Pilobolus, The Shooting of the Spore-case of, Prof. A. H. R. Buller, 155  
 Pilot Lamps in Laboratories, H. J. Denham, 683  
 Piltown Skull, The, Prof. Elliot Smith and Prof. Hunter, 726  
 Pinite, A Variety of, occurring at Ballycorus, Co. Dublin, L. B. Smyth, 398  
*Pisum sativum*, Abnormal Heredity of the Colour of the Embryos of a Variety of Pea, L. Blaringham, 567  
 Pitcairn Islanders, Anthropological Data relating to the, Dr. D. Colquhoun, 150  
 Pitchblende at Kingswood Mine, Buckfastleigh, A Discovery of, A. Russell, 126  
 Pitot Tubes, Very Small, for measuring Wind Velocity, The Use of, M. Barker, 698  
 Planetary: Distances, Ratios of, F. A. Black, 422; Observations at Sétif, M. Jarry-Desloges, 386  
 Plant: Evolution, The Influence of Selenium on, in the Presence or Absence of Radioactivity, J. Stoklasa, 732; Growing, Physiology of the, 769; Growth in Media poor in Oxygen, L. Maquenne and E. Demoussy, 831; The Quantitative Analysis of, Dr. L. Balls, 189; Life, Aspects of, with special reference to the British Flora, Prof. R. L. Praeger, 513; Soil, The Relation between the Chlorine Index and the Nitrogen Content of, Mlle. C. Veil, 226  
 Plants and Animals, Some Statistics of Evolution and Geographical Distribution in, and their Significance, Dr. J. C. Willis and G. U. Yule, 177; Organic Substances in, Transport of, S. Mangham, 476; Transport of Organic Substances in, Prof. H. H. Dixon and N. G. Ball, 236  
 Platinum Plates in Sulphuric Acid, Polarisation Capacity of, A New Apparatus for the Measurement of the, A. Griffiths and W. T. Heys, 731  
 Plato's Theory of *eikasia*, H. J. Paton, 224  
 Pleiades, The, R. Trumpler, 152  
 Plesiosaur, a New, from the Weald Clay of Berwick (Sussex), Dr. C. W. Andrews, 361  
 Pliocene Deposits of the County of Cornwall and their Bearing on the Pliocene Geography of the South-west of England, The Nature and Origin of the, H. B. Milner, 62  
 Plumage: Importation of, (No. 2) Order, 1922, Additions to the Schedule under the, 789; of Birds, Prohibition of the Importation of, 216; The Evolution of, 662; Prof. J. C. Ewart; H. F. G., 779  
 Pneumatic Conveying, E. G. Phillips, 135  
 Poison Gas in Warfare, The Proposal to prohibit the Use of, 51  
 Poland, Science in, 278  
 Polychaeta, Dr. W. B. Benham, 604; Antarctic, Prof. W. C. McIntosh, 604  
 Polyhedral Disease of *Tipula* Species, J. Rennie, 396  
 Polynesian Origin and Migration, An Expedition for the Study of, 86  
 Pons-Winnecke's Comet, Meteors of, W. F. Denning, 824  
 Population: Maps, S. de Geer, 390; Distribution of, M. Aurousseau, 23  
 Porcelain Kiln, An Experimental Oil-fired, 385  
 Porto Rico, The Bird Remains from the Caves of, A. Whetmore, 792  
 Portsmouth Literary and Philosophical Society, Revival of the, 216  
 Positive Rays, 671  
 Post-glacial Climatic Optimum in Ireland, The, J. de W. Hinch, 353  
 Post Office, Science at the, 401; Sir W. Noble, 609; The Writer of the Article, 610  
 Potash in Marl and Greensand, 218  
 Potato, Anthers of, The Degeneration in, Miss M. S. G. Breeze, 26  
 Pottery, Early Chinese, W. Burton, 705  
 Poultry Research, The Revised Scheme for, of the Ministry of Agriculture, 689  
 Powders, The Properties of, Prof. Lowry and L. P. MacHatton, and others, 496  
 Power: House Design, Sir J. F. C. Snell, 570; The Age of, A First Book of Energy, its Sources, Transformations, and Uses, J. Riley, 269  
 Prehistoric: Cooking-places in Norfolk, Miss N. Layard, 593; Man, The Art of, 167; Material Representation of the Pleiades with ten Stars in a Rock Basin in

- Epesses (Vendée), The, M. Baudouin, 362; Western Europe, 302
- Prehistory: A Study of Early Cultures in Europe and the Mediterranean Basin, M. C. Burkitt, 167
- Prices and Wages: An Investigation of the Dynamic Forces in Social Economics, P. Wallis and A. Wallis, 101
- Pricked Letters and Ultimate Ratios, Prof. F. Cajori, 477
- Primitive Society: Dr. R. H. Lowie, 203; The Beginnings of the Family and the Reckoning of Descent, Dr. E. S. Hartland, 203
- Probability: A Treatise on, J. M. Keynes, 132; The Theory of, P. Lévy, and others, 90; Dr. H. Jeffreys, 132
- Procyon's Orbit, Spectroscopic Study of, Dr. J. Lunt, 455
- Protein Therapy and Nonspecific Resistance, Dr. W. F. Petersen, 717
- Psychology: Industrial, Science of, 511; of Everyday Life, The, Dr. J. Drever, 368; The Subjectivity of, Prof. H. Wildon Carr, 368
- Puccinia graminis*, Pers., production in Australia of the æcidial stage of, W. L. Waterhouse, 226
- Pulp and Paper Making, Chemistry of, E. Sutermeister, 271
- Pulse Wave in Man, Velocity of the, J. C. Bramwell and A. V. Hill, 430
- Pyocyanic Bacillus, the culture of the, on definite artificial media, A. Goris and A. Liot, 363
- Pyocyanoid Bacilli, Varieties of, C. Gessard, 763
- Pythagoras's Theorem as a Repeating Pattern, Major P. A. MacMahon, 479; J. R. Cotter, 579
- Quanta Half, W. E. Curtis, 713
- Quantentheorie: Die, ihr Ursprung und ihre Entwicklung, F. Reiche, 234
- Quantum Theory, The, 234
- Queen's College, London, Appeal for Funds, 697
- Queensland University: Dr. J. P. Lowson appointed Research Professor of Medical Psychology in, 395; Bequest to, by Miss Kate C. Garrick, 729
- R. 38, Report on the Loss of, 279
- Racial Character, Growth and Sex Factors of, Miss R. M. Fleming, 389
- Radiant Spectrum, The, Prof. C. V. Raman, 175; Dr. H. Hartridge, 445
- Radiation from the Sky: Observations on, W. H. Dines, 54; Thermo-electric Instrument for Measuring, L. F. Richardson, 240
- Radio: -active Transformations as determined by Analysis of the Observations, The Number of, H. Levy, 362; -activity of the Waters from Mont Dore, The, P. Loisel and R. Castelnaud, 30; -communication, Principles of, Prof. J. H. Morecroft, assisted by A. Pinto and W. A. Curry, 38; -development, The Trend of, H. E. Penrose, 599; Frequencies, Oscillation Circuits for the Determination of Di-electric Constants at, P. A. Cooper, 814; Receiving Equipment, The Manufacture of, 688; -telegraphy, Directive, and Navigation, 650; Long-distance, Some Problems of, Dr. J. A. Fleming, 140, 179, 209; Some New Text-books on, 38
- Radiology and Physics, Dr. G. W. C. Kaye, 414
- Radium: Ampoules for Therapeutic Use, The Standardisation of, 252; Content of Sealed Metal Tubes, Measurement of the, E. A. Owen and Bertha Naylor, 256; Mining, 388; Synthesis of Carbon Compounds from Air, F. H. Glew, 714; Therapy, The Distribution of Activity in, H. H. Poole, 831; under Different Conditions of Screening, The Distribution of Activity in, H. H. Poole, 225
- Rainbow Peculiarity, A, Major W. J. S. Lockyer, 309; Prof. J. P. Dalton, 716
- Rainfall: and Drainage at Rothamsted in 1921, W. D. Christmas, 107; in 1921, Prof. J. Hendrick, 207; and Temperature, The Relationship between, as shown by the Correlation Coefficient, W. T. Russell, 598; British, 1920, 102; Day and Night Distribution of, W. J. Humphreys, 188; in Latin America, E. Van Cleef; B. O. Weitz, 424; in Mysore, N. V. Iyengar, 218; of the British Isles, The, M. de Carle S. Salter, 440; Shortage in 1921, 22; Weekly, The Correlation of, R. A. Fisher and Winifred A. Mackenzie, 598
- Rainfalls, Annual, Forecasting, Prof. A. McAdie, 139
- Ramsay Memorial Fellowships, The, 565
- Range: -finder, The Barr and Stroud 100-ft. Self-contained Base, Dr. J. W. French, 157; obtained by a Beacon Light of Great Power fitted with Metallic Reflectors, J. Rey, 226
- Raninidæ, Tribal Name of the, Rev. T. R. R. Stebbing; Prof. G. C. Bourne, 108
- Rat: The, and its Repression, A. E. Moore, 659; Lord Aberconway, 744; Problem, The, W. Boelter, 659
- Rayleigh Memorial, The Balance of the, granted to establish a Library Fund at the Cavendish Laboratory, 116
- Ray Society, Election of Officers of the, 384
- Rays of Positive Electricity and their Application to Chemical Analyses, Sir J. J. Thomson, Second edition, 671
- Reading, University College, Agricultural Training at, 697
- Reckertia sagittifera*, n.g., n.sp., Trichocysts in, Dr. W. Conrad, 22
- Recoil Curves as shown by the Hot-wire Microphone, Lt.-Col. C. B. Heald and Major W. S. Tucker, 126
- Recrystallisation and Grain Growth, The Effect of Impurities on, Research Staff of the General Electric Company (London), 396
- Red and Infra-red Rays, The Action of the, on Phosphorescent Sulphides, M. Curie, 362
- Reflector, Proposed 50-foot, Prof. Todd and Mr. McAfee, 592
- Reflex Action, Some Points regarding Present-day Views of, Sir Charles Sherrington, 463
- Refractive: Index, The Absolute Stress-variation of, The Determination of, F. Twyman and J. Perry, 666; Indices, Tables of, vol. xi. Oils, Fats and Waxes. Compiled by R. Kanthack. Edited by Dr. J. N. Goldsmith, 371
- Refractory Materials at High Temperatures, Expansions of Some, B. Bogitch, 29
- Refrigeration, "Power's" Practical, 271
- Regulating Resistances, Catalogue of, Isenthal and Co., Ltd., 793
- Rehtia, the Venetic Goddess of Healing, J. Whatmough, 154
- Reid's Comet, 1922 (a), H. E. Wood, 422
- Relativitätstheorie, Raum und Zeit im Lichte der speziellen, Dr. C. Von Horvath, 770
- Relativité, Le Principe de, et la Théorie de la Gravitation, Prof. J. Becquerel, 770
- Relativity: An Introduction to the Theory of, L. Bolton, 544; and Gravitation, edited by J. M. Bird, 544; and the Universe: A Popular Introduction into Einstein's Theory of Space and Time, Dr. H. Schmidt. Translated by Dr. K. Wichmann, 544; for All, H. Dingle, 770; More Books on, E. Cunningham, 770; Popular Expositions of, 544; The Astronomical Verifications of the Theory of, J. Chazy, 699; The General Theory of, 634; The Rudiments of, Lectures delivered under the Auspices of the University College, Johannesburg, Scientific Society, Prof. J. P. Dalton, 544; Theory, Recent Developments of, Dr. Dorothy Wrinch, and others, 90; The Theory of, A Proposed Laboratory Test of, Dr. H. S. King, 582; Dr. R. W. Lawson, 613; The Theory of, in Relation to Scientific Method, Dr. Dorothy Wrinch, 381
- Reproduction, Lunar Periodicity in, H. M. Fox, 237
- Reptiles and Batrachians exhibited in the Department of Zoology of the British Museum (Natural History), Guide to the. Third edition, 744
- Research: and Education in the Geddes Report, 197; Degrees and the University of London, Dr. A. M. Davies, 238; Prof. P. G. H. Boswell, 373; in America, The Universities and the Publication of the Results of, 664; The Benefits of, to Corporations, Dr. C. L. Reese, 124
- Réseau Mondiale, 1914, 150
- Respiration, Maximum, at very high Altitudes, R. Bayeux, 631



Respiratory Exchange and Biological Transformation of Energy, Tables, Factors and Formulas for Computing, T. M. Carpenter, 475

## REVIEWS AND OUR BOOKSHELF

### Agriculture, Forestry, and Horticulture :

- Cousins (H. A.), *The Chemistry of the Garden : A Primer for Amateurs and Young Gardeners*. Revised Edition, 443
- Elford (P.), and S. Heaton, *Practical School Gardening*. Second Edition, 514
- Fankhauser (Dr. F.), troisième édition française par M. Petitmermet, *Guide pratique de sylviculture*, 7
- Folger (J. C.), and S. M. Thomson, *The Commercial Apple Industry of North America*, 645
- Hammond (J.), and E. T. Halnan, *A Course of Practical Physiology for Agricultural Students*, 443
- Hanson (C. O.), *Forestry for Woodmen*. Second Edition, 547
- Howell (J. P.), *An Agricultural Atlas of Wales*, 304
- Index Kewensis Plantarum Phanerogamarum. Supplementum Quintum Nomina et Synonyma Omnium Generum et Specierum ab Initio Anni MDCCCXI usque ad finem Anni MDCCCXV Nonnulla Etiam Antea Edita Complectens, 472
- Jute and Silk, Report on, Imperial Institute. Indian Trade Inquiry, 170
- McCall (J. S. J.), *A Handbook on Cotton and Tobacco Cultivation in Nyasaland : A Guide to Prospective Settlers*, 337
- Morris (R. T.), *Nut Growing*, 337
- Percival (Prof. J.), *The Wheat Plant : A Monograph*, 366
- Physico-Chemical Problems relating to the Soil : a General Discussion held by the Faraday Society, 808
- Thomas (Prof. G.), *The Development of Institutions under Irrigation, with special reference to Early Utah Conditions*, 577
- Webbia : Raccolta di scritti botanici. Vol. Quinto, Parte 10, 644
- Wulfi (Dr. A.), *Bibliographia Agrogeologica : Essay of a Systematic Bibliography of Agrogeology*, 338

### Anthropology and Archæology :

- Browne (Rt. Rev. Dr. G. F.), *On some Antiquities in the Neighbourhood of Dunecht House, Aberdeenshire*, 265
- Burkitt (M. C.), *Prehistory : A Study of Early Cultures in Europe and the Mediterranean Basin*, 167
- Crawford (O. G. S.), *Man and his Past*, 302
- Evans (Sir Arthur), *The Palace of Minos : A Comparative Account of the Successive Stages of the Early Cretan Civilisation as illustrated by the Discoveries at Knossos*. Vol. I., *The Neolithic and Early and Middle Minoan Ages*, 466
- Fleming (R. N.), *Ancient Tales from Many Lands : A Collection of Folk Stories*, 269
- Hartland (Dr. E. S.), *Primitive Society : The Beginnings of the Family and the Reckoning of Descent*, 203
- Hutton (J. H.), *The Angami Nagas, with some Notes on Neighbouring Tribes*, 539
- Lowie (Dr. R. H.), *Primitive Society*, 203
- Macalister (Prof. R. A. S.), *A Text-Book of European Archæology*. Vol. I., *The Palæolithic Period*, 605
- Murray (M. A.), *The Witch-Cult in Western Europe : A Study in Anthropology*, 572
- Peoples of all Nations, Edited by J. A. Hammerton. No. 1, 475
- Pratt-Chadwick (M. L.), and L. Lamprey, *The Alo Man : Stories from the Congo*, 710
- Roy (Rai Bahadur Sarat Chandra), *Principles and Methods of Physical Anthropology*, 408
- Tyler (Prof. J. M.), *The New Stone Age in Northern Europe*, 302
- Westermarck (Prof. E.), *The History of Human Marriage*. Fifth Edition. Three volumes, 502

### Biology :

- Baker (F. C. S.), *The Game-Birds of India*. Vol. 1. Second edition ; Vol. 2, 606
- Ballard (Prof. C. W.), *The Elements of Vegetable Histology*, 773
- Benham (Dr. W. B.), *Polychæta (Australasian Antarctic Expedition, 1911-14. Scientific Reports : Series C—Zoology and Botany*. Vol. 6, Part 3), 604
- Bews (Prof. J. W.), *An Introduction to the Flora of Natal and Zululand*, 510
- Biologischen Arbeitsmethoden, Handbuch der. Edited by Prof. Emil Abderhalden. Abt. 5, *Methoden zum Studium der Funktionen der einzelnen Organe des tierischen Organismus*. (1) Teil 3, Heft 1, *Entwicklungsmechanik*; (2) Teil 3, Heft 2, *Entwicklungsmechanik*. Abt. 9, *Methoden zur Erforschung der Leistungen des tierischen Organismus*. (3) Teil 1, Heft 1, *Lieferung 34, Allgemeine Methoden*, 134; Abt. 5, *Methoden zum Studium der Funktionen der einzelnen Organe des tierischen Organismus*. Teil 7, Heft 1, *Lieferung 12, Sinnesorgane*, 171; Teil 7, Heft 2, *Sinnesorgane*, 305
- Bohn (Prof. G.), *La Forme et le mouvement : essai de dynamique de la vie*, 675
- Borzi (A.), *Problemi di filosofia botanica*, 547
- Brues (Prof. C. T.), *Insects and Human Welfare*, 710
- Buchner (Prof. P.), *Tier und Pflanze in intrazellulärer Symbiose*, 538; 576
- Capita Zoologica. Verhandelingen op systematisch-zoologisch gebied. Deel 1, *Aflevering 1 und 2*, 513
- Carpenter (Prof. G. H.), *Insect Transformation*, 673
- Cash (J.) and G. H. Wailes, assisted by J. Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*. Vol. 5. *Heliozoa*, by G. H. Wailes, 441
- Caullery (Prof. M.), *Le Parasitisme et la symbiose*, 643
- Clark (A. H.), *The Echinoderms as aberrant Arthropods*, 640
- Clarke (Dr. J. M.), *Organic Dependence and Disease : Their Origin and Significance*, 708
- Cunningham (J. T.), *Hormones and Heredity : A Discussion of the Evolution of Adaptations and the Evolution of Species*, 35
- Cushman (Dr. J. A.), *Shallow-water Foraminifera of the Tortugas Region*, 708
- Descour (L.), Translated by A. F. and Dr. B. H. Wedd, *Pasteur and his Work*, 805
- Fabre (J. H.), Translated by A. T. de Mattos, *More Hunting Wasps*, 270; *The Wonder Book of Science*, 270
- Fisheries—England and Wales. Ministry of Agriculture and Fisheries. *Fishery Investigations : Series 1, Freshwater Fisheries and Miscellaneous*. Vol. 2, No. 1, *The Methods of Fish Canning in England*, 71
- Fritch (Prof. F. E.) and Dr. E. J. Salisbury, *Botany for Students of Medicine and Pharmacy*, 773
- Fyson (Prof. P. F.), *The Flora of the Nilgiri and Pulney Hill-Tops*. Vol. 3, 510
- Gunther (R. T.), *Early British Botanists and their Gardens, based on unpublished writings of Goodyer, Tradescant, and Others*, 806
- Howell (G. C. L.), *Ocean Research and the Great Fisheries*, 201
- Jenkins (Dr. J. T.), *A History of the Whale Fisheries : From the Basque Fisheries of the Tenth Century to the Hunting of the Finner Whale at the Present Date*, 298
- Knight (Dr. M. M.), Dr. Iva L. Peters, and Dr. Phyllis Blanchard, *Taboo and Genetics : A Study of the Biological, Sociological, and Psychological Foundation of the Family*, 235
- Kofoed (Prof. C. A.), and Olive Swezy, *The Free-living unarmored Dinoflagellata*, 130
- Lee (A. B.), Eighth edition. Edited by Prof. J. B. Gatenby, and others. *The Microtometist's Vade Mecum : A Handbook of the Methods of Microscopic Anatomy*, 72
- Livingston (B. E.), and E. Shreve, *The Distribution of Vegetation in the United States as related to Climatic Conditions*, 371
- Lucanus (F. von.), *Die Rätzel des Vogelzuges. Ihre*

- Lösung auf experimentellem Wege durch Aeronautik, Aviatik und Vogelberingung, 573  
 Molliard (Prof. M.), *Bibliothèque de physiologie et de pathologie végétales: nutrition de la plante*, 1 et 2, 769  
 Pearce (E. K.), *Typical Flies: A Photographic Atlas. Second Series*, 677  
 Pell (C. E.), *The Law of Births and Deaths: Being a Study of the Variation in the Degree of Animal Fertility under the Influence of the Environment*, 267  
 Penard (Dr. E.), *Études sur les infusoires d'eau douce*, 441  
 Praeger (Prof. R. L.), *Aspects of Plant Life*, with special reference to the British Flora, 513  
 Reptiles and Batrachians exhibited in the Department of Zoology of the British Museum (Natural History), Cromwell Road, London, S.W.7, Guide to the. Third edition, 744  
 Simroth (Prof. H.), *Die Pendulations-Theorie. Zweite Auflage*, 809  
 Smith (A. Lorrain), *Lichens: A Handbook of the British Lichens*, 5  
 Step (E.), *Animal Life of the British Isles: A Pocket Guide to the Mammals, Reptiles, and Batrachians of Wayside and Woodland*, 514; *British Insect Life: A Popular Introduction to Entomology*, 514  
 Strasburger's Text-book of Botany. Rewritten by Dr. H. Fitting, Dr. L. Jost, Dr. H. Schenck, Dr. G. Karsten. Fifth English edition Revised with the fourteenth German edition by Prof. W. H. Lang, 740  
 Thomson (Prof. J. A.), *Mountain and Moorland*, 513; *The Haunts of Life: Being Six Lectures delivered at the Royal Institution, Christmas Holidays, 1920-1921*, 710  
 Vallentin (Mrs. E. F.), with descriptions by Mrs. E. M. Cotton, *Illustrations of the Flowering Plants and Ferns of the Falkland Islands*, 370  
 Wildeman (Dr. E. de), *Contribution à l'étude de la flore du Katangar*, 548  
 Woodhead (T. W.), *Junior Botany*, 773

## Chemistry:

- Abegg (Prof. R.), and Dr. Fr. Auerbach, *Handbuch der anorganischen Chemie in vier Bänden. Vierter Band. Erste Abteilung, zweite Hälfte. Die Elemente der sechsten Gruppe des periodischen Systems. Zweite Hälfte. Edited by Dr. Fr. Auerbach*, 300  
 Aston (Dr. F. W.), *Isotopes*, 736  
 Auden (Dr. H. A.), *Sulphur and Sulphur Derivatives*, 235  
 Barrowcliff (M.), and F. H. Carr, *Organic Medicinal Chemicals (Synthetic and Natural)*, 37  
 Biddulph-Smith (T.), *Coke-oven and By-product Works Chemistry*, 4  
 Blanc (Prof. M. le). Translated by Drs. W. R. Whitney and J. W. Brown, *A Text-book of Electro-chemistry*, 100  
 Burton (Prof. E. F.), *The Physical Properties of Colloidal Solutions. Second edition*, 39  
 Chamot (Prof. E. M.), *Elementary Chemical Microscopy. Second edition*, 546  
 Comey (Dr. A. M.). Second edition, Enlarged and Revised, by Dr. A. M. Comey and Prof. Dorothy A. Hahn, *A Dictionary of Chemical Solubilities. Inorganic*, 505  
 Coulthard (Dr. A.), *A First Book of Chemistry for Students in Junior Technical Schools*, 774  
 Explosives Supply, *Technical Records of, 1915-1918. Nos. 1 to 4*, 541  
 Färber (Dr. E.), *Die geschichtliche Entwicklung der Chemie*, 603  
 Farmer (Dr. R. C.), *The Manufacture and Uses of Explosives, with Notes on their Characteristics and Testing*, 270  
 Findley (A. E.), and R. Wigginton, *The Practical Chemistry of Coal and its Products*, 678  
 Francis (Prof. F.), *Notes on Inorganic Chemistry for First Year University Students*, 707  
 Friend (Dr. J. N.), *Iron and its Compounds*, 505; *The Chemistry of Combustion*, 709

- Graebe (Prof. C.), *Geschichte der organischen Chemie. Erster Band*, 806  
 Grant (J.), *Confectioners' Raw Materials: Their Sources, Modes of Preparation, Chemical Composition, the Chief Impurities and Adulterations, their more Important Uses, and other Points of Interest*, 269  
 Hackh (Prof. I. W. D.), *Chemical Reactions and their Equations: A Guide and Reference Book for Students of Chemistry*, 678  
 Hammick (D. Ll.), *An Introduction to Organic Chemistry*, 39  
 Harper (H.), *Introduction to Textile Chemistry*, 268  
 Hatschek (E.), *An Introduction to the Physics and Chemistry of Colloids. Fourth edition*, 270  
 Hausding (A.), *A Handbook on the Winning and the Utilisation of Peat. Translated from the Third German edition by Prof. H. Ryan*, 774  
 Hirsch (Dr. P.), *Die Einwirkung von Mikroorganismen auf die Eiweisskörper*, 741  
 Hodgman (Prof. C. D.), assisted by Prof. M. F. Coolbaugh and C. E. Senseman, *Hand-book of Chemistry and Physics. A Ready-reference Pocket-book of Chemical and Physical Data. Eighth edition*, 369  
 Holleman (Prof. A. F.), *A Text-book of Inorganic Chemistry. Issued in English in co-operation with H. C. Cooper. Sixth English edition*, 677  
 Hull (T.), *Oils, Fats, and Fuels*, 774  
 Inorganic Chemistry, *A Text-book of. Edited by Dr. J. N. Friend. Vol. 9, Part 2, Iron and its Compounds*, Dr. J. N. Friend, 505  
 Kaiser Wilhelm Gesellschaft zur Förderung der Wissenschaften zu ihrem zehnjährigen Jubiläum dargebracht von ihren Instituten, *Festschrift der*, 69  
 Kanitz (Dr. A.), *Temperatur und Lebensvorgänge*, 741  
 Kanthack (R.). Edited by Dr. J. N. Goldsmith, *Tables of Refractive Indices. Vol. 11, Oils, Fats and Waxes*, 371  
 Kingzett (C. T.), *A Popular Chemical Dictionary: A Compendious Encyclopædia. Second Edition*, 338  
 Knox (Dr. J.), *The Fixation of Atmospheric Nitrogen*, 73  
 Lazennec (I.), *Manuel de parfumerie*, 774  
 Lewes (Prof. V. B.). 2nd edition, Revised and edited by J. B. C. Kershaw. *Liquid and Gaseous Fuels and the Part they play in Modern Power Production*, 73  
 Lucas (A.), *Forensic Chemistry*, 470  
 MacDougall (Prof. F. H.), *Thermodynamics and Chemistry*, 100  
 Martin (Dr. G.), *Perfumes, Essential Oils, and Fruit Essences used for Soap and other Toilet Articles*, 271  
 Meade (A.), *Modern Gasworks Practice*, 199  
 Miall (Dr. S.), *The Structure of the Atom: Notes on some Recent Theories*, 710  
 Milroy (Dr. J. A.), and Prof. J. H. Milroy, *Practical Physiological Chemistry. Third edition*, 704  
 Moldenhauer (Dr. W.). Translated by Dr. L. Bradshaw, *Laboratory Exercises in Applied Chemistry for Students in Technical Schools and Universities*, 710  
 Moore (Prof. B.), *Biochemistry: A study of the Origin, Reactions, and Equilibria of Living Matter*, 639  
 Moureu (Prof. C.). Translated from the Sixth French edition by W. T. K. Braunholtz, *Fundamental Principles of Organic Chemistry*, 505  
 Nernst (Prof. W.). 2<sup>e</sup> édition française, complètement refondue d'après la 10<sup>e</sup> édition allemande par Prof. A. Corvisy. *Traité de chimie générale. Première Partie: Propriétés générales des corps, atome et molécule*, 574  
 Neuburger (M. C.), *Das Problem der Genesis des Actiniums*, 809  
 Organic Syntheses: *An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. 1.*, 443  
 Parry (E. J.), *The Raw Materials of Perfumery: Their Nature, Occurrence, and Employment*, 305  
 Patterson (Dr. A. M.), *A French-English Dictionary for Chemists*, 73  
 Petroleum Industry, *The: A Brief Survey of the Technology of Petroleum based upon a Course of Lectures given by members of the Institution of*



- Petroleum Technologists on the occasion of the Petroleum Exhibition, Crystal Palace, 1920. Edited by A. E. Dunstan, 774
- Potts (H. E.), Patents and Chemical Research, 338
- Price (Dr. T. S.), and Dr. D. F. Twiss, A Course of Practical Organic Chemistry. Third edition, 305
- Richter (V. von). Edited by Prof. R. Anschütz and Dr. R. Meerwein. Translated by Dr. E. E. Fournier d'Albe, Organic Chemistry, or Chemistry of the Carbon Compounds. Vol. 2, Chemistry of the Carbocyclic Compounds, 709
- Rideal (Dr. S.), and Dr. E. K. Rideal, Chemical Disinfection and Sterilisation, 674
- Roaf (Dr. H. E.), Biological Chemistry, 704
- Röhmman (Prof. F.), Über künstliche Ernährung und Vitamine, 741
- Schenker (W.), Fuel and Lubricating Oils for Diesel Engines, 270
- Siegfried (Prof. M.), Über partielle Eiweisshydrolyse, 741
- Smith (Prof. G. McP.), A Course of Instruction in Quantitative Chemical Analysis for Beginning Students: With Explanatory Notes, Questions, and Analytical Problems. Revised edition, 709
- Solvent Recovery (Technical Records of Explosives Supply, 1915-1918. No. 8), 645
- Staley (R.), Town Gas Manufacture: A Practical Introductory Treatment of the Equipment and Processes of an Average Gas Works, for Students, Junior Gas Engineers, and others connected with Gas Works, 774
- Sutermeister (E.), Chemistry of Pulp and Paper Making, 271
- Taylor (Dr. W. W.), The Chemistry of Colloids and some Technical Applications. Second edition, 204
- Thorpe (Sir Edward), assisted by eminent contributors, A Dictionary of Applied Chemistry. Revised edition, vol. 1, 100; vol. 2, 266
- Trivelli (A. P. A.), and S. E. Sheppard, The Silver Bromide Grain of Photographic Emulsions, 304
- Underhill (Prof. F. P.), A Manual of Selected Biochemical Methods as applied to Urine, Blood, and Gastric Analysis, 645
- Whitehead (S. E.), Benzol: Its Recovery, Rectification, and Uses, 513
- Young (Prof. S.), with the collaboration of various authors, Distillation Principles and Processes, 434

## Engineering :

- Addyman (F. T.), My Electrical Workshop, 372
- Behrend (B. A.), The Induction Motor and other Alternating Current Motors. Second edition, 545
- Boulnois (H. P.), Municipal Engineering, 135
- Bowden-Smith (E. C.), Oil Firing for Kitchen Ranges and Steam Boilers, 204
- Callendar (Prof. H. L.), Abridged Callendar Steam Tables, Centigrade Units; Abridged Callendar Steam Tables, Fahrenheit Units; Callendar Steam Diagram, Centigrade Units; Callendar Steam Diagram, Fahrenheit Units, 171
- Chatley (Prof. H.), A Text-book of Aeronautical Engineering: The Problem of Flight. Third edition, 808
- Durand (Prof. W. F.), Hydraulics of Pipe Lines, 606
- Electrician's Pocket-book for 1922, The Practical, Twenty-fourth Annual Issue. Edited by H. T. Crewe, 269
- Higgins (A. L.), The Transition Spiral and its Introduction to Railway Curves, 103
- Hornor (H. A.), Spot and Arc Welding, 171
- Johnson (V. E.), Modern High-speed Influence Machines, 103
- Lamb (G. C.), Alternating Currents. 2 Parts, 710
- Motor Car Practice, Modern. Edited by W. H. Berry, 371
- Painton (E. T.), Small Single-phase Transformers, 135
- Phillips (E. G.), Pneumatic Conveying, 135
- Poole (H. E.), High Tension Switchgear, 7
- "Power's" Practical Refrigeration. Compiled by the Editorial Staff of *Power*, 271
- Priestley (Major R. E.), The Signal Service in the European War of 1914 to 1918 (France), 336

- Riley (J.), The Age of Power: A First Book of Energy, its Sources, Transformations, and Uses, 269
- Roget (S. R.), A First Book of Applied Electricity, 271
- Royal Engineers in the European War 1914-19, The Work of the. 4 vols., 336
- Snell (Sir J. F. C.), Power House Design. Second edition, 570
- Tompkins (A. E.), Turbines. Third edition, 171
- Wade (C. F.), The Fireman's Handbook and Guide to Fuel Economy, 204
- Walker (Prof. M.), The Diagnosing of Troubles in Electrical Machines, 674
- Walter (L. H.), Directive Wireless Telegraphy: Direction and Position Finding, etc., 270

## Geography and Travel :

- Babcock (W. H.), Legendary Islands of the Atlantic: A Study in Medieval Geography, 803
- Bartholomew's General Map of Europe, showing Boundaries of States according to Treaties, 1921, 204
- Behrmann (Dr. W.), 40 Blätter der Karte des Deutschen Reiches 1:100,000 ausgewählt für Unterrichtszwecke. Zweite Auflage, 548
- Chamberlain (J. F.), Geography: Physical, Economic, Regional, 102
- Cotton (C. W. E.), Hand-book of Commercial Information for India, 809
- Delany (M. C.), The Historical Geography of the Wealden Iron Industry, 410
- Highton (H. P.), Shooting-trips in Europe and Algeria: Being a Record of Sport in the Alps, Pyrenees, Norway, Sweden, Corsica, and Algeria, 336
- Hilton-Simpson (M. W.), Among the Hill Folk of Algeria: Journeys among the Shawia of the Aurès Mountains, 336
- Hints to Travellers. Scientific and General. Tenth edition, Revised and Corrected by E. A. Reeves. 2 vols., 268
- Homén (T.), East Carelia and Kola Lapmark. Described by Finnish Scientists and Philologists, 372
- Kephart (H.), Camping and Woodcraft: A Hand-book for Vacation Campers and for Travellers in the Wilderness. New edition, 268
- Physical Map of England and Wales, 1:1,000,000, 548
- Rasmussen (K.). Translated by A. and R. Kenney, Greenland by the Polar Sea: The Story of the Thule Expedition from Melville Bay to Cape Morris Jesup, 702
- Stefansson (V.), The Friendly Arctic: The Story of Five Years in Polar Regions, 636
- Swiss Travel Almanac. Summer Season, 1922, 809
- Taylor (E. G. R.), A Sketch-map Geography: A Text-book of World and Regional Geography for the Middle and Upper School, 135

## Geology and Mineralogy :

- Bonney (Rev. Canon T. G.), Memories of a Long Life, 607
- Cox (Dr. G. H.), Prof. C. L. Dake, and Prof. G. A. Muilenburg, Field Methods in Petroleum Geology, 474
- Dewey (H.), Lead, Silver lead, and Zinc Ores of Cornwall, Devon, and Somerset, 6
- Gregory (Prof. J. W.), The Rift Valleys and Geology of East Africa, 233
- Imperial Institute: Monographs on Mineral Resources, with Special Reference to the British Empire: Petroleum. Prepared jointly with H. M. Petroleum Department with the co-operation of Dr. H. B. Cronshaw, 475
- Lead and Zinc Ores in the Pre-Carboniferous Rocks of West Shropshire and North Wales. Part 1, West Shropshire, B. Smith; Part 2, North Wales, H. Dewey and B. Smith, 546
- Lewis (Prof. J. V.), A Manual of Determinative Mineralogy. Third edition, 772
- MacNair (Prof. P.), Introduction to the Study of Minerals and Guide to the Mineral Collections in Kelvingrove Museum. Second edition, 370

Redwood (Sir Boverton), Petroleum. Fourth edition, 3 vols., 403  
 Rosenbusch (H.), Mikroskopische Physiographie der petrographisch-wichtigen Mineralien. Band 1. Erste Hälfte. Untersuchungsmethoden. Fünfte Auflage. Prof. E. A. Wülfing. Lief. 1, 303  
 Smith (B.), Lead and Zinc Ores in the Carboniferous Rocks of North Wales, 6  
 Spitaler (Prof. R.), Das Klima des Eiszeitalters, 512  
 Steinriede (Dr. F.), Anleitung zur mineralogischen Bodenanalyse. Zweite Auflage, 643  
 Warner (C. A.), Field Mapping for the Oil Geologist, 474

# Mathematical and Physical Science :

Ampère (André-Marie), Mémoires sur l'électromagnétisme et l'électrodynamique, 677  
 Beckett (T. A.), and F. E. Robinson, Plane Geometry for Schools, Part 1, 737  
 Becquerel (Prof. J.), Le Principe de relativité et la théorie de la gravitation, 770  
 Beilby (Sir George), Aggregation and Flow of Solids: Being the Records of an Experimental Study of the Micro-structure and Physical Properties of Solids in Various States of Aggregation, 1900-1921, 262  
 Benedicks (C.), The Homogeneous Electro-Thermic Effect (Including the Thomson Effect as a Special Case), 608  
 Bolton (L.), An Introduction to the Theory of Relativity, 544  
 Brodetsky (Dr. S.), The Mechanical Principles of the Aeroplane, 296  
 Bromwich (Dr. T. J. I'A.), Examples in Optics, 235  
 Brown (S. E.), Experimental Science. 1, Physics. Section 5, Light, 641  
 Burns (Dr. D.), An Introduction to Biophysics, 704  
 Carslaw (Prof. H. S.), Introduction to the Theory of Fourier's Series and Integrals and the Mathematical Theory of the Conduction of Heat. Second edition. Vol. 1, Fourier's Series and Integrals, 435  
 Cashmore (M.), Fermat's Last Theorem: Proofs by Elementary Algebra. Third edition, 39  
 Chree (Dr. C.), British ("Terra Nova") Antarctic Expedition, 1910-1913: Terrestrial Magnetism, 508  
 Cracknell (A. G.), The School Algebra (Matriculation Edition). Sixth Impression (second edition), 737  
 Crehore (Dr. A. C.), The New Physics, 39  
 Dalton (Prof. J. P.), The Rudiments of Relativity: Lectures delivered under the Auspices of the University College, Johannesburg, Scientific Society, 544  
 Davison (Dr. C.), A Manual of Seismology, 368  
 Dickson (Prof. L. E.), First Course in the Theory of Equations, 773  
 Dingle (H.), Relativity for All, 770  
 Durell (C. V.), A Concise Geometry, 574; and R. M. Wright, Elementary Algebra. Part 2, 574  
 Durell (Dr. F.), and E. E. Arnold, A First Book in Algebra; A Second Book in Algebra; Plane and Solid Geometry, 737  
 Eccles (Prof. W. H.), Continuous Wave Wireless Telegraphy. Part 1, 38  
 Edwards (J.), A Treatise on the Integral Calculus, with Applications, Examples, and Problems. Vol. 1, 435  
 Fawdry (R. C.), Co-ordinate Geometry (Plane and Solid) for Beginners, 574  
 Ferry (Prof. E. S.), General Physics and its Application to Industry and Everyday Life, 641  
 Filon (Prof. L. N. G.), An Introduction to Projective Geometry. Third edition, 737  
 Fleming (Prof. J. A.), Fifty Years of Electricity: The Memories of an Electrical Engineer, 3  
 Forrest (S. N.), Mathematics for Technical Students: Junior Course, 574  
 Foster (V. Le Neve), Plane Geometry: Practical and Theoretical, *Pari Passu*, 737  
 Fourth Dimension Simply Explained, The, 474  
 Franck (M.), La Loi de Newton est la loi unique: théorie mécanique de l'univers, 739  
 Gheury de Bray (M. E. J.), Exponentials made Easy, or The Story of "Epsilon," 574

Good (F. F.), Laboratory Projects in Physics: A Manual of Practical Experiments for Beginners, 641  
 Graefe (A.), and T. Saemisch, fortgeführt von C. Hess, Dritte Auflage. Handbuch der gesamten Augenheilkunde. Die Brille als optisches Instrument, Prof. M. von Rohr, Dritte Auflage, 772  
 Gray (Prof. A.), Absolute Measurements in Electricity and Magnetism. Second edition, 166  
 Guye (Prof. C. E.), S. Ratnowsky, and C. Lavanchy, Vérification expérimentale de la formule de Lorentz-Einstein, 406  
 Haler (P. J.), and A. H. Stuart, An Introduction to Physics for Technical Students, 641  
 Heath (Sir Thomas), A History of Greek Mathematics, 2 vols., 330  
 Helmholtz (Hermann v.), Schriften zur Erkenntnistheorie, Herausgegeben von P. Hertz and M. Schlick, 409  
 Hobson (Prof. E. W.), The Theory of Functions of a Real Variable and the Theory of Fourier's Series. Second edition. Vol. 1, 435  
 Horvath (Dr. C. von), Raum und Zeit im Lichte der speziellen Relativitätstheorie. Versuch eines synthetischen Aufbaus der speziellen Relativitätstheorie, 770  
 Jessop (Prof. C. M.), Elementary Analysis, 737  
 Jones (D. C.), A First Course in Statistics, 473  
 Jones (H. S.), Calculus for Beginners: A Text-book for Schools and Evening Classes, 574  
 Keynes (J. M.), A Treatise on Probability, 132  
 Kossel (Prof. W.), Valenzkräfte und Röntgenspektren. Zwei Aufsätze über das Elektronengebäude des Atoms, 170  
 Lémery (E. M.), L'Éther actuel et ses précurseurs (simple récit), 770  
 Lenard (Prof. P.), Über Äther und Uräther, 739  
 Loring (F. H.), Atomic Theories, 372  
 Mach (E.), Die Prinzipien der physikalischen Optik. Historisch und erkenntnispsychologisch entwickelt, 706  
 MacMahon (Major P. A.), New Mathematical Pastimes, 200  
 Mallik (Prof. D. N.), Optical Theories: Based on Lectures delivered before the Calcutta University. Second edition, 706  
 Mie (Prof. G.), Die einsteinsche Gravitationstheorie: Versuch einer allgemein verständlichen Darstellung der Theorie, 544; La Théorie einsteinienne de la gravitation: essai de vulgarisation de la théorie, 770  
 Milne (Prof. W. P.), and G. J. B. Westcott, A First Course in the Calculus. Part 2, Trigonometric and Logarithmic Functions of  $x$ , etc., 574  
 Mordell (L. J.), Three Lectures on Fermat's Last Theorem, 4  
 Morecroft (Prof. J. H.), assisted by A. Pinto and W. A. Curry, Principles of Radio-Communication, 38  
 Nordmann (C.), translated by J. McCabe, Einstein and the Universe: A Popular Exposition of the Famous Theory, 770  
 Norton (A. P.), A Star Atlas and Telescopic Handbook (Epoch 1920) for Students and Amateurs, 269  
 Osgood (Prof. W. F.), Elementary Calculus, 574  
 Pacotte (Dr. J.), La Physique théorique nouvelle, 739  
 Palmer (A. R.), A Short Course in Commercial Arithmetic and Accounts; The Use of Graphs in Commerce and Industry, 644  
 Petrovitch (Prof. M.), Mécanismes communs aux phénomènes disparates, 739  
 Philip (A.), The Calendar: Its History, Structure, and Improvement, 203  
 Planck (Prof. Max), Physikalische Rundblicke. Gesammelte Reden und Aufsätze, 739  
 Pringsheim (Dr. P.), Fluoreszenz und Phosphoreszenz im Lichte der neueren Atomtheorie, 739  
 Reade (W. H. V.), A Criticism of Einstein and his Problem, 770  
 Reiche (F.), Die Quantentheorie: ihr Ursprung und ihre Entwicklung, 234  
 Relativity and Gravitation. Edited by J. M. Bird, 544  
 Rohr (Prof. M. von), Die Brille als optisches Instrument, 772



- Rougier (Prof. L.), *La Matière et l'énergie selon la théorie de la relativité et la théorie des quanta*. Nouvelle édition, 339; translated by Prof. M. Masius, *Philosophy and the New Physics: An Essay on the Relativity Theory and the Theory of Quanta*, 339
- Saccheri's (Girolamo), "*Euclides Vindicatus*," Edited and translated by G. B. Halsted, 232
- Schmidt (Dr. H.), translated by Dr. K. Wichmann, *Relativity and the Universe: A Popular Introduction into Einstein's Theory of Space and Time*, 544
- Scott (P. W.), *Elements of Practical Geometry: A Two Years' Course for Day and Evening Technical Students*, 574
- Scott-Taggart (J.), *Thermionic Tubes in Radio-Telegraphy and Telephony*, 38
- Smith (W. B.), *Elements of Natural Science*. Part 1, 641
- Southerns (L.), *An Outline of Physics*, 641
- Stars, "*Intermediate*," Catalogue of 1068, situated between 51° and 65° South Declination for the Equinox 1900: From Observations made at the Sydney Observatory, N.S.W., Australia, during the years 1918-1919, under the direction of Prof. W. E. Cooke, 743
- Telescope Objectives, *The Adjustment and Testing of*. Third edition, 338
- Thirring (Prof. J. H.), translated by R. A. B. Russell. *The Ideas of Einstein's Theory: A Theory of Relativity in Simple Language*, 544
- Thomson (Sir J. J.), *Rays of Positive Electricity and their Application to Chemical Analyses*. Second edition, 671
- Turner (L. B.), *Wireless Telegraphy and Telephony: An Outline for Electrical Engineers and Others*, 38
- Villey (J.), *Physique élémentaire et théories modernes*. Première partie, 739
- Warburg (Comdr. H. D.), *Tides and Tidal Streams: A Manual compiled for the Use of Seamen*, 767
- Waters (H. H.), *Astronomical Photography for Amateurs*, 339
- Wegener (Prof. A.), *Die Entstehung der Kontinente und Ozeane. Die Wissenschaft: Sammlung von Einzeldarstellungen aus den Gebieten der Naturwissenschaft und der Technik*. Herausgegeben von Prof. E. Wiedemann. Band 66. Zweite gänzlich umgearbeitete Auflage, 202
- Weyl (Prof. H.), translated by H. L. Brose, *Space-Time—Matter*, 634
- Wheeler (Eng. Lt.-Commr. S. G.), *Entropy as a Tangible Conception: An Elementary Treatise on the Physical Aspects of Heat, Entropy, and Thermal Inertia for Designers, Students and Engineers, and particularly for Users of Steam and Steam Charts*, 404
- Wightman's Secondary School Mathematical Tables. Edited by F. Sandon, 737
- Zeeman (Dr. P.), *Verhandeligen van, over Magneto-Optische Verschijnselen*, 66
- Medical Science:**
- Allbutt (Sir T. Clifford), *Greek Medicine in Rome: The FitzPatrick Lectures on the History of Medicine delivered at the Royal College of Physicians of London in 1909-10, with other Historical Essays*, 438
- Berman (Dr. L.), *The Glands regulating Personality: A Study of the Glands of Internal Secretion in Relation to the Types of Human Nature*, 670
- Boothby (Dr. W. M.), and Dr. Irene Sandiford, *Laboratory Manual of the Technic of Basal Metabolic Rate Determinations*, 514
- Browne (Prof. E. G.), *Arabian Medicine: Being the FitzPatrick Lectures delivered at the College of Physicians in November 1919 and November 1920*, 438
- Craig (Sir Maurice), *Nerve Exhaustion*, 744
- Dixon (Prof. W. E.), *A Manual of Pharmacology*. Fifth edition, 372
- Dobell (C.), and F. W. O'Connor, *The Intestinal Protozoa of Man*, 98
- Fuller (H. C.), *The Chemistry and Analysis of Drugs and Medicines*, 509
- Hoch (Dr. A.), *Benign Stupors: A Study of a New Manic-Depressive Reaction Type*, 743
- Hunter (Col. W.), *The Serbian Epidemics of Typhus and Relapsing Fever in 1915: Their Origin, Course, and Preventive Measures employed for their Arrest*, 743
- Karsner (Prof. H. T.), and Dr. E. E. Ecker, *The Principles of Immunology*, 7
- Langley (Prof. J. N.), *The Autonomic Nervous System*. Part 1, 773
- Metchnikoff (Olga), *Life of Elie Metchnikoff*, 1845-1916, 163
- Petersen (Dr. W. F.), *Protein Therapy and Non-specific Resistance*, 717
- Rhodes (E. C.), *On the Relationship of Condition of the Teeth in Children to Factors of Health and Home Environment*, 409
- Roberts (Prof. J. B.), and Dr. J. A. Kelly, *Treatise on Fractures in General, Industrial and Military Practice*. Second edition, 304
- Schafer (Sir E. Sharpey), *Experimental Physiology*. Third edition, 710
- Watson (Dr. M.), and others, *The Prevention of Malaria in the Federated Malay States: A Record of Twenty Years' Progress*. Second edition, 334
- Metallurgy:**
- Gow (C. C.), *The Electro-Metallurgy of Steel*, 768
- Metals, Institute of, *Journal of the*, No. 2, 1921. Vol. 26, edited by G. Shaw Scott, 644
- Pring (Dr. J. N.), *The Electric Furnace*, 99
- Meteorology:**
- Baldit (A.), *Études élémentaires de météorologie pratique*, 440
- British Rainfall, 1920: *The Sixtieth Annual Volume of the British Rainfall Organisation*, 102
- Defant (Prof. A.), *Die Zirkulation der Atmosphäre in den gemässigten Breiten der Erde. Grundzüge einer Theorie der Klimaschwankungen*, 469
- Redway (J. W.), *Handbook of Meteorology: A Manual for Co-operative Observers and Students*, 440
- Salter (M. de Carle S.), *The Rainfall of the British Isles*, 440
- Stenhouse (E.), *Simple Lessons on the Weather for School Use and General Reading*, 440
- Taffara (L.), *Le Nubi*. Parte 1, Testo; Parte 2, Atlante, 301
- Miscellaneous:**
- Brown (Dr. W.), and Prof. G. H. Thomson, *The Essentials of Mental Measurement*, 472
- Carpenter (T. M.), *Tables, Factors, and Formulas for Computing Respiratory Exchange and Biological Transformations of Energy*, 475
- Catalogue of Scientific Papers. Fourth Series (1884-1900). Compiled by the Royal Society of London. Vol. 17, 133
- Chambrier (P. de), *Exploitation du pétrole par puits et Galeries*, 443
- Corbett (Sir J. S.), *History of the Great War, based on Official Documents. Naval Operations*. Vol. 2, 135
- Fiedler (Prof. H. G.), and Prof. F. E. Sandbach, *A First German Course for Science Students*. Second edition, 204
- Fleming (A. P. M.), and J. G. Pearce, *Research in Industry: The Basis of Economic Progress*, 807
- Greece, *The Legacy of*, Edited by R. W. Livingstone, 169
- Grinnell (G. B.), *When Buffalo Ran*, 7
- Indian Science Congress: *Handbook for the Use of Members attending the Ninth Meeting to be held at Madras from the Thirtieth of January to the Fourth of February 1922*, 304
- Ingram (Dr. T. A.), *The New Hazell Annual and Almanack for the Year 1922*, 103
- Microscope, *The: Its Design, Construction and Applications*. A Symposium and General Discussion by many Authorities. Edited by F. S. Spiers, 370

Nernst (Prof. W.), Das Weltgebäude im Lichte der neueren Forschung, 766  
 Noyes (A.), The Torch-bearers, 638  
 Oxford University Press, Some Account of the, 1468-1921, 514  
 Plimmer (Dr. R. H. A.), Analyses and Energy Values of Foods, 608  
 Torr (C.), Small Talk at Wreyland. Second Series, 678  
 Universities of the Empire, Second Congress of the, 1921: Report of Proceedings. Edited by Dr. A. Hill, 407  
 Venn (Dr. J.), and J. A. Venn, Alumni Cantabrigienses. Part 1, From the Earliest Times to 1751. Vol. 1, Abbas-Cutts, 742  
 Vernon (Dr. H. M.), Industrial Fatigue and Efficiency, 511  
 Wallis (P. and A.), Prices and Wages: An Investigation of the Dynamic Forces in Social Economics, 101  
 War List of the University of Cambridge, The, 1914-18, 102  
 Waste in Industry, 676  
 Wilson (Prof. G. M.), and Prof. K. J. Hoke, How to Measure, 472  
 Year-book of the Universities of the Empire, 1922, The. Edited by W. H. Dawson, 677

### Philosophy and Psychology:

Aristotelian Society, Proceedings of the, New Series—Vol. xxi., 371  
 Bevan (E.), Hellenism and Christianity, 409  
 Drever (Dr. J.), The Psychology of Everyday Life, 368; The Psychology of Industry, 511  
 Dunlap (Prof. K.), Personal Beauty and Racial Betterment, 339  
 Iqbal (Sheikh Muhammad), Translated from the Original Persian, with Introduction and Notes by Dr. R. A. Nicholson, The Secrets of the Self (Asrār-i Khudī), 370  
 Johnson (W. E.), Logic, 2 Parts, 506  
 Russell (B.), The Analysis of Mind, 513  
 Strong (C. A.), The Wisdom of the Beasts, 608

### Technology:

Browne (Edith A.), Cocoa, 269  
 Combustibles liquides et leurs applications, Les, 577  
 Courau (R.), Technique des pétroles, 548  
 Farmer (Dr. R. C.), Industrial and Power Alcohol, 577  
 Hetherington (A. L.), The Early Ceramic Wares of China, 705  
 Holzkonservierung, Handbuch der, Edited by E. Troschel, 73  
 Horgan (S. H.), Photo-Engraving Primer: Concise Instructions for Apprentice Engravers or for those seeking simple yet practical knowledge of Line and Half-tone Engraving, 547  
 Puchner (Prof. H.), Der Torf, 608  
 Reg (O.), Edited and with an Introduction by W. Gamble, Byeways of Colour Photography, 547

Rhodesian Man, The Brain of, Prof. G. Elliot Smith, 355  
*Rhodymenia palmata*, The Efflorescences of, C. Sauvageau and G. Denigès, 535  
 Rhynie Chert Beds, The, Drs. Lang and Kidston, and others, 189  
 Richards, Ellen, Research Prize, The, Grant awarded to Miss Ann Catherine Davies, 789  
 Rift Valleys, The, and Geology of East Africa, Prof. J. W. Gregory (with ten Appendices by various authors), 233  
 Rivers, Discharge of: A New Method of Finding the, Prof. J. Joly, 398; A New Method of Gauging, Prof. J. Joly, 624  
 Rockall, The Algæ of, G. Hamel, 194  
 Rodents of North America, Damage done by the, W. B. Bell, 87  
 Röntgen Society, Election of Officers and Council of the, 824

Rosenbusch's Petrology, Dr. J. W. Evans, 303  
 Rosiwal Method of Micro-analysis, A Simplification of the, W. A. Richardson, 127  
 Rothamsted Experimental Station: Annual Meeting, 828; Gift by Lady Ludlow to the Library, 420; H. V. Garner appointed to explain the Plots of the, 248  
 Royal: Academy, The, 586; Winter Exhibition, The, 60; Academy of Belgium, Arrangements for 150th Anniversary of the Foundation of the, 654, Prof. C. Sarolea, 684; Anthropological Institute, Presidential Address of Sir Everard im Thurn, 53; Astronomical Society, Approaching Centenary of the, 215; Election of Officers and Council of the, 217; The Centenary of the, 622; Prof. Eddington, and others, 760; The Gold Medal of the, awarded to Dr. J. H. Jeans, 84; Botanic Gardens, Peradeniya, Work of the, 754; College of Physicians of London, Sir Humphry Rolleston elected President of the, 526; Engineers, The Work of the, in the European War, 1914-19, 4 vols., 336; Geographical Society, Awards of the, 384; Election of Officers and Council of the, Lord Ronaldshay, President, 724; Institution, Bequest to, by Sir W. Phipson Beale, 724; Irish Academy, Election of Prof. T. H. Morgan and Prof. J. Bordet as Honorary Members of the, 487; Meteorological Society, Dr. Chree elected President of the, 117; Election of Officers and Council of the, 217; Observatory, Greenwich, The Report of the Astronomer Royal, 796; Society Catalogue, The, 133; Conversazione, 693; Selected Candidates for Election into the, 279; of Arts, Purchase of the House of the, 117; of Edinburgh, Election of Fellows, 384  
 Rush and Straw Crosses, Miss E. Andrews, 529  
 Russia: Scientific Literature for, Sir R. A. Gregory and Dr. C. H. Wright, 208; Platinum Industry of, Prof. Duparc to organise the, 755  
 Russian: Academy of Sciences, Invitation to the Paris Academy of Sciences to attend the Celebration of the Bicentenary of the, 116; Names, Transcription of, Prof. B. Brauner, 552; Maj.-Gen. Lord Edward Gleichen, 648; J. G. F. Druce, 777

Saccharose and Aucubine in the Seeds of *Melampyrum arvense*, Presence of, M. Bridel and Mlle. Marie Braecke, 30  
 Safeguarding of Industries Act: Judgment as to Certain Articles in connexion with the, 453; Major A. G. Church, 583; Complaints of Improper Inclusions and Exclusions under the, 262  
 Safflower-seed Oil, 250  
*Sagina filicaulis* Jord.; *Cerastium subtetrandrum* Murbeck; *Arum italicum* Mill. C. E. Salmon, 431  
 St. Andrews University: Lord Haig elected Chancellor of, 155; (United College), N. McLeish awarded the Gray Prize in Logic and the Tyndall Bruce Logic Prize, 254; resignation of Prof. A. S. Butler, 828; F. Whyte appointed lecturer in Engineering in University College, Dundee; M. McGibbon appointed Demonstrator in Botany; Miss J. M. Reid appointed Demonstrator in Zoology, 829  
 Salaries of Heads of Departments in Pure and Applied Science in Technical Institutions, 192  
 San Juan Area, Chronology of the, E. H. Morris, 158  
 Sand- and Mud-binding Plants, 726  
 Sap, The Ascent of, Sir J. C. Bose, 561  
 Saturn, 318; the Ringless, The Stellar Magnitude of, J. van der Bilt, 352  
 Scale-insects, Fungi Parasitic on, Mr. Petch, 154  
 Scandium from Thorveitite of Madagascar, The Extraction and Purification of, P. Urbain and G. Urbain, 799  
 Schistosomes, The Differentiation of Closely-allied, F. G. Cawston, 599  
*Schizophyllum commune*, Fr., Revival of Sporophores of, F. A. Mason, 272  
 Science Abstracts, 559  
 Science: An Epic of, F. S. Marvin, 638; Gas Warfare, Col. C. H. Foulkes, 661; and Industry, Sir Alfred Keogh and Sir Edward Boyle, 728; at the Post Office, 401; Sir W. Noble, 609; The Writer of the Article, 610; Classics and, 33; Experimental, 1, Physics, S. E.



- Brown, Section 5, Light, 641; Importance of, H. G. Wells, 728; in Bohemia, Prof. B. Brauner, 625; in Poland, 278; in Preparatory Schools, Suggestions for the Teaching of, 28; in Secondary Schools, The Master of Balliol, and others, 56; Masters' Association, Annual General Meeting of the, 56; Natural Elements of, W. B. Smith, Part 1, 641; Research in, Importance of, G. Lemoine, 183; The Influence of, 801; The Message of, W. Robertson, 9; J. J. Robinson, 43; The Wonder Book of, J. H. Fabre, 270
- Scientific: Instruments, British, 65; Education, The Function of English in, 229; Literature for Russia, Sir R. A. Gregory and Dr. C. H. Wright, 208; Papers, Catalogue of, Fourth Series (1884-1900). Vol. 17, 133; Research and Industrial Development, 124; Services, Government, 569; Society, the Work and Scope of a, Sir Robert Robertson, 420; Workers, National Union of, Report of the Executive Committee of the, 621
- Scientist's Reference Book and Diary for 1922, J. Woolley, Sons & Co., Ltd., 88
- Scombriform Fishes, The Ontogenesis of the, belonging to the Family of the Luvareides, L. Roule, 732
- Scott, John, Medals, Certificates and Premiums awarded to Dr. W. Duane, Prof. R. A. Fessenden, E. Haynes, and Dr. T. B. Osborne, 558
- Sea Dayak Fabrics and their Decoration, Laura E. Start, 291
- Sea-water, Variations in the Chemical Composition of, and the Evaluation of Salinity, G. Bertrand, M. Freundler, and Mlle. Ménager, 732
- Sedum telephium*, Presence of a Glucoside giving rise to an Essential Oil in the Stems and Roots of, M. Bridel, 158
- Seeds: Influence of Lime on the Yield of, during the Germinative Period, L. Maquenne and R. Cerighelli, 763; The Determination of the Germinative Faculty other than by the Actual Germination of the, P. Lesage, 535; the Germination of, The Influence of Selenium and of Radium on, J. Stoklasa, 632; the Vitality of, A New Indicating Method for Evaluating, by the Biochemical Method, A. Nemeč and F. Duchon, 399
- Seiches, and the Effect of Wind and Atmospheric Pressure on Inland Lakes, 462
- Seismological: Notes*, No. 1, 454; Stations of the World, A List of, 351; H. O. Wood, 489
- Seismology: A Manual of, Dr. C. Davison, 368; appointment of an Advisory Committee in, by the Carnegie Institution of Washington, 486
- Selenium, The Action of, on Gold, H. Pélabon, 258; The Constitution of, H. Pélabon, 63
- Self, The Secrets of the (Asrār-I Khudi), Sheikh Muhammad Iqbal. Translated from the Original Persian with Introduction and Notes by Dr. R. A. Nicholson, 370
- Sema Nagas: Life among the, 769; The, J. H. Hutton, 769
- Sensitiser, New, for Green Light, Dr. W. H. Mills and Sir William Pope, 825
- Serbian Epidemics of Typhus and Relapsing Fever in 1915, The, Their Origin, Course, and Preventive Measures employed for their Arrest, Col. W. Hunter, 743
- Serum, The Superficial Equilibrium of the, and of some Colloidal Solutions, P. Lecompte der Noüy, 599
- Sex: Development, Miss R. M. Fleming, 691; Reversal in Frogs and Toads, F. A. E. Crew, 218
- Sexual Life and Marriage among Primitive Mankind, Dr. B. Malinowski, 502
- Shackleton, the late Sir Ernest, Funeral of, 247
- Shackleton-Rowett Expedition, the, F. Wild, 622
- Shales-with-Beef, a Sequence in the Lower Trias of the Dorset Coast, 3 parts, W. D. Lang, L. F. Spath, and W. A. Richardson, 157
- Shape Assumed by a Deformable Body immersed in a Moving Fluid, E. Karrer, 54
- Sheep-breeding: and Ancestry, 595; Experiments, Report on, Prof. J. Cossar Ewart, 595
- Sheffield University, Appointments in, 223
- Shell, Spinning, The Aerodynamics of a, R. H. Fowler and C. N. H. Lock, 224
- Sidmouth, a Prehistoric Village Site at, 823
- Silicified Plant Remains, Drs. Kidston and W. H. Lang, 251
- Silk Weavers and their Output, P. M. Elton, 388
- Silkworms, Pébrine in, C. M. Hutchinson, 253
- Sitones injurious to Leguminous Crops in Britain, Miss Dorothy J. Jackson, 26
- Skjellerup's Comet, Observations of, P. Chofardet; A. Schaumasse, 799; J. Guillaume, 831
- Smell, The Sense of, in Birds: A Debated Question, 783; J. H. Gurney, 784
- Smithsonian Institution, Annual Report of the, for 1919, 559
- Snails, Land, of the Madeira Islands, Prof. T. D. A. Cockerell, 446
- Snook Apparatus, Catalogue of the, Newton & Wright, Ltd., 88
- Snow Furrows and Ripples, E. C. Barton; Dr. Vaughan Cornish, 374
- Society, The Earliest Forms of, 203
- Soda with Ammonia, The Manufacture of, H. le Chatelier, 566
- Sodite, a New Radioactive Mineral, A. Schoep, 631
- Sodium: Bicarbonate, The Preparation of, E. Toperescu, 567; Sulphite, Action of, on Nitrobenzene, Seyewetz and Vignat, 226; Vapour, Fluorescing, The Absorption of, Prof. J. K. Robertson, 43
- Soil: Survey in the Lothians, A. Drs. W. G. Smith and A. Lauder, 25; The Partial Sterilisation of the, G. Rivière and G. Pichard, 327
- Soils, a Photographic Survey of, M. M. Monie, 25, 151
- Solar: Eclipse, The Partial, of March 28, 352; The Total, of next September, 152; Radiation, Influence of, on the Culture of Belladonna and the formation of Alkaloids in the Leaves, A. Goris and H. Deluard, 158; Researches, 592
- Solfatara of Pozzuoli near Naples, A Phenomenon at the, J. Place, 559
- Solids: A Searchlight on, Prof. A. Smithells, 262; Aggregation and Flow of, being the Records of an Experimental Study of the Micro-Structure and Physical Properties of Solids in Various States of Aggregation, 1900-1921, Sir George Beilby, 262; Influence of Temperature on the Velocity of Interpenetration of, H. Weiss and P. Henry, 226; the Interpenetration of, by Chemical Reaction, The Influence of the Time Factor on, H. Weiss and P. Henry, 831
- Solutions: Correlation of Compound Formation, Ionisation, and Solubility in, J. Kendall, 159; The Diffusion of, T. H. Littlewood, 225
- Solvay Institute of Chemistry, The, 718
- Solvent Recovery, 645
- Somatic Nucleus in Development, Behaviour of the, Prof. McLean, 190
- Somersetshire, The Dialect of, 691
- Sonometer, An Optical, F. Twyman, 666
- Sound Producer, An Efficient, Prof. K. Grant, 692
- South: African and Indian Floras, 510; African Coalfields, Recent Additions to our Knowledge of the, Dr. E. T. Mellor, 564; Railway, the Electrification of Part of the, 149; American Anthropology, Studies in, Dr. R. Karsten, 119; Tropics, Climate and Health in the, Dr. F. L. Hoffman, 792; Australia, Opening of a Lock and Weir at Blanchetown, 487; -eastern Union of Scientific Societies, the 27th Annual Congress of the, 623; -west of England, University College of the, Gift of the Site of the, W. H. Reed, 629
- Southampton, University College, Prof. K. H. Vickers appointed Principal of, 429
- Southport, Meteorological Observations at, J. Baxendell, 88
- Space and Æther, S. V. Ramamurty, 75; —Time—Matter, Prof. H. Weyl. Translated by H. L. Brose, 634
- Species and Adaptations, J. T. Cunningham, 775
- Specific Heats of Air, Steam, and Carbon Dioxide, Sir Richard Glazebrook, 461
- Speckled Wave Front of Light, The, L. F. Richardson, 683
- Spectacle Design, Principles of, Dr. J. W. French, 772
- Spectra, Variability of, Problems in the, Prof. T. R. Merton, 519
- Spectral Type, Relation of, to Magnitude, Dr. H. Shapley and Miss Annie J. Cannon, 281
- Spectroscopic Parallaxes with Objective Prism Spectrograms, Dr. H. Shapley and B. Lindblad, 422

- Spectrophotometer, A Non-polarising, A. J. Bull, 430  
Spectrum : Lines, A New Series of, F. S. Brackett, 209 ;  
of Magnesium, Evolution of the, under the Influence of  
Increasing Electrical Actions, A. de Gramont and  
G. A. Hemsalech, 258  
Spinoza Society, The, 486  
Spiral : Nebula M 81, Internal Motions in the, Dr. van  
Maanen, 186 ; Nebulae, Movements in, Dr. J. H. Jeans,  
55 ; Movements in, Dr. van Maanen, 249  
Spirals and Clusters, Radial Motions of, C. Wirtz, 791  
Spitsbergen : Central, The pre-Devonian Basement Com-  
plex of, G. W. Tyrrell, 257 ; Norwegian Explorations in,  
A. Hoel, 561 ; The Ecology of the Flora of, J. Walton,  
396  
Spolia Runiana—V., Sir W. A. Herdman, 396  
Sponge-spicules, Prof. A. Dendy, 191  
Spruce Bud Worm, Offer of a Prize for a Method of Com-  
bating and Suppressing the, F. J. D. Barnjum, 689  
Sprengel Pump, A Defect in the : its Causes and a Remedy,  
J. J. Manley, 225  
Star : A Very Massive, Prof. Plaskett, 791 ; An Abnormal,  
Observation of, by the Heterochrome Photometer of  
the Paris Observatory, C. Nordmann and M. Le  
Morvan, 127 ; Atlas and Telescopic Handbook, A.  
(Epoch 1920), for Students and Amateurs, A. P.  
Norton, 269 ; Distances, Deduction of, from Proper  
Motions, Prof. H. N. Russell, 121 ; Long-period  
Variable, A Unique, Major W. J. S. Lockyer, 530 ;  
Magnitudes, Determination of, by a Thermopile, J.  
Schilt, 528 ;  $\theta$  of the Great Bear, A Singular Phenom-  
enon presented by the, C. Nordmann and M. Le  
Morvan, 463 ; The Deviations of Light Rays passing  
in the Neighbourhood of a, M. Ferrier, 831  
Stars : Binary, Colours of, P. Doig, 824 ; Binary, The  
Origin of, Dr. J. H. Jeans, 89 ; Catalogue of 1068  
"Intermediate," situated between  $51^\circ$  and  $65^\circ$  South  
Declination for the Equinox 1900, 743 ; Double, A  
Catalogue of, 592 ; Effective Temperatures of, Dr.  
W. W. Coblentz, 560 ; Evening, 488 ; New, The  
Search for, 824 ; of Class A in the Solar Cluster, Dr.  
H. Shapley and Miss Annie J. Cannon, 386 ; of the  $\beta$   
Canis Majoris Type, F. Henroteau, 422 ; the Apparent  
Diameter of, A New Interference Method for Measur-  
ing, A. Danjon, 831 ; The Determination of the  
Diameter of, by the Interference Method, M. Hamy,  
599 ; The Pressures of the Atmospheres of the, and  
the Sun, P. Salet, 158  
Stasite, a New Mineral, Dimorphous with Dewindite, A.  
Schoep, 567  
State Medicine in London, an Institute of, Offer of the  
Rockefeller Foundation, for, 280  
Statistical Method, 473  
Statistics, A First Course in, D. C. Jones, 473  
Steel : Industry of South Yorkshire, The, Prof. C. H.  
Desch, 691 ; Manufacture, Electrothermic Processes  
in, 768 ; Tempered, The Colours of, Prof. C. V. Raman,  
105 ; Tempering in, The Penetration of, G. Charpy  
and L. Grenet, 763 ; The Electro-metallurgy of, C. C.  
Gow, 768  
*Sterigmatocystis nigra* : A New Acid Fermentation pro-  
duced by, M. Molliard, 567 ; The Toxicity of various  
Nitrophenols for, L. Plantefol, 127  
Steward Observatory, University of Arizona, A 40-inch  
Disc made in America, 755  
Stomata, Behaviour of, J. V. G. Loftfield, 387  
Stone : Age, The New, in Northern Europe, Prof. J. M.  
Tyler, 302 ; Implements in the Perth Museum,  
Catalogue of the, J. Asher, 423 ; Preservation of, N.  
Heaton, 287, Prof. A. P. Laurie, 814  
Stonehenge : Concerning the Four Stations, E. H. Stone,  
410 ; Recent Excavations at, Col. W. Hawley, 781  
Strangers' Hall, Norwich, etc., Offer of, to the Norwich  
Corporation, by L. G. Bolingbroke, 84  
Strasburger's Text-book of Botany. Rewritten by Dr. H.  
Fitting, Dr. L. Jost, Dr. H. Schenck, Dr. G. Karsten.  
Fifth English edition Revised with the Fourteenth  
German edition by Prof. W. H. Lang, 740  
Stratiotes, The Geological History of the Genus, Miss M.  
E. J. Chandler, 598  
Stream-flow and Erosion, Forests in Relation to, 417  
Stress, Effect of, on the Heat Conductivity of Metals, Dr.  
Bridgman, 793 ; Optical Effect in Transparent  
Solids strained beyond the Elastic Limit, Prof. L. N.  
P. Filon and H. T. Jessop, 326  
Stringybark, An Additional Blue-leaf, J. H. Maiden, 226  
Stupors, Benign, A Study of a New Manic-depressive  
Reaction Type, Dr. A. Hoch, 743  
Suberone, Some Derivatives of, M. Godchot and P. Brun,  
399  
Submarine, Coast Sediments, The Neutral Lines of, J.  
Thoulet, 399 ; Periscope, A Projective Treatment of  
the, T. Smith, 431 ; Periscopes, Dr. A. Gleichen, 490 ;  
Volcanic Eruptions, Deep, J. Thoulet, 632  
Sucrase, The Law of Action of, H. Colin and Mlle. A.  
Chaudun, 194  
Sulphur and Sulphur Derivatives, Dr. H. A. Auden, 235 ;  
in Illinois Coal beds, H. F. Yancey and T. Fraser, 354 ;  
in Iron Pyrites, The Estimation of, G. Chaudron and  
G. Juge-Boirard, 463  
Summer Time : Act, Effect of the, on the Health of School  
Children, 656 ; Bill, 214, 384  
Sun : Observations of the, made at the Lyons Observatory,  
J. Guillaume, 29, 631 ; Observations, the Partial  
Eclipse of the, on March 28, 1922, J. Mascart, 599 ;  
The Atmosphere of the, Measurement of Pressure in,  
A. Perot, 599 ; Total Eclipse of the, 591 ; Variability  
of the, New Observations on the, C. G. Abbot, 30  
Sun-fish, The Buoyancy of the, Capt. G. C. C. Damant  
and Prof. A. E. Boycott, 578  
Sunlight : The Action of, Dr. C. W. Saleeby, 11, 274  
Sun's Rotation, The, from Spectroheliograms, Prof. P.  
Fox, 422  
Sun-spots in Latitude, The Periodicity and the Movement  
of the, explained by the Pulsation of the Nucleus, E.  
Belot, 226  
Surface Curvature at the Focus of an Astronomical Object  
Glass, The Effect of Changes of, E. W. Taylor, 566 ;  
Energy and Forces of Short Range, Historical Notes  
upon, W. B. Hardy, 375 ; Tension and Narcosis, W.  
Kopaczewski, 226  
Surveying for Oil Geologists, 474  
Suzette Layer, Our Knowledge of the, P. Termier and L.  
Joleaud, 29  
Swallows, British, The Migration of, Dr. A. L. Thomson,  
346  
Swedish Academy of Sciences, Prof. M. Planck elected a  
Foreign Member of the, 384  
Swine, Progress of Metabolism after Food in, Prof. T. B.  
Wood and Dr. J. W. Capstick, 730  
Swiss Travel Almanac, 809  
Sydney Harbour, Proposed Cantilever Bridge across, 120  
Sylviculture, Guide pratique de, Dr. F. Frankhauser.  
Troisième édition française par M. Petitnermet, 7  
Symbiose, intrazellulärer, Tier und Pflanze in, Prof. P.  
Buchner, 538, 576  
Symbiosis, Studies in, Prof. F. W. Gamble, 538, 576  
Symbiotic Bacteria and Phosphorescence, F. A. Potts, 814  
Symons Gold Medal, The, presented to Col. H. G. Lyons,  
117  
Synthetic Dyes as Antiseptics and Chemotherapeutic  
Agents, Prof. C. H. Browning, 750  
Syphilis : The Preventive and Curative Action in, of the  
Acetyl Derivative of Oxyaminophenylarsinic Acid  
(Sodium Salt), C. Levaditi and A. Navarro-Martin,  
567 ; The Preventive Action in, of the Acetyl  
Derivative of Oxyaminophenylarsinic Acid (Sodium  
Salt), L. Fournier, C. Levaditi, A. Navarro-Martin  
and A. Schwartz, 800  
System : The,  $\text{Na}_2\text{O}-\text{CO}_2-\text{NaCl}-\text{H}_2\text{O}$ , F. A. Freeth, 461  
Taboo and Genetics : A Study of the Biological, Socio-  
logical, and Psychological Foundation of the Family,  
Drs. M. M. Knight, Iva L. Peters, and Phyllis Blan-  
chard, 235  
Teeth : in Children, On the Relationship of Condition of  
the, to Factors of Health and Home Environment,  
E. C. Rhodes, 409 ; of the Nation, The, Prof. W. D.  
Halliburton, 356  
Telegraphic Transmission of Photographs, Drawings, and  
Manuscripts, E. Belin, 463, 686  
Telephony, Wireless, Universal, 719  
Telescope Objectives, The Adjustment and Testing of,  
Third edition, 338



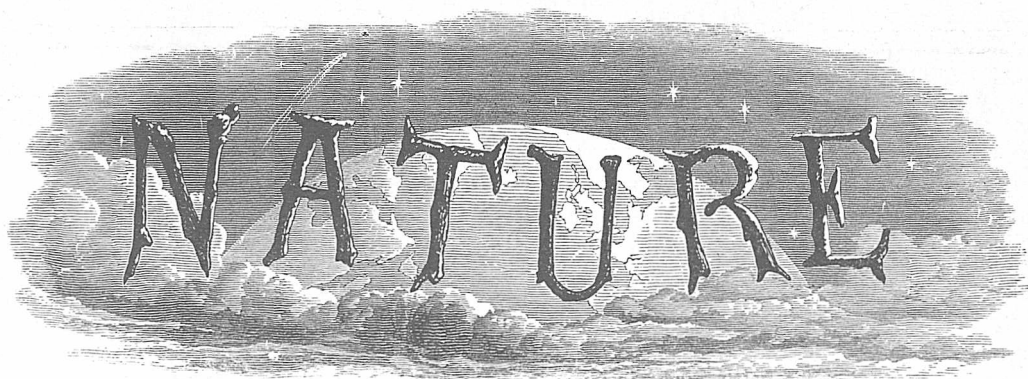
- Telluric Lines, Variation in the Wave-length of the, A. Perot, 194
- Tellurium, The "Dynamic" Allotropy of, A. Damiens, 799
- Temperatur und Lebensvorgänge, Dr. A. Kanitz, 741
- Temperature: Functions of Certain Properties of the Metals, Periodical Phenomena in the, Dr. G. Borelius, 613; of 1921, The, 52; Rainfall, and Sunshine in the United Kingdom for the Winter Season, 420
- Ternary Mixtures, The Vapour-pressure of, Prof. A. W. Porter, 257
- Terrestrial: Life Begin? Where did, Dr. A. C. Macfie, Prof. J. W. Gregory, 107, 310; J. S. Dines, Dr. F. J. Allen, 207; Magnetic Disturbances and Sun-spots, Father A. L. Cortie, 44; Magnetism in the Antarctic, 508; The 27-day Period (Interval) in, Dr. C. Chree, 698
- Tertiary Mollusca of Santo Domingo, Dr. H. A. Pilsbry, 692
- Textile Research Fellowships, 766
- Therapeutic Serums and the Sero-diagnosis of Syphilis, The International Standardisation of, 20
- Therapy: Deep, Apparatus, Section 2b, Newton and Wright, Ltd., 150; Non-Specific, Dr. J. Stephenson, 717
- Thermal Stresses in Solid and in Hollow Circular Cylinders Concentrically Heated, The, Prof. C. H. Lees, 762
- Thermionic: Tubes in Radio-telegraphy and Telephony, J. Scott-Taggart, 38; Valve, Applications of the, J. Joseph, 522
- Thermodynamics and Chemistry, Prof. F. H. MacDougall, 100
- Thermo-electric Force of Contact for the Identification of Certain Steels, The Utilisation of, M. Galibourg, 362
- Thermometers for Measuring Rock Temperatures, Negretti and Zambra, 562
- Thionyl Chloride, The Action of, on the A-acid Alcohols, E. E. Blaire and Mlle. Montagne, 700
- Thomson Effect, Measurement at Various Temperatures of the, A Special Apparatus for the, H. R. Nettleton, 225
- Thorium-X; Some Oxydasic Properties of, P. Lernay and L. Jaloustre, 158
- Thorpe's Dictionary, 266
- Three-colour Printing Process, A New, Major Klein, 24
- "Thymo-plas," 559
- Tidal Theory, Harmonic Development of, Dr. A. T. Doodson, 283
- Tide-predicting Machines, The Accuracy of, H. A. Marmer, 136, 479, The Writer of the Article, 137; Dr. A. T. Doodson, 239, 479
- Tides: A Manual of, Dr. A. T. Doodson, 767; and Tidal Streams: A Manual compiled for the Use of Seamen, Comdr. H. D. Warburg, 767
- Tillæa aquatica* found at Adel, near Leeds, R. W. Butcher and Dr. G. C. Druce, 54
- Timothy Grass Bacillus, Studies in the Fat Metabolism of the, Marjory Stephenson and Margaret Whetham, 126
- Tin: Plague and Arctic Relics, T. Sheppard, 78, 209; The Isotopes of, Dr. F. W. Aston, 813
- Tisiphone, the Satyrine Germs, Breeding Experiments with, G. A. Waterhouse, 832
- Tissue Diastases, The Utilisation of the, for the Determination of the Organ, the Functional Insufficiency of which is the Cause of a Pathological State, F. Maignon, 463
- Tolgarrick Radium Mine, The, to be re-opened, 147
- Tonkin, Southern, The Structure of, C. Jacob, 326
- Torch-bearers, The, A. Noyes, 638
- Toredo, the Shipworm, The Food of, F. A. Potts, 290
- Torf, Der, Prof. H. Puchner, 608
- Toxic Index of Illuminating Apparatus, of Heating Apparatus, and of Explosion Motors, The, K. Abrest, 631
- Transformers, Small Single Phase, E. T. Painton, 135
- Transition Spiral, The, and its Introduction to Railway Curves, A. L. Higgins, 103
- Transmutation, Energy Changes involved in, I. W. Wark, 108
- Transport, Some Post-War Problems of, Sir John Aspinall, 695
- Travel and Exploration, 268
- Travellers, Hints to, Scientific and General. Tenth edition, E. A. Reeves, 2 Vols., 268
- Trees, Transplantation of, Influence of Orientation on the Success of the, M. Martin-Zédé, 94
- Trilobites, The Limbs of, Dr. C. D. Walcott, 562
- Triode Oscillator, The Electromagnetic Screening of a, R. L. Smith-Rose, 462
- Tropical Medicine, Discoveries in, Sir E. Ray Lankester, 549, 812; Lt.-Col. A. Alcock, 611; Dr. L. W. Sambon, 681
- Tube Resistance Furnace, Experiments with the, on the Effect of Potential Difference, A. S. King, 31
- Tunny Fish, The Periodic Changes of Habitat of the Common, L. Roule, 30
- Turbines, A. E. Tompkins. Third edition, 171
- Turbulence as a Meteorological Agency, Sir Napier Shaw, 469
- Turpentine, Aleppo Essence of, The Composition of, G. Dupont, 258
- Ultra-violet: Absorption Spectra, The, and the Optical Rotation of the Proteins of the Blood Sera, S. J. Lewis, 126; Solar Spectrum, Photography of the, C. Fabry and H. Buisson, 352
- United States: Research Laboratories in Industrial Establishments of the, 349; State Laws relating to Public Education in the, 829; Temperatures, Prof. R. de C. Ward, 490; The Graduate Schools of Universities of the, 665; University Education in the, 425
- Universities: Annual Conference of, 759; of Great Britain and Ireland, Conference of Representatives of the, 664; of Oxford and Cambridge: Report of the Royal Commission, 428; of the Empire, Second Congress of the, 1921; Report of Proceedings. Edited by Dr. A. Hill, 407; The Year-book of the, 1922, Edited by W. H. Dawson, 677; The, and Colonial Scientific Services, 365
- University: Bulletin*, No. 1, 325; College, London, Annual Report for 1920-21, 565; Education, Sir Wilmot Herringham, 28; in the U.S.A., 425; Pensions, 531
- Upper: Cretaceous, Existence of the, in the Central Cavity of the Channel from the Dredgings of the *Pourquoi Pas?*, P. Lemoine and R. Abrard, 194; Cretaceous of Hungary, The Geological Importance of the Primitive Reptilian Fauna in the, Baron F. Nopcsa, 430
- Uranium: Oxides, The Radio-activity of the, G. Strachling, 63; The Oxides of, P. Lebeau, 258
- Urea, The Gravimetric Quantitative Micro-analysis of, M. Nicloux and G. Welter, 63
- Urticaceæ, The Mucilage of the, P. Guérin, 327
- Vaccination, Preventive, by the Digestive Tract in Man, C. Nicolle and E. Conseil, 534
- Vaccine Virus, Study of the Culture *in vitro* of the, H. Plotz, 732
- Valency and Atomic Structure, 170
- Valenzkräfte und Röntgenspektren: Zwei Aufsätze über das Elektronengebäude des Atomes, Prof. W. Kossel, 170
- Vapour Pressures and Boiling-points of Non-miscible and Miscible Liquids and the Composition of the Vapours (Distillates) from such Heterogeneous and Homogeneous Mixtures, The, Prof. S. Young, 431
- Vedanta, The Logic of the, S. N. Dasgupta, 362
- Vegetable: Assimilation and Respiration, Experimental Researches on, Pts. XV. and XVI., G. E. Briggs, 730; Histology, The Elements of, Prof. C. W. Ballard, 773
- Végétales: Bibliothèque de physiologie et de pathologie, nutrition de la plante, I., II., Prof. Molliard, 769
- Vegetation in the United States, The Distribution of, as related to Climatic Conditions, Prof. B. E. Livingston and Dr. E. Shreve, 371
- Venus, Observations of, A. Rordame; Prof. St. John, 592
- Vibrations: in Plates, Membranes, etc., A Method of Exciting, based on the Bernoulli Principle, K. Grant, 256; of Vehicles, A. Boyer-Guillon, 251; The Free Transverse, of a Uniform Circular Disc clamped at its

- Centre; and on the Effects of Rotation, R. V. Southwell, 289
- Vine Mildew, The Germination of the Spores of, L. Ravaz and G. Vergé, 30
- Viscosity: and Flash-point Apparatus, A. Gallenkamp and Co., Ltd., 793; Determination by Means of Orifices and Short Tubes, W. N. Bond, 462
- Viscous: Liquid, Stability of a, contained between two Rotating Cylinders, G. I. Taylor, 533; Properties of (a) Carbon Dioxide and Nitrous Oxide, and (b) Nitrogen and Carbon Monoxide, An Experimental Comparison of the, C. J. Smith, 666
- Visibility of Distant Objects, Prof. H. Bénard, 412
- Visual Instruction, Organisation for, Dr. C. W. Kimmins, 617
- Vitamins and their Relation to Public Health, Dr. J. C. Drummond, 123
- Vogelzuges, Die Rätzel des, ihre Lösung auf experimentellem Wege durch Aeronautik, Aviatik und Vogelberingung, F. von Lucanus, 573
- Vowel Sounds, Nature of, Sir R. A. S. Paget, 341
- Walaëus and the Circulation of the Blood, Dr. G. A. Stephens, 552
- Wales, National Museum of, Annual Report of the, 53
- War: History of the Great, based on Official Documents. By Direction of the Historical Section of the Committee of Imperial Defence: Naval Operations, Sir J. S. Corbett. Vol. 2, 135; The, and the Royal Engineers, 336
- Wasps, Hunting, More, J. H. Fabre. Translated by A. T. de Mattos, 270
- Waste in Industry, 676
- Water: Flow in Pipes, 606; Power, British, and its Administration, 161; Power Resources of India, J. W. Meares, 531
- Waterways, Harbours, and Docks, Dr. Brysson Cunningham, 151
- Wave: Detector, An Electric, E. V. Appleton, 397; Resistance, Effect of Shallow Water on, T. H. Havelock, 224
- Waves maintained by Modulation, The Reception of, R. Jouaust, 94
- Wealden Iron Industry, The Historical Geography of the, M. C. Delany, 410
- Weather: and Harvest Cycles, Sir William Beveridge, 627; and the Crop-yield in the North-east Counties of Scotland, A. E. M. Geddes, 763; Exceptionally Hot, 723; of 1921, The, 118; Simple Lessons on the, for School Use and General Reading, E. Stenhouse, 440; The, and the Crops in Eastern England, 1885-1921, R. H. Hooker, 193
- Webbia: Raccoltà di scritti botanici. Edita da Prof. U. Martelli. Vol. Quinto, Parte 1<sup>a</sup>, 644
- Week, The, in West Africa, N. W. Thomas, 124
- Wegener's Displacement Theory, 202
- Welding: Engineers, Institution of, to be formed, 147; Spot and Arc, H. A. Hornor, 171
- Weldless Steel Tubing, Tests of, W. W. Hackett, 188
- Weltgebäude, Das, im Lichte der neueren Forschung, Prof. W. Nernst, 766
- West: Africa, The Week in, N. W. Thomas, 124; Virginia, University of, and Morgantown, Gift to, by Dr. I. C. White and Mrs. White, 316; Yorkshire Metallurgical Society, The, 454
- Western Reserve University, Gift to, by S. Mather, 317
- Whale Fisheries, A History of the, from the Basque Fisheries of the Tenth Century to the Hunting of the Finner Whale at the Present Time, Dr. J. T. Jenkins, 298
- Whales of the Genera Megaptera and Balænoptera, The Skull in Fœtal Specimens of, the late Dr. W. G. Ridewood, 499
- Whaling, The History of, 298
- What the Public Wants: A Study of the American Museum of Natural History, 81
- Wheat: A Monograph on, 366; as the Basis of Britain's Food Supply in Time of War, Lord Bledisloe, 25; Plant, The, A Monograph, Prof. J. Percival, 366; Prices and Rainfall in Western Europe, 627; Rusts near Cambridge, Occurrence of, K. C. Mehta, 462
- Whey, Production and Utilisation of, Prof. R. A. Berry, 25
- Wind: at Llandudno, The Effect Produced by, W. Dallimore, 290; Observations in Finnish Lightships, Dr. G. Granqvist, 88
- Wireless: Apparatus for Tristan da Cunha, 655; Communication Apparatus, Catalogue of, C. F. Elwell, Ltd., 824; Telegraphy and Telephony: An Outline for Electrical Engineers and others, L. B. Turner, 38; Commission, Report of the, 149; Directive, Direction and Position Finding, etc., L. H. Walter, 270; Continuous Wave, Prof. W. H. Eccles, Part 1, 38; Precursors of, Sir Joseph Larmor, 410; Telephone Receiving Sets, 819; Universal, 719; Time-Signals, Prof. Sampson, 422
- Witch: -craft in Western Europe, 572; -cult in Western Europe: A Study in Anthropology, M. A. Murray, 572
- Wood, Trueman, Lecture, The, Dr. J. A. Fleming, 140, 179
- Woollen and Worsted Research, 564
- World: The External, K. Gerhards, 691; The Genesis of the, 765
- Wreyland, Small Talk at, C. Torr, Second Series, 678
- Wright, Wilbur, Memorial Lecture, The, A. Ogilvie, 822
- Wrought-iron Currency, A Specimen of, from the Kisi Country, Sierra Leone Protectorate, West Africa, R. C. Gale and Capt. E. R. Macpherson, 138
- X-Ray: Spectra, on the N-Series in, V. Dolejšek, 582; Spectrum, The L-series of the, D. Coster, 258; Studies on the Crystal Structure of Iron and Steel, Dr. Westgren and Mr. Phragmen, 817; Work, "Safety First" in, Watson and Sons, 791
- X-Rays: Examination of Textiles by, Truesdale and Hayes, 283; Measurement of the Mean Penetrating Power of a Bundle of, by a New Radio-Chromometric Method, M. de Laroquette, 399; of the L-series, 3, The Intensities of, F. C. Hoyt, 30
- Xylenes, Three, Solubility of Isomeric Toluic Acids in the, M. Chapas, 399
- Yerkes Observatory, Slides of Photographs taken at, 386
- York Philosophical Society, Appeal for Funds, 689
- Yorkshire Philosophical Society, Centenary of the, 53
- Ytterby, The Small Haloes of, Prof. J. Joly, 711
- Yunnan and Western Szechuan, Impending Expedition to, by Prof. J. W. Gregory and C. J. Gregory, 51
- Zeeman's Discovery, The History of, and its Reception in England, Sir Oliver Lodge, 66
- Zinc: and Cancer, P. Cristol, 567; Sulphide, Phosphorescent, A. A. Guntz, 800
- Zoological Society of London: Additions to the Menagerie of the, 248, 421, 622; Annual Report of the, for 1921, 689; Monthly Report of the, 148; Prince Albert of Monaco and Prof. G. O. Sars elected Foreign Members of the, 21
- Zoology, Botany, and Prehistoric Archæology of the British Isles, Papers bearing upon the, T. Sheppard, 622
- Zulkowski's Theory of the Relation between the Composition and Durability of Glass, An Examination and Extension of, W. L. Baillie, 157



*Printed in Great Britain by R. & R. CLARK, LIMITED, Edinburgh.*





A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

*"To the solid ground*

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

1921. 1002.

THURSDAY, JANUARY 5, 1922.

*Editorial and Publishing Offices:*

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters should be  
addressed to the Publishers.

Editorial communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.

### Education and the Nation.

ON Sunday, November 27, Mr. Fisher, President of the Board of Education, speaking in Whitefield's Mission, London, on "Our Schools," said:

"Education is a great unifying influence, not only between classes, but also between nations. The estranging influences between man and man are not rooted in the externals of situation or wealth, but are founded in differences of intellectual acquisition and of intellectual and moral outlook. There still persists the delusion that the education of the poor must be different, not only in amount, but also in quality, from the education which is at the service of the more affluent members of the nation. But the poor, even more than the rich, stand in need of the best possible education, since they lack the home advantages of the wealthy. Indeed, in the crowded areas of the cities the school plays an even greater part than the home in the formation of the national mind. The elementary school may not give all the

results we are entitled to expect, though there has been great progress made in the last generation through the development of a spirit of humanism in the schools. It will not become fruitful in result until something is done to provide education for the vital period of adolescence."

This was the spirit that animated Mr. Fisher in the drafting of the measure which culminated in the Education Act of 1918, and served to mark the public appreciation of the benefits of education and the great progress made since the Education Act of 1902. Mr. Fisher stated that day continuation schools were provided for in the Education Act of 1918, but, owing to financial circumstances, at the present time they could not develop the system adequately. He added that the children of the nation needed more schools, more books, and better teachers, and if the nation was in earnest they would assuredly get them in time. Yet the Board of Education has continually thwarted the progressive efforts of the more enterprising local authorities in the provision of new schools; it hampers the provision of Central Schools in London even where such provision can be made by the reorganisation of existing elementary schools, and it checks the development of schools where physically defective children can receive remedial treatment.

There has arisen—and it is an extremely hopeful sign of the public interest in the value of education—a strong demand for the advantages of higher education, and thousands of children in all parts of the country are eager for admission to secondary schools; but the Board offers no encouragement to that end; in fact, it has sanctioned the raising of the fees in such schools, thereby preventing the poorer children from taking advantage of them, and



the same policy is being pursued with respect to the much-needed nursery schools for children under five. Day continuation classes during two years, as provided for by the Act, for young people who have left the elementary school at fourteen in order to enter into employment, are, except in the London area, practically a dead letter, the Board refusing its sanction to the fixing of the appointed day.

The Committee of business men appointed by the Chancellor of the Exchequer, with Sir Eric Geddes as chairman, to consider the national expenditure with a view to drastic economies in the various spending departments has presented its Report to the Cabinet, but its full details have not been made public. It is rumoured that there is a proposed reduction in the total estimates for the year 1922-23 of 195,000,000*l.*, of which the education estimates are responsible for 16,000,000*l.* As showing the spirit in which this question has been approached, Lord Inchcape, one of the influential members of this Committee, and the chairman of the P. and O., said, at a recent meeting of the shareholders of his company, that "education is an excellent thing in its way, but there are limitations to its economic usefulness." Lord Haldane, at a meeting held at London University on December 17, arranged by the London Head Teachers' Association, dealt effectively with Lord Inchcape's observations, and showed how much the progress of the nation in every department of industrial life and even in his own particular business of shipping has been due to education. He said:

"Lord Inchcape could not sail a single steamer but for the education of the great inventors and men of science which made it possible, nor would his staff know how to handle the instruments but for the training they have received from their teachers. Modern business cannot stand still, neither can education. Other nations realise the value of education, and will get ahead of us if we do not; if we neglect it, hard times will come, when we shall be driven belatedly to reverse the policy threatened to-day in order to recover our resources and progress, which will have failed us through our misunderstanding of the true meaning of economy."

In this respect the decision of the Treasury to reduce the grant to the universities from 1,500,000*l.* to 1,200,000*l.* will seriously hamper these institutions in their endeavour to get and to retain competent teachers, and will impede scientific research on which a further advance in knowledge and especially industry, alike in the spheres of manufac-

tures and of agriculture, so largely depends. The joint meeting of the general council of the Trade Union Congress and the Labour Party Executive, held in London on December 14, views this policy with profound disapproval, which can do virtually nothing, it says, "to relieve the national finances, but which will be a serious blow to higher education."

An important manifesto has recently been issued by the Teachers' Registration Council, entitled "Education and National Life," for presentation to his Majesty's Ministers and in the expectation that it will be signed by many eminent men and women. It refers to the national danger which attends any attempt to reduce expenditure on education, and urges that the recent extension of the franchise has made it the more necessary to open all possible avenues of knowledge and enlightenment as preventives of error and half-truths in politics, economics, and social relationships. A complete and generous system of education will fortify the State against civil unrest and strife, while serving to widen the vision and enrich the lives of individuals. We were led in the tragic ordeal of the war to perceive the faults of our previous educational system and to frame the new proposals embodied in the Education Act of 1918. But that measure is not really in operation, and the newly awakened desire of working people for further knowledge is left unsatisfied. The signatories recognise the need for a careful survey of our national resources and for thrift in all public and private expenditure, but hold that thrift should be exercised with discrimination and not so as to curtail educational opportunity. They conclude with the desire to see our country take its place in the van of civilised and enlightened communities and regard public expenditure on education as a wise investment which will bring to this and succeeding generations the rich rewards of civic greatness and private contentment.

It is to be hoped that this weighty manifesto from an influential body of well-wishers to education may receive speedy and favourable consideration at the hands of the Government, in order that the provisions of the Education Act of 1918 may be put into practical operation without further delay, and also that the full grant of 1,500,000*l.* be restored to the universities so as to encourage research in all departments of knowledge and give them the opportunity of fully developing their resources in the vital and permanent best interests of the nation.

### Fifty Years of Electrical Science.

*Fifty Years of Electricity: The Memories of an Electrical Engineer.* By Prof. J. A. Fleming. Pp. xi + 371. (London: The Wireless Press, Ltd., n.d.) 3os. net.

IN giving us his memories of the past fifty years, Prof. Fleming has compiled a noteworthy work. "The book makes no claim," he writes, "to be a systematic treatise on electricity or electrical engineering, but is simply intended as an attempt to place before the intelligent general reader a fairly comprehensive view of the chief triumphs of applied electricity during the last half-century." The intention is carried out with the clearness of style and the lucidity of expression we have long learned to expect from the author. He may be assured that, as he hopes, it will "assist junior engineering students in obtaining a preliminary acquaintance with the outlines of a subject they will study in greater detail in other books," while to those who are not going to be professional physicists or engineers it will give a far more useful appreciation of what electricity is and what it has done than they gain from their attempts to verify Ohm's law or measure the magnetic moment of a piece of magnetised steel. Electrical progress lends itself in a very special way to treatment of this kind, but if it were possible to do for other branches of science what Fleming has achieved for his the gain would be very great.

From Sturgeon, who in 1825 constructed the first electro-magnet, to Einstein, whose work is referred to in one of the later chapters of the book, is nearly twice fifty years, but the work of the first half of the period, though fundamental, is passed over briefly in an introductory chapter. We are reminded of the importance of Sturgeon's discovery, of its extension by Joule and Faraday and Henry, and its almost immediate application to the electric telegraph by Cooke, Wheatstone, and Morse, culminating in the Hughes printing telegraph, for which the first U.S. patent was secured in 1855; the laying of the first Atlantic cable, 1857-58, which survived for only two months; the work of William Thomson, Lord Kelvin, based on his Royal Society paper of 1855 on "The Theory of the Electric Telegraph," leading to the mirror galvanometer (1858) and the siphon recorder (1867) after the successful laying of the 1866 cable.

Electrical telegraphy in England was at first developed entirely by private enterprise, and in 1870, when the business was taken over by the State, the various companies owned altogether

some 16,000 miles of lines. Up to this time, the date at which Prof. Fleming's memories start and his detailed history begins, electrical engineering had been almost entirely concerned with telegraph work. The Society of Telegraph Engineers and Electricians—afterwards to become the Institution of Electrical Engineers—was in 1870 the only electro-technical society in England.

But the seeds of a greater development had been planted. Electro-magnetic induction was discovered by Faraday in 1831. From that followed the early magneto machines of Saxton (1833) and Clarke (1835); the Siemens armature was devised in 1856, the Gramme ring by Pacinotti in 1860. Wilde, in 1850, had used electro-magnets instead of permanent magnets for the field-coils of a machine, and this was followed, in 1867, by the invention of the dynamo; the machine became self-exciting.

The account of these fifty years occupies some fifty pages of Prof. Fleming's book; for the next fifty the remaining 300 pages barely suffice. In six chapters details are given of the advance in all directions. Telegraphs and telephones, from Hughes's first printing instrument and Graham Bell's early telephone to the modern multiplex type machines and the automatic telephone exchange, are all described. Then we have dynamos, alternators, transformers, and motors, from 1870 to 1920, from the first Gramme and Siemens machines of some few kilowatts to the giants of the present day. Another chapter treats of electric lamps and lighting; yet another of supply stations, storage batteries, and railways; while fifty pages are devoted to electric theory and measurements, from Kelvin and the work of the first British Association Committee on Electrical Units in 1861-62 to Maxwell and theories of the ether, the discoveries of J. J. Thomson and Rutherford, and the influence of Einstein on modern physics. The final chapter deals with wireless telegraphy. Commencing with the theoretical work of Maxwell and Hertz, it passes in review the experiments of Hertz, Lodge, and Admiral Jackson, concluding with those of Marconi and his associates. An account is given of the valve detector devised by the author in 1904, and of the improvement due to Dr. Lee de Forest, by which it became the triode valve and amplifier for wireless waves.

This very brief *résumé* will indicate the scope and extent of the work. The limitations of space prevent any detailed account, and indeed no such account is necessary beyond the statement that all important developments in electrotechnics of the last fifty years are described with the well-



known skill of the author, who has added to our libraries a most useful and interesting work. Both he and the Wireless Press, which has produced the book, may be cordially congratulated on the result of their labours.

### Fermat's Last Theorem.

*Three Lectures on Fermat's Last Theorem.*

By L. J. Mordell. Pp. vii + 31. (Cambridge: At the University Press, 1921.) 4s. net.

THE "last theorem of Fermat" states that if  $x, y, z, p$  denote positive integers, the equation  $x^p + y^p = z^p$  is impossible if  $p$  exceeds 2: thus no cube can be the sum of two cubes, and so on. If the theorem is true when  $p$  is 4, or an odd prime, it is true for all other integral values of  $p$ . For three centuries this theorem has baffled the efforts of all who have attacked it, although it has attracted the attention of all first-rate arithmeticians, and a great number of amateurs. For  $p=3, 4, 5, 7$  comparatively simple proofs have been discovered; but so far none of these has led to a complete generalisation.

The first great advance in the theory was made by Kummer, in connection with his researches on cyclotomic integers. He showed that if the theorem is false for any particular odd prime  $p$ , then  $p$  must not be a factor of the numerator of any one of the first  $\frac{1}{2}(p-3)$  numbers of Bernoulli. This very recondite test rules out all values of  $p$  below 100 except 37, 59, 67. By additional criteria Kummer was able to prove the theorem for these exceptional primes, and hence for all values of  $p$  from 3 to 100 inclusive.

Not many years ago (1907) a prize of 100,000 marks was set aside for the first who succeeded in giving a complete proof or disproof of the theorem. Quite recently, new criteria, independent of Kummer's, have been discovered, which have to be satisfied by odd primes  $p$  for which the theorem is false, and the simplest of these is the condition  $2^{p-1} \equiv 1 \pmod{p^2}$ , discovered by Wilferich in 1909. Other tests of a more or less similar kind have been accumulated, and the net result is that any value of  $p$  for which the theorem is false must exceed 7000. Gauss's tables of quadratic forms warn us not to draw any conclusions from this result; in fact if  $N$  is any assigned integer, however large, a proof that the theorem is true unless  $p > N$  gives us no information about the truth or falsity of the theorem in general.

Mr. Mordell's lectures give a clear and interesting account of the history and present state of this subject. Lecture I. gives a statement of the

theorem, and a summary of the work done by Kummer's predecessors; Lecture II. is on Kummer's researches, and more recent investigations of similar type; and Lecture III. gives an account of various results obtained by Libri, Sophie Germain, and others. Full references are given to the original papers, so that a reader within reach of a good reference library can make himself acquainted with details of all that has been done hitherto.

A perplexing circumstance, often alluded to, is the fact that, in a private note, Fermat distinctly asserted that he had proved the theorem. Now Fermat was never convicted of a false assertion, and only once of a wrong conjecture; on the other hand it is extremely improbable that Fermat's proof, if he had one, was in any way analogous to the work of Kummer and his successors. It is not, perhaps, unreasonable to hope that a proof may be found, some day, derived from Diophantine analysis proper, combined with a process of induction, and possibly with some application of analytical geometry, or theory of equations, or both. A really gifted youth, approaching the problem without knowledge of modern analysis, might throw a quite new and unexpected light upon it.

Mr. Mordell's pamphlet ought to do much to stimulate our rising mathematicians, and we hope that it will have a large circulation.

G. B. M.

### Chemistry of Coke-oven and By-product Works.

*Coke-oven and By-product Works Chemistry.*

By T. Biddulph-Smith. Pp. x + 180 + 7 plates. (London: Charles Griffin and Co., Ltd., 1921.) 21s.

THE author states in the preface that his object in compiling this book is to furnish a concise manual covering, so far as space will allow, the general work required for the chemical control of coke-oven and by-product works. As regards the variety of subjects treated, he has doubtless achieved his object, but it is to be regretted that the apparent exigencies of space have caused the manual to become so concise in certain sections as to detract appreciably from the value of the work as a whole.

The most valuable section of the manual is that relating to the coal-tar naphthas. There is no doubt that the author has taken considerable pains to collect together the work of some of our best analytical chemists on methods of evaluating the constituents of coal-tar naphthas—work which

was carried out during the war period when the adequate examination of these products was a matter of such great importance. Although most of the methods dealt with have already been described either in technical journals or in the proceedings of technical societies, chemists will welcome the accumulation of this information within the covers of one volume. Moreover, the admirable summary of "The Constituents of Coal-tar and their Properties," compiled by Dr. Spielman, appears in a revised form as an appendix, and the inclusion of this information may prove useful to the coke-oven chemist by saving reference work.

The rest of the book is disappointing. In describing analytical methods the author has obviously attempted to do more than supply indications of the method recommended by him, but has failed to furnish sufficient detailed information to be of real service to the works chemist.

The chapter dealing with the fractions of coal-tar other than the naphtha fraction is meagre, and the weakness of this section accentuates the fact that chemists have not yet given adequate study to the analytical methods required in the examination of the heavier fractions of coal-tar, which are no less important than the naphtha distillate. It is in this section of the book that a recommendation appears which would have shocked those older and well-established chemists who attempted to teach us our subject, and who, not living in these times of efficiency systems and labour-saving devices, paid due reverence to instruments by which accurate measurements might be made. The recommendation refers to the crystallisation of crude tar acids, the instructions being to cool the liquid, "stirring continually with a Fahrenheit thermometer graduated in tenths of a degree."

The treatment accorded in other sections of the book to the analysis of gases, calorimetry, and the examination of chemical products made and required in the recovery works is all too brief. The analysis of coal-gas, which is acknowledged to be so intricate as to require considerable experience before trustworthy results can be expected, is dealt with in a few pages, whilst the method of procedure recommended is archaic. The estimation of naphthalene is carried out by a method which would be quite unpractical if small quantities of ammonia were present in the gas, though no mention is made of this fact.

Finally, the manual contains the usual collection of tables and conversion factors in the second appendix—so useful to reader, author, and publisher.

E. V. EVANS.

## Lichens.

- (1) *Lichens*. By A. L. Smith. (Cambridge Botanical Handbooks.) Pp. xxviii + 464. (Cambridge: At the University Press, 1921.) 55s. net.
- (2) *A Handbook of the British Lichens*. By Annie Lorrain Smith. Pp. vii + 158. (London: The British Museum (Natural History), 1921.) 6s. 6d.

(1) **F**OR many years botanists have been without a guide to the large mass of facts that have been added year by year to our knowledge of lichens. Miss A. Lorrain Smith has therefore done a good work in compiling a very comprehensive handbook on this group of plants. The growth of our manufacturing and even our garden cities proves fatal to all except a few insignificant lichens. They are driven away to those far-off parts of the country where the air is still fresh and pure. This circumstance very possibly, but the absence of any comprehensive handbook on, and guide to, the lichens certainly, is a reason why so little interest is taken in this group. Yet, ecologically, it is one of the most interesting groups. Lichens grow on the outskirts of vegetation, as pioneers of the plant world, preparing the way for moss, fern and flowering plant. They are most intimately in touch with the substratum in its virgin condition. Few ecologists, however, properly consider lichens. Anatomically, the lichen thallus very directly reflects the nature of the substratum. A great deal, however, still remains to be done in this direction. The elaborate and careful work of the late Abbé Hue has, unfortunately, not brought much morphological order into our knowledge of lichen structure.

The whole question of the dependence of one organism, whether animal or plant, on another, or even others, again whether animal or plant, is every day becoming of greater interest. The views of various lichenologists on this matter are placed before us by Miss Lorrain Smith, but the simple word symbiosis is the term most favoured. It does not define the relationship between alga and fungus in too great a detail. Terms like helotism (due, by the way, to Warming and not to Nienburg), parasitism, consortium, endosaprophytism, and others, may cover certain individual cases, but the relationship of alga to fungus certainly varies in different species, or possibly even in different individuals of one species growing under different conditions. There is no doubt that on the whole the lichen-fungus fully controls growth and reproduction of the gonidial alga,



though within certain limits both take place freely. Lindau, however, has described how in certain hypophloeodic lichens the alga actually forges ahead of the fungus.

The various branches of the subject have been very fully dealt with by Miss Lorrain Smith, but we think that not sufficient reference has been made to Exsiccata, which have played such an important part in lichenological nomenclature. We also consider that the book as a whole is not well illustrated. Many of the line drawings are quite inadequate as illustrations in a handbook of this standard. The half-tone figure on p. 117 appears to us to be *Cladonia uncialis* rather than *Cladonia furcata*, whilst Fig. 135 on p. 416 does not recall to us *Parmelia omphalodes*, which it purports to represent. Apart from these blemishes, which we consider rather serious, the handbook is a storehouse of valuable information, and Miss Lorrain Smith deserves the thanks of all lichenologists and botanists for the care and thoroughness with which she has completed her task. Some readers might possibly object that they are left too much to draw general conclusions for themselves.

The price of the book, unfortunately, is prohibitive except for public and college libraries.

(2) We are sure that Miss Lorrain Smith's "Handbook of the British Lichens" will answer its purpose very well and help both botanist and collector to name their specimens, instead of being compelled to depend for this on foreign books. The book, however, is only a key to the "Monograph of the British Lichens," by Miss Lorrain Smith, the price of which, again, is well-nigh prohibitive. We may express the hope that this little book will help to create renewed interest in a group of plants the study of which was at one time keenly followed in this country.

O. V. D.

### British Mineral Resources.

*Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain.* Vol. 19, *Lead and Zinc Ores in the Carboniferous Rocks of North Wales.* By Bernard Smith. Pp. iv+162+3 plates. 1921. 5s. 6d. net. Vol. 21, *Lead, Silver-lead, and Zinc Ores of Cornwall, Devon, and Somerset.* By Henry Dewey. Pp. iv+72. 1921. 2s. 6d. net. (Southampton: Ordnance Survey Office; London: E. Stanford, Ltd.)

THE two volumes under notice form an important contribution to our knowledge of British mineral deposits, and afford satisfactory evidence that Dr. Flett is continuing energetically

the valuable series of reports inaugurated by his predecessor at the Geological Survey. The scheme of both volumes is identical and is upon the lines with which previous reports had already familiarised us, but the economic importance of the deposits discussed therein differs very widely. The lead and zinc veins of North Wales have not only been highly productive in the past, but also may well take rank in the future among the leading British lead-producing mines, whilst those of the south-west of England present little more than academic interest. Needless to say, none of the mines discussed in either volume is at work just now; in fact, in the whole of Great Britain there is not a single lead or zinc mine capable of working save at a loss at the present time, probably a result of Government interference in the control of industries.

In North Wales such well-known mines as the Halkyn mines and others in the Holywell-Halkyn area, the Minera mines and other adjoining mines in Denbighshire are fully described, together with numerous less important mining properties. It is abundantly clear that in all these cases the great difficulty to be overcome is the enormous influx of water, which has rendered the economic working of these mines practically impossible. An interesting account is given of the various deep adit drainage schemes by which it is proposed to unwater some of the more important mining areas down to a considerably greater depth than has hitherto been reached. Although he does not specifically say so, it would appear that Mr. Bernard Smith entertains no doubt of the ore holding down to the greatest depth that would thus be rendered available. Incidentally he shows that the 35,000l. which the Government advanced for unwatering the Halkyn area have been wasted and have never yielded any return whatever. It can only be hoped that some satisfactory scheme for unwatering this area may be devised and carried into execution, though it is difficult to see how this can be done until British lead-mining reaches a sounder economic position than that with which it is faced to-day.

As regards the lead mines in Cornwall, Devon, and the Mendip Hills, it can only be said that there is practically no likelihood at all of any serious revival of the lead-mining industry in these parts, and it is fortunate that the task of collecting information as to the past history of these mines has been undertaken before it is too late. Mr. Dewey has done a useful piece of work in carefully compiling an account of these mines, which will be especially interesting to the student of mineral deposition.

H. LOUIS.

## Our Bookshelf.

*Guide Pratique de Sylviculture.* Par Dr. F. Fankhauser. Troisième édition française par M. Petitmermet. Pp. 348. (Lausanne, Genève, et Paris: Payot et Cie, 1921.)

DR. FANKHAUSER'S elementary text-book on forestry is used in Switzerland for the instruction of agricultural students and working foresters; that it has great merits is evidenced by its appearance in five German and three French editions. The work is remarkable for its clear style, excellent illustrations, and admirable choice of subject-matter. The introduction, concerned with the utility of forests, explains their importance in creating industries, in regulating water supply, in preventing erosion of the soil, etc., in a country like Switzerland, where there is so much of what the author calls "absolute forest soil," or land that cannot be put under any other form of cultivation. The forests of Switzerland cover, in fact, 2,300,000 acres, about 23 per cent. of the total area of the country, and are credited with a production of about 42 cubic feet of timber per acre annually.

The first part of the book—forest botany—after some elementary notes on morphology and physiology, deals separately with each forest tree, giving its botanical characters, distribution, reproduction, growth, sylvicultural features, enemies, diseases, wood, and other products. Only one foreign conifer is included, *Pinus strobus*, and it is evident that exotic trees, like Douglas fir, Sitka spruce, and Japanese larch, so much favoured in England for planting at present, are not valued in Switzerland as yet. The next part of the book, concerned with the art of sylviculture, is an excellent summary of the different kinds of forests and how they are created, maintained, and cared for. Much attention is paid to practical subjects, like choice, collection, testing, and sowing of seeds of forest trees, nursery treatment, artificial plantations, natural regeneration, and thinnings.

Other chapters deal with utilisation, a subject which includes felling and transport of timber, and the properties and uses of wood, and with the protection of forests from wind, frost, fire, drought, insects, fungi etc. The conclusion of the work is devoted to the simple engineering and building problems that are handled daily by foresters in Switzerland.

*The Principles of Immunology.* By Prof. H. T. Karsner and Dr. E. E. Ecker. Pp. xvii+309 +2 plates. (London: J. B. Lippincott Company, 1921.) 21s. net.

THE researches of Pasteur on immunisation against fowl cholera, swine erysipelas, anthrax, and rabies, and the discovery by Behring and Kitasato of the antitoxic properties of the blood serum, constituted the beginnings of the science of immunology, which since 1890 has grown to incredible dimensions and in every direction has insinuated itself into the domains of practical

diagnosis and therapeutics. It is no longer within the capacity of one or even two individuals to deal authoritatively with the subject, although this was attempted, and with a fair measure of success, a year or two ago by such a master as Jules Bordet. Naturally many text-books exist on immunity, and the present work of Karsner and Ecker must be ranked as one of the more successful among these. The authors have handled a goodly part of the periodical literature, and have applied to their reading and study a critical acumen which is conspicuous by its absence in most books of this class. Their knowledge is of a most modern kind, and they have thrown over allegiance to the Ehrlich "side chain" hypothesis which dominated immunology for so many years. Naturally in a work of its size Karsner and Ecker's book is highly condensed, and is, in fact, restricted to fundamental principles. They state that it is primarily designed for medical students and busy practitioners. As a text-book for students working for the higher examinations it can be cordially recommended, and it may possibly be read with profit by the more intellectual types of practitioners who have previously prepared themselves for the intricacies of the subject by the perusal of some more elementary work on the subject.

We notice a number of misprints, especially in the names of several of the authorities cited, and it may be said that some of the few illustrations are crude. Otherwise it may be recommended as an accurate guide to those who wish to study the subject with profit in the periodical literature of the day.

W. B.

*When Buffalo Ran.* By G. B. Grinnell. Pp. 114 +8 plates. (New Haven: Yale University Press; London: Humphrey Milford, Oxford University Press, 1920.) 10s. 6d. net.

THE supposed autobiography of a Red Indian boy of some seventy years ago, when the veteran author was himself a small boy. The tribe is not mentioned, doubtless with intention; but Mr. Grinnell probably had in his mind the Cheyenne, which he knows so well. Anyhow, the book is not for ethnologists, but for boys, and the one on whom we have tried it pronounces it "topping." Written in the simplest English, without affectation, the story brings out all the noblest features of the tribal life that has passed away. There is abundance of sympathy, but no sentimentality.

*High Tension Switchgear.* By H. E. Poole. (Pitman's Technical Primers.) Pp. ix+118. (London: Sir Isaac Pitman and Sons, Ltd., 1921.) 2s. 6d. net.

In this brief introduction to a large subject, the author contents himself with a summary of the principal features of present practice in the design of oil-break switches for the voltages in common use in this country. A few notes on isolating links, surge arresters, high-tension fuses, and testing pressures have also been inserted.



### Letters to the Editor.

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

#### Atmospheric Refraction.

THE correspondence on terrestrial refraction from Mr. Mallock and Dr. de Graaff Hunter in NATURE of June 9, p. 456, and August 11, p. 745, raises a paradox which I think must have puzzled many readers of NATURE besides myself. Mr. Mallock is, of course, quite correct in stating that the diminution of density of the air observable under ordinary conditions is practically linear for moderate increases of height above the earth's surface, and that, consequently, the refractive index of the air may for moderate increases of altitude be taken as diminishing linearly at such a rate that it would reach vacuum value at the height  $H$  of the homogeneous atmosphere. Dr. Hunter is equally correct in pointing out that Mr. Mallock's reasoning, based on the above-mentioned observational fact, leads to a value of  $k$ , the coefficient of terrestrial refraction, which is almost exactly twice as great as that found by observation under ordinary conditions. Dr. Hunter does not, however, point out what I think is the real fallacy in Mr. Mallock's argument.

The difficulty is not to be got over by any consideration of temperature-gradient in the air, although it is well known that variations in the temperature-gradient constitute the chief cause of variations in terrestrial refraction. The only way in which temperature-gradient could affect Mr. Mallock's result would be by its requiring a change in the value (4.32 sea-miles) which he adopts for the height  $H$  of the homogeneous atmosphere. Whether we calculate  $H$  for air at a uniform temperature, as is usually done, or on the assumption of a diminution of temperature with increase of height at the rate ordinarily observable (say  $1^\circ \text{C.}$  for each 200 metres), we obtain a value of  $H$  which is nearly the same as that used by Mr. Mallock in his argument.

May I suggest that the solution of the riddle is to be found in Mr. Mallock's supposition of a "plane vertical wave-surface starting from P," whereas the rays of light from a terrestrial point must give rise to an approximately spherical wave-surface? In the diagram (Fig. 1), which represents a vertical section through the homogeneous atmosphere with the curvature of the earth neglected for simplicity, a plane wave-surface HPO would change its position to BAC in the time  $t$ , where HB and OC are proportional to the velocities of light at H and O. But in that time rays from a point P would reach points D and E, such that  $PD - PA = \frac{1}{2}(PB - PA)$  and  $PA - PE = \frac{1}{2}(PA - PC)$ , because the average velocity along PD would be the mean of the velocities at P and H, and, similarly, the average velocity along PC would be the mean of the velocities at P and O. It is easy to see that this gives a radius of refractive curvature exactly twice as great as that found by Mr. Mallock, and consequently leads to a value for the coefficient of terrestrial refraction which is in agreement with observation and with the tables ordinarily employed by navigators for the dip and distance of the sea horizon.

It may be worth while to mention here a very likely source of confusion in comparing the values of the coefficient of terrestrial refraction  $k$  found by different observers under different conditions, and especially by observers in different countries. There are two definitions of  $k$  in use by surveyors, one of

which makes its numerical value double that given by the other. An assistant of mine who read Dr. Hunter's letter was greatly surprised at his statement that  $k=0.133$  "is not a value ordinarily met with in practice," because in Egypt we ordinarily use  $k=0.13$ , and our trigonometric levels derived from observations made in the afternoon hours when refraction is at its minimum and steadiest value are found to agree surprisingly well over great distances with those found by spirit-levelling. The explanation of the apparent discrepancy between Dr. Hunter's statement and our experience is that we follow the Continental practice in defining  $k$  as the ratio of the curvature of the refracted ray to the curvature of the earth, while Dr. Hunter and most English writers define it as half this quantity.

It does not seem to be very generally known that a rational formula for calculating the coefficient of terrestrial refraction at any point where the barometric pressure, air-temperature, and temperature-gradient are known was advanced by Jordan so long ago as 1876. This formula, which is given, together with an account of the theory on which it rests, in Jordan's "Handbuch der Vermessungskunde," Band 2, is

$$k = 0.2325 \frac{B}{760(1+\epsilon t)^2} (1 - 29.35n),$$

where  $k$  is the coefficient of terrestrial refraction, defined as being the ratio of the curvature of the ray

to that of the earth,  $B$  the barometric pressure in mm.,  $\epsilon$  the coefficient of expansion of air at constant pressure,  $t$  the air-temperature in degrees C., and  $n$  the temperature-gradient in degrees C. per metre of height.

Jordan's theory is probably not quite complete, in that it omits any consideration of variations in the humidity of the air; but it does take account of variations of pressure, temperature, and temperature-gradient, and these are probably the principal factors affecting the value of  $k$ . The resulting formula is

very simple and easy of application, and, so far as I have been able to test it in the Egyptian deserts, I have found it to give results which are in good agreement with those of observation. It appears also to accord very satisfactorily with Indian experience; for when applied in the two examples given by Dr. Hunter in his letter, one at sea-level and the other at an altitude of 19,000 ft., it yields (allowing for the difference in the definition of  $k$ ) results identical with those which were found by Dr. Hunter to agree well with numerous observations.

JOHN BALL.

Survey of Egypt, Cairo, December 14.

IN NATURE of June 9, p. 456, a letter appeared from Mr. A. Mallock giving a proof that the path of a nearly horizontal ray through the earth's atmosphere is a circle of about 14,900 miles' radius, and later (August 11, p. 745) Dr. de Graaff Hunter, of the Indian Survey, wrote controverting Mr. Mallock's statement, and asserting in effect that the radius of

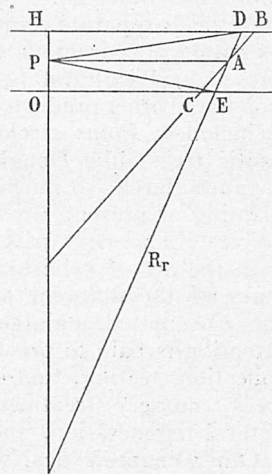


FIG. 1.

the ray as deduced from measured values of the coefficient of refraction is distinctly higher, being about six and a half times the earth's radius, or about 26,000 miles.

Both letters contain an inadequate presentation of the facts of atmospheric refraction in that they assume that the path of the ray is circular. A very much fuller investigation is necessary in order to account for the distance of the visible horizon or its depression below the true horizontal.

Starting with the assumption that the atmosphere is in static equilibrium, leading to the differential equation  $dp = -g\rho dh$ , and with the pressure-density-temperature law  $p = C\rho T$ , a further assumption must be made before a complete solution can be arrived at giving pressure, density, and temperature in terms of height. A simple assumption to make is that of a uniform temperature-gradient expressed as  $T/T_0 = 1 - \alpha h$ . For the isothermal conditions  $\alpha = 0$ ; for the adiabatic,  $\alpha$  corresponds to a drop of  $1^\circ \text{C.}$  per 330 ft. increase in height. The integration of the general equation leads, provided  $h$  does not exceed 200 or 300 ft., to  $p = p_0 - g\rho_0 h$  and  $\rho/\rho_0 = 1 - (g\rho_0/p_0 - \alpha)h$ . Since by Dale and Gladstone's law  $\rho$  is proportional to  $n - 1$ , we obtain without difficulty

$$n = n_0 - 0.00029(g\rho_0/p_0 - \alpha)h.$$

Further, it is not difficult to show that with a ray that is nearly horizontal the radius of curvature  $\sigma$  is given by the approximate equation

$$1/\sigma = 0.00029(g\rho_0/p_0 - \alpha).$$

This equation will give any value we like for  $\sigma$  provided we assume a suitable temperature-gradient. If we put  $\alpha = 0$  (the isothermal state) we get substantially Mr. Mallock's figure. If we take the adiabatic gradient the radius is about 20,000 miles. If we take a fall of temperature of  $1^\circ \text{C.}$  per 200 ft., Dr. de Graaff Hunter's value results. A gradient of  $1^\circ \text{C.}$  per 100 ft. gives a flat ray and an atmosphere of uniform density. To obtain greater curvatures than Mr. Mallock's figure the temperature-gradient must be reversed.

It is no use to take this formula and expect it to be uniform over even very narrow levels when close to the surface of the sea. The temperature-gradients in the first 30 ft. (the average height of the bridge of a ship above the sea) are very frequently greater than any of the gradients mentioned above, and show wide variations in that space. In such case the path of a ray from a visible object more than a mile away is nothing like circular, but may have variations in its curvature of 300 or 400 per cent. I am aware that the value of the coefficient of refraction mentioned by Dr. de Graaff Hunter is used in books of nautical tables in computing the dip and distance of the sea horizon, but I am aware also that actual measurements of the dip at sea show that tabulated values are frequently in error, sometimes even of the wrong sign! Measurements made by Blish off the coast of California showed that a zero dip is quite possible. In the Red Sea the sea horizon is often refracted above the true horizontal.

Consider the path of the ray of light from the horizon to the observer's eye when the dip is zero. The path touches the earth's surface at the horizon and touches a concentric sphere of perhaps 30 ft. greater radius at a point only six or eight miles away. The radius of curvature of the ray must be greater than the earth's radius at the horizon and smaller at the observer—a maximum at the first point and a minimum at the second. Neither Mr. Mallock's figures nor Dr. de Graaff Hunter's can deal even approximately with a ray-path of this nature, and I

think it may be asserted without question that to take adequate account of the path of rays of light through the lower levels of the atmosphere demands consideration, not only of the curvature of the ray-path, but also of the first and second differentials of the curvature.

THOS. Y. BAKER.

Admiralty Research Laboratory, Teddington,  
Middlesex, December 22.

### The Message of Science.

Two great questions are raised in the abridgment given in NATURE of December 22 of the notable address delivered by Sir Richard Gregory during the Edinburgh meeting of the British Association. They are:—(1) How can an interest in, and respect for, science in all its branches, with their essential unity, be developed locally? (2) How can the work of the British Association be so broadened and improved as to ensure that it will yield—to use the words of Sir Richard Gregory—"a statement of ideals and of service, of the strength of knowledge and of responsibility for its use"?

Local scientific societies consist of three types:—

- (1) Sectional bodies interested in general engineering problems or in the technical details of certain sciences applied to the chief industries of the district.
- (2) Natural history societies or field clubs.
- (3) Literary and philosophical societies which provide in a few large towns a good library and series of winter lectures.

With regard to the first type little need be said. They fulfil their specialised functions fairly well, but their work would be greatly improved, and made gradually more attractive, if it were possible to secure an outlook on the broad field of science. Sir Richard Gregory said in the course of his address in Edinburgh: "Whatever Labour may declare officially, it is scarcely too much to say that artisans in general show less active interest in scientific knowledge now than they did fifty years ago." This statement is true, not of artisans only, but of all classes. The demand has been made on science: "Make us rich and comfortable." Science, in a large measure, has responded. But with wealth and comfort has come a lessening of respect for knowledge. The highest things that science can give—an ardour for truth, the power to rise above sordid interests, the desire to become co-workers in an infinite process by which soul is drawn from matter—have been set aside, and we have been landed in a back-wash.

I do not think any revolutionary changes are necessary locally in order to bring back the enthusiasm which linked science a generation ago to human liberty and human justice. Sir Richard Gregory speaks of a federation of local societies "to proclaim the message of knowledge from the housetops." It may be necessary, first of all, for these societies to find out what the real message of knowledge is, but they need not wait for perfect vision; much can be done while they are only groping.

What is wanted, above all things, is such an infusion of earnestness as will arrest the displacing power of the mere lantern lecture. The lantern has been a good servant, but it is threatening to become a bad master. At present the great trouble of the secretary of a literary and philosophical society is to make his organisation pay its way. The chief thing for which the organisation stands is often sacrificed in the attempt to secure popular support. This attitude must be abandoned even if abandonment leads into the wilderness. The message of science will come back from there with renewed constraining power. There are thousands waiting for the message. What



stands in their way is the lack of faith and of courage on the part of the present directing agencies. Probably the most practical suggestion of immediate value that has been made is that the various scientific societies in any town should arrange meetings for study and discussion—the discussion which seeks agreements and does not emphasise differences—and that the underlying, but not obtrusive, object of the meetings should be the progressive connecting of science with individual and corporate conduct.

The second question has many factors in common with the first. The British Association has suffered from the mental reaction which set in a quarter of a century ago. It is a much smaller factor in the thought and life of the age than it was a generation ago. I think the first helpful change desirable is the recognition of a new principle in the selection of a president and in the making of his annual address. Above all things, the president should stand for the unifying of the sciences, and his address should make some definite contribution to that unity, even when it is built largely on the recent achievements of one section of knowledge.

It is only through a conception, becoming ever clearer, of this unity that science can become the "chief formative factor of modern life." The yearly appeal of a president may do much, but more would be achieved if a day were set apart for the study or discussion of the thoughts and facts he has communicated—a study or discussion, I say again, which should emphasise agreements and not differences.

Progress in this direction might receive a healthy impetus from the universities. They, too, have lost a considerable amount of influence. They are not, at home or abroad, leading humanity. The note of real universality is departing from them. Here again the first practical improvement will come from the manifestation of greater care in the selection of the principals of the attached colleges. They ought to be something more than skilled administrators. They, too, have a great unifying function.

This unifying work might be facilitated if there were periodical meetings of the various professors and lecturers for the study of unifying problems. That does not, I admit, promise to help them immediately to overcome the financial difficulties which are now laming them to a terrible extent and driving them to seek greater support from an overburdened State. But if the universities, encouraged by a steadily increasing enthusiasm for science locally and centrally, were themselves to become again great inspirers of thought, they would soon cease to be troubled by the lack of pence.

W. ROBERTSON.

Middlesbrough, December 29.

### Cohesion.

THE theory of cohesion put forward by Dr. Herbert Chatley in NATURE of August 18 is logically based on those of other investigators, and, consequently, does not involve any new element. In all these theories cohesion is made to depend on centrally directed forces which follow either the inverse square law of gravitation or electrical attraction, or that of some other inverse power higher than the second. Dr. Chatley says: "It is difficult to conceive of one force having all these properties, but perfectly simple to imagine an attraction and repulsion combined that will do so, provided that the attraction decreases more slowly with separation than the repulsion." He takes the ground that the force of cohesion as stated by him is related to those following the inverse square law, and that the question of the relation between them is of great importance.

Now it is a matter of common observation that two

free liquid spheres on coming into contact with each other always coalesce. The force which causes this is evidently a force *enveloping* their masses, and not a force attracting them. This enveloping property of surface tension was noticed by Maxwell and others; but the theory which makes it depend on molecular attraction renders it impossible to conceive of such a force as enveloping *molecular* masses.

The present writer has adduced (*Phil. Mag.*, June, 1921) very strong, if not conclusive, evidence that the same force which causes liquid spheres to coalesce also causes the free molecules of a gas to coalesce or cohere. It cannot, therefore, be explained by molecular attraction. The alternative is that *it is an elemental force acting, not in lines, but over areas*. As such it is a universal property of the surface of both liquid and solid mass extending to molecular dimensions.

Fortunately, however, there is very definite and easily verifiable evidence that cohesion, and adhesion also, is due to a surface force, whatever its nature may be, as can be seen from the following simple experiments which will be published later in fuller detail.

Spheres of mercury, ranging from 0.05 mm. to 1.5 mm. in diameter, were hung from a drop of water wetting a glass surface above. Each one fitted into an inverted hemispherical cavity in the water, with a well-defined angle in the contact circle where the water surface joined the mercury surface. With a specially adapted microscope the diameter of the sphere, the width of the contact circle, and the angle between its water arm and the vertical were measured. From these measurements, *W*, the weight of the mercury sphere, and *T*, the vertical component of the pull of the water surface on the mercury, were calculated for a large number of spheres. The results showed that for small spheres *T* greatly exceeded *W*, but tended to become equal to *W* when the spheres were at the point of falling off. The ratio *T/W* decreased gradually from about 6 to 1, thus showing that the surface force of the water pulling on the mercury in the periphery of the contact area was more than sufficient, except in the limit, to support the weight.

Similarly, mercury spheres, with diameters from 0.05 mm. to 2.25 mm., were suspended from a horizontal glass surface. They were attached to the glass either directly or by suspending them from water as before and allowing the water to evaporate. The mercury surface was joined to the glass surface in the periphery of a wide circular contact area, and formed a definite angle with the glass surface. Measurements were made as before, and *W* and *T* (for mercury) were calculated. The results showed that, as the spheres increased throughout the range, the ratio of *T/W* decreased from the surprisingly large number of more than 6000 to about 2. Had *T*, however, been calculated from  $\sigma=270$  instead of  $\sigma=547$ , the decrease would have been from about 3000 to 1 as before, and hence 270 may be regarded as an approximate value of the surface tension of glass. The increasing values of *T/W* for the smaller particles would account for the persistence with which molecules of a gas condense on a glass surface.

Further, small particles of any insoluble solid become attached to any surface above by the evaporation of a connecting water drop; or, if the particles be clean and small, they become attached to any clean surface by simple contact with it. This is amply confirmed by extended observations.

Now there is no reason to think that the force of cohesion is not of the same nature in the case of two solids as it is in the cases of a liquid and a solid and

of two liquids. Moreover, as it has been shown that two free molecules of a gas cohere (coalesce) from this same cause, it is justifiable to conclude that in all cases down to molecular dimensions cohesion is simply a *surface force pulling in the periphery of the contact area perpendicularly to that area*. It may be remarked also that these results furnish no evidence of the so-called molecular attraction.

By calculation this force binding two molecules of water together is  $2.05 \times 10^{-5}$  dynes; of mercury,  $7.7 \times 10^{-5}$  dynes. These agree with Dr. Chatley's statement that (molecular) cohesion is of the order of  $10^{-6}$  dynes. Again, in the case of two molecules cohering in this manner the enveloping force can have a range not greater than two molecular diameters, while for larger molecular masses the range may be as great as three or four molecular diameters. It thus fulfils the condition for the range of action. In comparison with their gravitational attraction this force binding two water molecules together is of the order  $10^{22}$  times as great. It is of the same order as the electrical attraction of two oppositely ionised molecules just before they come into contact. It causes a pressure on the interior molecular mass of the same order as the intrinsic pressure of the liquid. It does appear, then, that one force can be conceived as having all the properties of cohesion.

The conception of this force as a cause of molecular phenomena appears to be, in fact, fundamental. It solves the problem of surface tension; it explains, as we have seen, both cohesion and adhesion, and it accounts satisfactorily (*Phil. Mag., ibid.*) for the latent heat of condensation. But besides all this there is the remarkable coincidence that the force itself is located, or performs its function, in the precise area bounding free mass that the phenomena of reflection and refraction of light take place and electrons have their movement. These considerations give point to Dr. Chatley's concluding words: "It would appear that a complete solution of the macroscopic properties of matter would also solve the question of the inner structure of the molecules and atoms."

WILSON TAYLOR.

Physics Laboratory, University of Toronto,  
Canada, November 15.

### The Resonance Hypothesis of Audition.

ADDITIONAL evidence in favour of the resonance hypothesis of audition has been found recently.

The study of long-distance telephony has shown that low-pitched notes travel more rapidly than do those of high pitch, owing to the impedance of the electrical circuits. Mixed tones must, therefore, arrive with phase relationships between the high and low tones quite different from those with which they started.

In spite of this, even such complex sounds as those composing human speech are found to suffer but small apparent change in quality and distinctness during transmission. And this statement appears to apply equally to wireless telephony, where similar changes of phase must occur.

These facts suggest that the ear responds to tones quite independently of their relative phases, and therefore that true harmonic analysis must take place in the organ of Corti. A survey of the different types of harmonic analysers used in physics, for tide production and the like, shows that such harmonic analysis is invariably performed by a series of some type of resonator. Presumably, therefore, since the ear can carry out harmonic analysis, it also must contain resonators.

To test the premises more thoroughly the following experiment was carried out:—

Two electrically driven tuning-forks, emitting pure tones, were connected to separate battery and switch circuits, and were mounted on separate tables, so that while they vibrated independently their tones entered the ear of the observer simultaneously. They were tuned so that their tones had rates of vibration in the ratio of 1 and 3, this ratio being chosen because of all pairs of tones these give the largest changes in the form of the sound wave-curve as the relative phases of the tones are changed. Thus with one phase relationship the sound wave-curve has a single sharp, well-marked peak, whereas with another phase relationship two peaks are found, having a trough between them. If, then, the ear is affected at all by the form of the sound wave-curve, these two tones, combined in different relative phases, should show it. The experiment was performed by causing the higher-toned fork to sound continuously, the lower-toned one being turned on and off at irregular intervals, so that the relative phases should be chance ones. No difference whatever in the quality of the sound could, however, be detected by the observer. The response of the ear appeared to be quite independent of the relative phases of the tones, and, therefore, we must conclude that the ear effects a true harmonic analysis by means of resonators.

If the above experiment is repeated with two sources of tones that are not free from overtones it is found that the ear does readily detect differences in the quality of the sound as the relative phases of the tones are altered. For example, if Helmholtz's syren is used with, say, 18 holes operating in the lower wind chest, and 6 holes in the upper, then there are found to be 18 regularly spaced positions where the lower tone predominates, and 18 intermediate positions in which the upper tone predominates.

These effects are produced by the summation and interference between the upper tone and the second harmonic overtone of the lower tone. When holes of both wind chests are exposed simultaneously, summation occurs, and the upper tone predominates, whereas when the holes of one chest alternate with those of the other, interference occurs which weakens the upper tone, so that the lower tone predominates.

Many years ago there was considerable controversy as to whether the ear could, or could not, detect difference of phase. The above experiments suggest that pure tone free from harmonics may have been used by one school, and impure tones containing harmonics by the other, because in this way their difference in opinion could be readily explained.

C. R. G. COSENS.  
H. HARTRIDGE.

King's College, Cambridge.

### The Action of Sunlight.

IN NATURE of December 15 Sir Oliver Lodge is good enough to refer me to some experiments on the anti-septic action of sunlight which he carried out long ago in association with the late Prof. Marshall Ward. I have not yet been able to see the memoir to which Sir Oliver Lodge refers, but I believe that I am already well acquainted with it, and have been able to quote its essential findings on many occasions in connection with the demand for the abolition of the coal-smoke curse—thanks to an admirable account of Marshall Ward's methods and results, referred to the year 1892, in Sir James Crichton-Browne's "Light and Sanitation," an address delivered in Manchester in 1902 (Sherratt and Hughes, 27 St. Ann Street, Manchester). Particularly I value the last paragraph, in which Sir Oliver Lodge praises the anti-



septic and innocent quality of the sunlight just as we get it after filtration by the "unpolluted atmosphere."

But after seeing the clinical action of sunlight at Leysin under Dr. Rollier and at the Treloar Hospital under Sir Henry Gauvain, and reading the papers of Sonne (*Acta Medica Scandinavica*, vol. 54, fasc. 4, "The Mode of Action of the Universal Light Bath," from the Laboratory of the Finsen Medical Light Institute, Copenhagen) mentioned in my previous letter, I am absolutely certain, as anyone else would be, that there is more in the curative action of sunlight than its bactericidal effect. In a recent lecture before the Physiological Society of University College, entitled "The Physiology and Therapeutics of Sunlight: Facts and Questions," I cited instances and showed photographs of many cases where the value of sunlight could not have depended upon its antiseptic power. Sonne's view is that sunlight warms the blood without appreciably raising the general body-temperature, that this produces the valuable, without the injurious, effects of fever, and that this action is obtainable by the proper use of sunlight, and by that alone.

The practical importance of this fascinating physiological problem is apparent to me after recent visits to certain sanatoria, otherwise admirable, where I have been told that I should see the sunlight employed, and have found, for instance, that open air and diffused daylight, the latter reaching the face and possibly the hands, were regarded as the equivalent of Rollier's treatment; or that the children were scrupulously put under awnings or sent to school in an adjacent wood whenever the sun shone. The pitiful statistics of these places, compared with those of Rollier and Gauvain, point the moral.

Since first drafting this letter I have seen, thanks to Prof. Leonard Hill, new records of work done by Prof. A. F. Hess in New York, showing the cure of experimental rickets in animals fed and continuing to be fed on a diet which invariably produces rickets—when they were placed in sunlight for a few hours daily. No mere antiseptic action is here in question.

With rare exceptions, we do not yet know what heliotherapy consists of in this country; no one yet knows its action, nor even the pure physiology of sunlight. Meanwhile, we are carefully depriving many patients of their one chance of life, and quacks and others are using all manner of artificial lights in therapeutics as if they were equivalent to, or better than, the sunlight, which, according to Sonne's experiments—nicely consorting from another point of view with those of Sir Oliver Lodge—is incomparable.

The Smoke Abatement Committee has now published its admirable Final Report, and reiterates now my plea for an inquiry such as Carrel, I am told, is about to undertake at the Rockefeller Institute in New York, but which no one, not even Prof. Leonard Hill, our great student of the air and temperature relations of the body, is yet making here into the action of sunlight. I believe that the restoration of sunlight to our urban populations, mostly darkened in slums and smoke, is the next great task of hygiene in this country.

C. W. SALEEBY.

Royal Institution, January 2.

#### Units in Aeronautics.

A LARGE number of equations in aerodynamics appear in the form  $R = k\rho SV^2$ , where  $R$ ,  $\rho$ ,  $S$ ,  $V$  are the reaction, density of the atmosphere, surface, and relative wind velocity.

Since both  $R$  and  $\rho SV^2$  have the dimensions of force,  $k$  is clearly a numerical coefficient unchanged

by transformation from one self-consistent system of dynamical units to another, e.g. from foot, pound, second, poundal to centimetre, gram, second, dyne.

In transforming to an inconsistent system,  $k$  will in general be altered, but the inconsistencies may cancel each other in particular cases so far as to leave  $k$  unaltered. For example, if a gravitational unit of force is introduced  $g$  times the consistent unit, then we may write  $R = k\rho SV^2/g$  pounds *weight* in the British system, or grams *weight* in the c.g.s. system. And while the numerical values of both  $R$  and  $g$  vary inversely as each other, the value of  $k$  is not affected if the system is otherwise consistent.

Prof. Bairstow ("Applied Aerodynamics," p. 119) maintains that the gravitational unit of force is the natural one, and to get rid of the local value of  $g$  that mars the consistency of his dynamical equations he introduces a new unit of *mass*, the "slug" of (local)  $g$  pounds mass, the use of which he restricts to the measurement of atmospheric density. Then putting  $\rho' = \rho/g$  he can write  $R = k\rho' SV^2$  in the same form externally as before, and read off the value of  $R$  in pounds weight instead of in poundals, all without showing  $g$  explicitly.

In this way, in his opinion, "it appears that the divergence of language (*sic*) between science and engineering would disappear."

But if we apply this method of measuring the density of the atmosphere to the estimation of the lift of an aerostat we get, putting  $m$  = density of hydrogen/density of air,  $(1-m)\rho' \times \text{volume} = R$  slugs *weight* ( $=gR$  pounds *weight*  $=g^2R$  poundals!).

Altogether it seems more satisfactory to teach engineers the physical meaning of Newton's laws of motion than to invent units which evade them, just as it has proved better to teach them the elementary notation of the infinitesimal calculus than to devise "calculus-dodging" demonstrations. A. R. LOW.

London, December 8.

#### Self-fertilisation in Mollusca.

As the question of self-fertilisation in the more highly organised invertebrates is of considerable importance from the genetic point of view, I would like to direct the attention of readers of *NATURE* to a publication (*Acta Soc. pro Fauna et Flora Fennica*, vol. 40, No. 2, 1915), a copy of which I have just received from the author, Dr. A. Luther. It constitutes an important addition to the evidence for the occurrence of self-fertilisation in mollusca, as Dr. Luther states that he succeeded in rearing two generations by self-fertilisation in *Agriolimax agrestis*. I have recently pointed out (*Proc. Malac. Soc.*, vol. 14, 1921) the value of Künkel's work on *Arion* in this respect; but at the time Dr. Luther's results were not known to me, as the publication was not available and had not figured in the "Zoological Record." Should these important observations be finally confirmed and the technique improved so as to produce more than two generations, a very valuable contribution to genetic study will be achieved. Dr. Luther's work, however, emphasises the necessity for conducting a study of environmental conditions in order to secure improved viability.

I may point out, perhaps, that though quite a number of cases of self-fertilisation have been recorded in Pulmonata by Lang, Holzfuss, and others, the subject is by no means fully explored either with regard to the distribution of the phenomenon among Pulmonata or the circumstances in which it occurs.

G. C. ROBSON.

British Museum (Natural History),

Cromwell Road, London, S.W.7, December 23.

## The Law of the Heart.<sup>1</sup>

By PROF. E. H. STARLING, C.M.G., F.R.S.

THE discovery by Harvey of the circulation of the blood, and of the part played by the heart in carrying on this circulation, is one of the few scientific discoveries which have become common knowledge. We have to think of the body as a collection of mechanisms or machines, each one of which is doing some form of work for one common end—*i.e.* the preservation of the body. For this work the oxidation of the food taken in at intervals during the day provides the energy; thus each part of the body must be supplied not only with food derived from the alimentary canal, but also with the oxygen taken in with the air we breathe into the lungs. Like any other machine, each body mechanism produces, as a result of this consumption of the food, waste gases and other waste products which have to be carried to the lungs or to the kidneys and there cleared out of the body. It is for this reason that the existence of the higher animal demands a common fluid, the blood, which can carry food, oxygen or carbonic acid, and is maintained in continual circulation between all the organs of the body, so that the alimentary canal, for instance, may serve for the maintenance of all parts, and the lungs can supply oxygen to these parts or excrete the carbonic acid which is produced as a result of their activity.

But a uniform mechanical circulation would be of little value to the body, since the activities of all its parts vary within wide limits. Thus, during muscular exercise the activity of the muscles may be increased tenfold or more, and this increase means a corresponding augmentation in their call for oxygen and in the quantity of waste products, especially carbonic acid, that they produce. Since the oxygen is carried by the blood, it follows that for the continued functioning of the muscles these must receive a blood supply which is ten times greater during activity than during rest if their activity is not to be brought to an end by a species of suffocation. Therefore, in any violent exercise involving the greater number of the muscles of the body, the circulation must be increased in force seven to ten times, and the heart, which is the pump maintaining the circulation, must under these conditions do from seven to ten times as much work as during rest.

### *The Mechanism of Adaptation.*

What is the mechanism of these adaptations? How is it that the heart is able to carry on a circulation which may vary from a passage of 3 litres of blood per minute up to 30 litres of blood per minute (these figures representing the extreme limits between which the output of the heart-pump may vary according to the condition of the body)? It might be thought that we are dealing here simply with the influence of the central nervous system,

which adapts the activity of the muscles of the body to the requirements of the environment, and that the heart being a muscle would be stimulated to contract more strongly at the same time as the nervous system calls into activity the voluntary muscles of the body. There is no doubt that the heart is under the control of the central nervous system, so that its action can be altered, increased, or diminished by the brain in accordance with the needs of the economy, but in the heart we find also a wonderful power of adaptation to the varying requirements of the organism which is quite independent of the central nervous system.

This can be shown quite easily either in the cold-blooded or warm-blooded animal. The heart of the frog and tortoise can be cut out and will continue beating for hours or even days. It has long been known that the heart of the mammal would beat for some minutes after being cut out of the body, but if we take pains to ensure that the muscles constituting the walls of the heart continue to receive their supply of oxygenated blood, the mammalian heart can be made to beat for eight to twelve hours after the death of the animal from which it is taken. In order to investigate this properly we want to make such a preparation that we can control at will all the conditions which may affect the action of the heart—*viz.* the amount of blood flowing into the heart from the big veins, the resistance which the heart has to overcome when it drives the blood out into the arteries, and the temperature at which the heart contracts. We must be able to measure at any time the output of the heart, the arterial pressure it maintains, its changes in volume during contraction, the pressure in all its cavities during contraction, the amount of blood flowing through the blood vessels of its walls, and its chemical exchanges, as measured by the amount of oxygen which it takes up and the amount of carbonic acid which it produces. It is these chemical changes which give the energy for the work of the heart.

### *The Heart-Lung Preparation.*

All these procedures and controls can be carried out in the heart-lung preparation. In this preparation the pulmonary circulation from right ventricle to left auricle is left intact, and by means of artificial respiration the lungs are blown up rhythmically so that the blood in its course may take up oxygen and get rid of carbonic acid. The whole systemic circulation is replaced by rubber tubes. A glass tube is tied into the largest branch of the aorta, all the other branches being tied, so that the blood driven out by the left ventricle can escape only by the glass tube. From the glass tube a rubber tube passes to a thin rubber tube container within a wide glass tube. This thin rubber tube can be compressed to any desired extent by pumping air at a known pressure into the glass tube

<sup>1</sup> Discourse delivered at the Royal Institution on Friday, May 20, 1921.



surrounding it. We can thus vary at pleasure the resistance which has to be overcome by the left ventricle, and, by maintaining a normal pressure in the beginning of the aorta, ensure a proper supply of oxygenated blood through the coronary arteries to the muscular tissue of the ventricles. It is this fact which makes it possible for the warm-blooded heart to continue to beat for eight to twelve hours after removal from the body. On the other side of the artificial resistance the blood is led through a spiral immersed in warm water to keep the blood at body temperature, and then passes into a reservoir from which a wide rubber tube leads to a glass tube placed in the big vein opening into the right auricle. By means of a screw clip on this tube the inflow of blood may be regulated to any desired extent, and can be kept constant while other conditions are varied. Thus in this preparation the three chief factors, temperature, the inflow of blood, and the resistance to the outflow of blood, can be varied separately and at the will of the operator. Any of the heart cavities or any part of the circuit can be connected to manometers so as to record the pressure of the fluid, and by means of a side tube placed just beyond the artificial resistance we can allow the blood to flow off into a graduated cylinder, and thus measure the time taken by the left ventricle to expel 50 or 100 c.c. of blood, thus measuring the average output of the organ.

#### *An Experiment Described.*

A typical experiment may be divided into six stages. Records of one experiment show that in the first stage the heart was beating at a normal rate (72 per minute), the blood pressure varied from 100 mm. Hg, and the output of the heart was 240 c.c. of blood per minute. In the second stage the resistance to the flow of blood through the tubes was increased to such an extent that the pressure rose to 160–180 mm. Hg. The heart continued to beat, and for a time put out just as much blood as it did at the lower pressure. In the third stage the artificial resistance was suddenly reduced to zero, the arterial pressure fell to about 20 mm. Hg, but the heart beat regularly and the outflow of blood was unaltered because the inflow of blood had not been altered. In the fourth stage the inflow of blood was raised suddenly to 600 c.c. per minute. The heart became bigger, but the regularity of its contractions remained unaltered, and it drove forward all the blood that it received.

The same thing happened in the fifth stage, in which the artificial resistance was raised simultaneously with the venous inflow. The reason for these phenomena is that within certain limits the heart isolated from the body can respond to all the demands made upon it; it can overcome a higher resistance, and it can pump out more fluid. In the sixth stage the inflow of blood was further increased to 1200 c.c. per minute, and the artificial resistance was increased until the blood pressure rose to 200 mm. Hg. This was too much for the heart, which began to beat irregularly and dilate widely. It would have failed altogether if the pressure sur-

rounding the thin rubber tube had not then been released to allow the artificial pressure to drop to a level at which the left ventricle could empty itself.

If during this experiment the amount of oxygen taken up by the blood had been measured, and also the amount of carbonic acid given off by this fluid in passing through the lungs, an increase in both these amounts would have been found during the stage at which greater demands were being made on the heart. That is to say, the greater the work done by the heart, the greater the chemical changes to supply energy. A motor-car may be running steadily with an even beat of its engines along a level road; when it comes to a hill it will slow up and finally stop unless the chauffeur increases the chemical changes and the energy of each explosion within the cylinder by opening the throttle and letting in more mixture of petrol and air. In the case of the heart there is no chauffeur, but there is some automatic regulation by which the heart increases its chemical changes, and therefore the energy of each beat, in exact proportion to the work which is demanded of it. It is the nature of this automatic regulation which concerns us now.

#### *The Nature of the Automatic Regulation of the Heart.*

By a careful observation of the changes in the heart in the experiment described above we may arrive at some clue to the nature of the pressure, but more accurate methods are necessary if we are to be certain of the correctness of our guess. We must, under these varying conditions, measure: (1) the pressure in the heart cavities produced at each contraction; (2) the volume of the heart cavities—i.e. the length of the muscle fibres of their walls. The first we measured in the experiment described by connecting the interior of each cavity in turn with a quickly acting manometer, the excursions of which are registered by an optical method so as to avoid the instrumental vibrations of a lever. The curve of pressure obtained under two conditions—i.e. low and high artificial resistance—could then be plotted. It must be remembered that the heart was sending on in each case all the blood that it received, though the work necessary under the high pressure was two or three times as great as that necessary to send on the blood at the low pressure. To measure the volume of the heart the ventricles are enclosed in an instrument known as a cardiometer. This communicates with a piston recorder so that the change of the volume of the ventricles at each beat can be registered on a moving surface.

The question we have to decide is: How does the heart know when it is relaxed that at the next contraction it will have to exert more force than it did previously, when the arterial resistance to be overcome was lower? If we measure the pressure in the ventricles in the manner just described we find that during the period of relaxation of the ventricles the pressure in its cavities is approximately zero, whether the artificial pressure which it has to overcome at its next beat is 50 or 150 mm. Hg. It

is not, therefore, the tension on the walls of the heart which determines the strength of its contraction at its next beat. When, however, we come to measure the volume of the heart, we find that in the isolated heart this is directly proportioned to the work which the heart has to accomplish. Thus we find that the larger the heart—*i.e.* the more it is dilated during diastole—the greater is the pressure that it will get up at the succeeding contraction or systole.

We may put this in another form, as is shown by continuing our experiment over several hours, when we find that the worse the condition of the heart muscle, the more it must dilate in order to get up an adequate pressure. Other things remaining equal, we thus see that the volume of the heart during diastole is a measure of its physiological condition, and we are not surprised that a failing heart means a dilated heart. Of course there is a limit to this power of adaptation. As the heart dilates it is working at an ever-increasing mechanical disadvantage, and a point will finally arrive at which this disadvantage more than counterbalances the physiological effect of dilatation. The heart then dilates widely and fails to empty its contents. Dilatation of the heart means elongation of the muscular fibres composing its walls, so that we may put the law of the heart another way and say that the longer its muscle fibres the greater is the energy developed at each contraction. But in this form this wonderful power of adaptation possessed by the heart becomes part of the general properties of all muscular tissues, since the same rule applies to the fibres composing our voluntary muscles. Can we obtain any more precise and physiological conception of what is involved in this relationship between length of fibre and strength of contraction? Microscopic examination of the fibres, either of the heart or of voluntary muscle, shows that these are composed of innumerable fibrils, so that internally the muscle is made up of structures presenting an enormous extension of longitudinal surfaces. The more the muscle is stretched, the greater will be the extent of these surfaces. A large

amount of evidence, based on the electrical and chemical changes occurring in muscle as a result of excitation, points to the contraction as being essentially a surface phenomenon—a molecular change over the whole of the longitudinal surface which may result in a polarisation or depolarisation of the surface and an increase of surface tension, so that the muscle is a surface tension machine in which there is on excitation a direct conversion of chemical into surface energy. The greater the surface the greater will be the number of molecules involved, so that increased length of muscle must increase at the same time the total chemical changes and the total tension produced by the summation of the surface tension of each fibril.

It is only by such a change of molecular dimensions that we can explain the rapidity of events in a muscle (the insect wing muscle can contract and relax 300 times per second), or the high efficiency of the machine, an efficiency which A. V. Hill has shown may amount to 100 per cent. for each isolated contraction, and over a length of time to 50 per cent. As directly measured in the heart-lung preparation, we find a mechanical efficiency of about 25–30 per cent.

### *Conclusion.*

It is impossible here to enter into the applications of this law of the heart, but so far it has not failed in accounting for the behaviour of this organ under all manner of conditions, either in health or disease. It is important to remember, however, that we are dealing here with the isolated heart. In the natural body the mechanisms which we have studied are fenced round, protected and aided by the complex activity of the central nervous system, which is always acting on the heart, balancing its activity against that of the blood vessels, and co-ordinating it with the events which are occurring in every other part of the body. All these factors must be taken into account when we are endeavouring to form a conception of the total behaviour of this organ under the varying activities of the intact animal.

## A Summer Visit to Jan Mayen Island.

By J. M. WORDIE.

JAN MAYEN ISLAND lies in  $71^{\circ}$  N. latitude,  $8-9^{\circ}$  W. longitude, and is approximately 300 miles north of Iceland, 200 east of Greenland, and 600 west and north-west respectively of Tromsø and Aalesund—the leading hunting ports in Norway. It was possibly discovered in 1607 by Henry Hudson and named “Hudson’s Tutches”; the name, nevertheless, by which it is now known commemorates a Dutch seaman, Jan Jacobsz May, who visited the island in 1614. The evidence for the earlier visit by Hudson can scarcely be regarded as trustworthy. May’s voyage, on the other hand, is well supported

by documentary evidence. Immediately following its discovery, Jan Mayen became frequented almost every year by rival Dutch and British whalers. As a whaling and sealing centre, however, the island was markedly inferior to Spitsbergen. Its importance was, nevertheless, far from small, and the British Government is said to have made a grant of it to the Corporation of Hull in 1618. The number of whalers frequenting the island, however, dropped off very considerably about 1635, the immediate cause being probably a series of bad ice years.



Scoresby was the first to give a scientific account of the island. His narrative was based on a visit in 1817, when he was ashore for a short while and climbed one of the smaller extinct craters. Berna and Vogt in 1861, Mohn in 1877, and Rabot in 1892 also published descriptions. The only expedition last century which remained any length of time on the island, however, was that of the Austrian International Circumpolar Station in 1882-83. During a fourteen months' stay under Wohlgemuth's leadership the party made full magnetic and meteorological records. Their map, which we found very useful and accurate, was the work of von Bobrik. Curiously enough, the natural history was very slightly studied.

station for meteorological purposes either last year or this. A satisfactory arrangement was made, and our expedition secured passages in Engineer Ekerold's two ships *Polarfront* (24 tons) and *Isfuglen* (54 tons). On the Norwegian side the affair was now pushed with greater vigour than ever, and after innumerable difficulties Ekerold finally was able to carry his plans into execution.

At Bergen we were met by Prof. Mercanton, of Lausanne, who had long wished to climb the mountain, and it was arranged that on reaching the island he should transfer from the Norwegian party to ours. We were now strongly represented in the various branches of science. Musters himself undertook botanical collections, Bristowe and Leth-

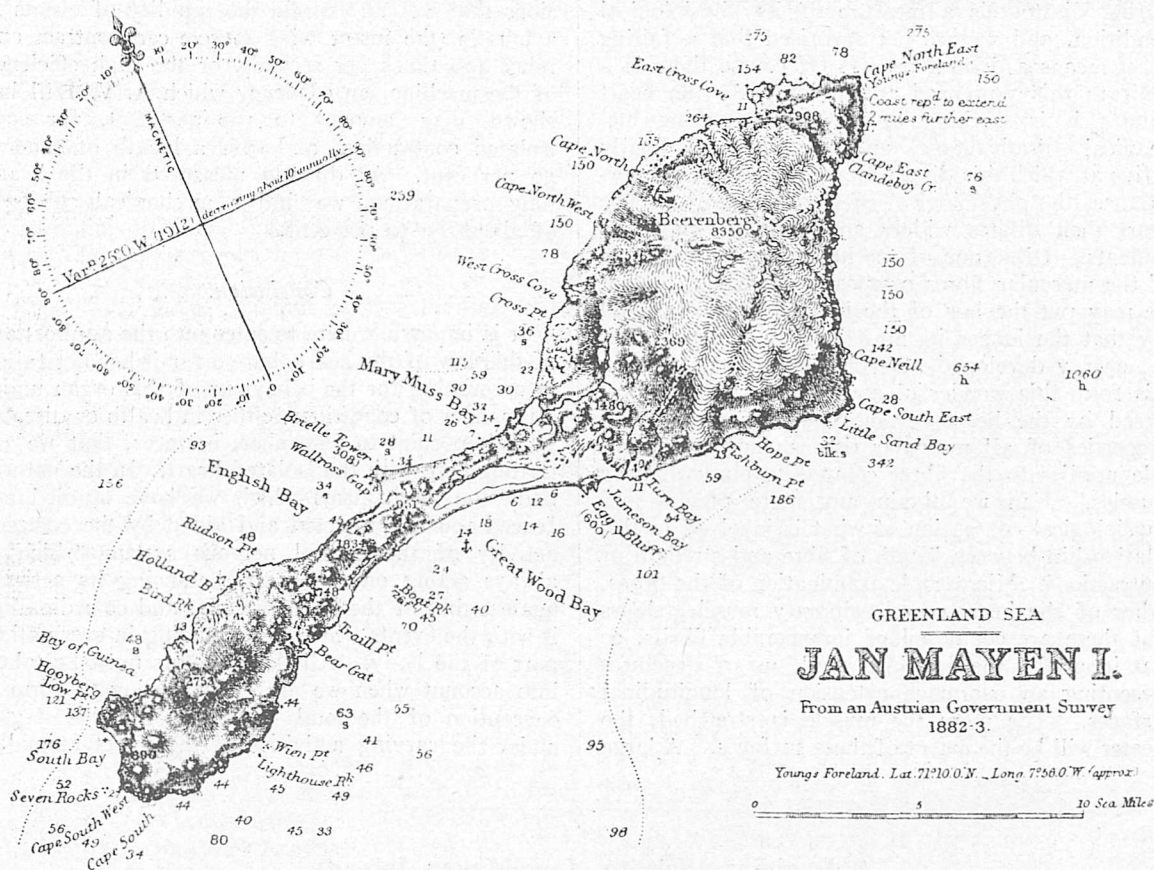


FIG. 1.—Reproduced, by permission of the Hydrographer, from an inset on British Admiralty Chart No. 2751.

Last summer's expedition was originated by J. L. Chaworth-Musters at the beginning of last year; the objects were partly to climb Beerenberg, a mountain more than 8000 ft. high, and often stated to be a still active volcano, partly to complete the Austrian survey of the island by investigating more minutely its geology and natural history. Musters originally intended to charter a hunting sloop from Aalesund. This, however, proved unnecessary through the establishment of friendly relations with a Norwegian engineer, who, under the auspices of the Norwegian Government, was hoping to establish a wireless

bridge the natural history, and Mercanton's knowledge of glaciology and mountaineering made him a valuable recruit. The party of six was completed by Richmond Brown as "campman," and myself as geologist. Four of us were members of Cambridge University.

After a somewhat rough passage the island was reached on August 7. It was much too late to think of studying the nesting habits of the birds. It was almost too late to find the plants still in flower. Musters, therefore, accompanied by Bristowe, at once commenced his collecting. The lateness of the

season also made it advisable immediately to attack the hitherto unclimbed Beerenberg. To make the ascent direct from sea-level seemed hardly practicable, and an advance camp was, therefore, established at 2700 ft. on the highest of the frontal moraines. Unfortunately, Brown was not well enough to go farther, and the size of the party was thus reduced to three. Starting on August 11 about 11 a.m., for there had been some rain during the night, we trudged for some hours up a gently sloping and but little-crevassed ice-slope to a nunatak at a height of 5600 ft. The real climb now began. Mercanton went first, Lethbridge second, with myself as last man. Two thousand feet of interesting snow- and ice-work brought us finally to the bergschrund not far below the ridge, and after a little delay it was safely negotiated. A stiff climb up a steep snow-wall then brought us to the ridge, and we suddenly found ourselves standing on the rim of a great crater. This was an unexpected and exciting development. The crater was about half-a-mile in diameter, and from 500 to 800 ft. deep. At its northern edge one of the later eruptions had burst the rim and formed a gateway of which the highest part of the mountain is now the western pillar. Since that distant period, however, the crater has become filled with ice, and a much-crevassed glacier now breaks away to the north in a series of striking icefalls, finally reaching the sea (so Mercanton afterwards informed me) as the Weyprecht Glacier. To complete the ascent by following a snow-arête to the actual summit was not long of accomplishment, and gave us a further opportunity of appreciating Mercanton's mountaineering skill. That the summit, deep-covered in rime as it is, has solid rock not far below is certain; scoriaceous lava was collected 50 ft. away. Observations on the summit occupied some time, and, fortunately, there were bursts of sunshine sufficient to enable photographs to be taken. It was almost 9 p.m., therefore, before we commenced the return, but a brisk pace was kept up, and a distance which had taken eight hours on the ascent was now covered in three.

Apart from the geological observations, which showed that the Beerenberg eruptions had been exclusively lava, quite the most interesting and perplexing feature is the gentle ice-slope extending from 5600 ft. down to the camp at 2700 ft. Viewed from a distance, it has all the appearance of an "ice-cap"; it reminded one very closely of the Hardanger Jökul, for instance. At the time I was inclined to regard it as a new type of piedmont or as an "ice-cap" caused by higher precipitation at intermediate levels. It may be so, but, on the other hand, since returning I have noticed that a similar gentle slope characterises both Mount Vesuvius and Mount Erebus, and it can, therefore, be explained on other grounds. Aneroid observations were taken at regular intervals during the ascent. These give Beerenberg a height of 8090 ft. The Austrian figure arrived at by theodolite observations was 8350 ft. It is not usual to prefer aneroid to theodolite-determined heights, but as the Austrian

triangle was a very bad one I think there may be some justification in this case for adopting a lower figure than that generally accepted.

Whilst the mountain was being climbed, Musters and Bristowe had been working at lower levels. After hurried preliminary collections round the base camp they transferred their quarters to a small tent eight miles farther down the coast. From this point the southerly parts were within reach. Musters records a most interesting visit to Seven Hollander Bay, interesting not only historically, but also botanically in respect of the more luxuriant vegetation in that quarter. When Musters finally left the island he was able to tabulate forty-three species of flowering plants, of which five had not previously been recorded there; in addition, the lower orders have still to be worked out and his ecological observations put together. The collections have an added interest just now, as they arrived at the Cambridge Botany School simultaneously with collections made last summer by Prof. Seward in West Greenland, and by Mr. Walton in Spitsbergen. Bristowe's insects are taking longer to name; meantime he has discovered that the spiders are forms met with in the Scottish Highlands; of the flies, etc., only one is native to Britain; the rest are not yet identified. Seventy per cent. of his specimens are new records for the island.

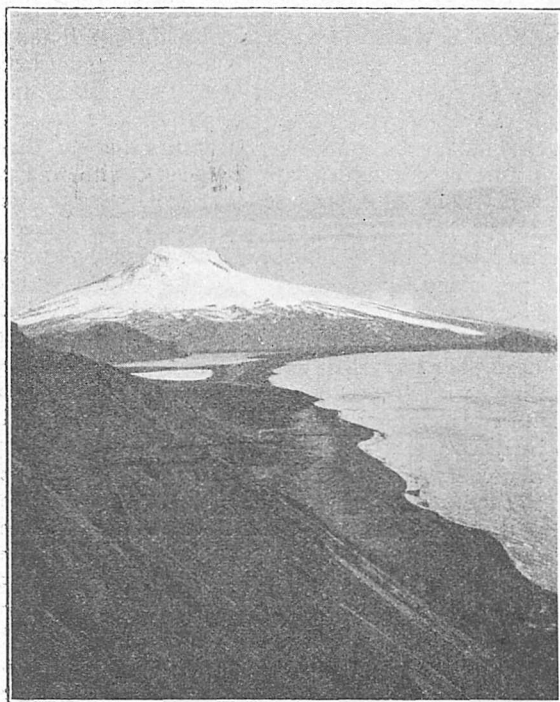
The successful climb on Beerenberg had revealed a good deal about the geology and glaciology. We realised, however, that on that mountain we were dealing with comparatively recent events in the island's history, and the older chapters, if any, had to be discovered. Lethbridge and the present writer in due course relieved Musters and Bristowe at the tent at the south end. From here we ranged over the more distant and inaccessible parts. Apart from the distances which had to be covered, it was arduous travelling both along the coast and on the scree-covered mountain slopes. As the survey was not absolutely exhaustive, additional data may still come to light; meantime the geological record is somewhat as follows: The oldest rocks are coarse and fine augite tuffs; they are generally covered and hidden by later lavas, but are occasionally seen forming rugged and picturesque cliffs along the coast. The earliest lavas were biotite-trachyte; rocks of this composition are nowhere found at craters still well preserved, but always as old hill features. The other and later distinctive lava type is an olivine-augite-basalt rich in alkalis. This rock is found at all the recent craters and also at many older, half-obliterated centres of eruption. A rock of much the same composition, but varying in details, has a widespread occurrence in the form of sills. The south end of the island consists of the older volcanoes; Beerenberg, at the north end, however, must be one of the latest, and round its foot there are many subsidiary cones—e.g. Palfy and Vogt craters, which must also be of comparatively recent date. These are exclusively lava craters. One of the very latest, however, is an ash cone—Egg Bluff; it has



a further interest because on the summit there are a few short irregular cracks from which hot steam still issues. Under certain atmospheric conditions these cracks "smoke" quite obviously and this phenomenon was possibly the "eruption" reported by Scoresby in 1818. Scoresby's account is unfortunately written with considerable hesitation. "Smoke" on Egg Bluff scarcely satisfies his description, however. It seems more probable that an ash eruption actually took place at the foot of the western side of Vogt (Scoresby's Esk) crater, possibly in the same spot where the only other authentic eruption, that of 1732, was observed by the whaler, J. J. Laab. Beerenberg itself has never been observed in activity. There is no evidence of when the first eruptions took place; they may even be post-glacial.

similar decreasing glaciers in Switzerland. More exact figures, however, will be available when the ground is re-visited.

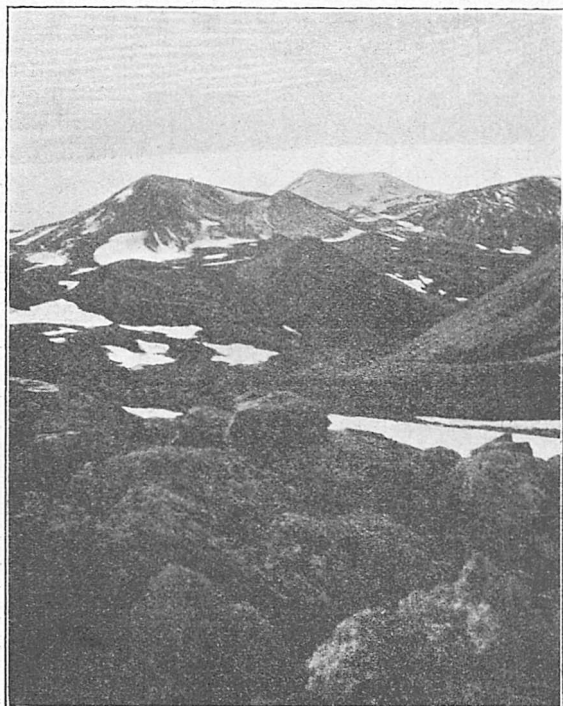
By the beginning of September it was obvious that the work was now practically complete. Winter weather had already set in, but we were told that we might still make a fair passage. We left the island in *Polarfront* on September 3. *Isfuglen*, however, was remaining another fourteen days in order to bring home the men working at the erection of the wireless station. This they soon completed, and the first message had already reached Norway when we made the coastal waters on September 9. Engineer Ekerold has therefore put up a weather station in a spot where it will be of real value—in the "blind corner" whence no weather warnings had previously been available. He did so



[Photo]

[W. S. Bristowe

FIG. 2.—Beerenberg from the south.



[Photo]

[W. S. Bristowe

FIG. 3.—Mountains at south end of Jan Mayen.

As regards glaciology, Prof. Mercanton has supplied me with a brief summary. Glaciers are confined to Beerenberg. Four elements are distinguished: (a) the glacier which issues from Beerenberg crater; (b) a "collerette glaciaire," continuous in its middle portion, covering the north and north-east parts of the mountain; (c) an independent system on the eastern flanks; (d) a great "collerette" covering the flanks from north round through west and south to east-south-east. (Part of the latter has already been referred to as the ice-cap feature.) The examination of these different elements shows decreasing glaciation, but whether recent or ancient has not yet been discovered. The rate of movement recorded shows the same order of things as on

under the most difficult and unsuitable conditions. The work involved the unloading of delicate machines from small boats on an unprotected surf-ridden coast, the overcoming of the difficulties of transport to the site selected, and finally the raising of the masts in adverse wind conditions, and fixing them in frozen ground. Ekerold is now sending daily weather reports to Norway. With the assistance of these it is hoped that it will be possible to forecast the arrival of the northerly and north-westerly gales which come down so suddenly all along the Scandinavian coast, and thus to warn the Norwegian coastal shipping, which has suffered so heavily in the past from the unexpected gales from that "blind corner."

## Obituary.

SIR GERMAN SIMS WOODHEAD, K.B.E.

WE regret to record the death of Sir German Sims Woodhead, professor of pathology in the University of Cambridge, which occurred suddenly on December 29. At the commencement of the war Prof. Woodhead was mobilised and became a colonel in the R.A.M.C. (T.), and was for some time head of a camp in Tipperary. He afterwards was appointed inspector of laboratories in the military hospitals in the United Kingdom, a post which involved perpetual travelling and discomfort, the strain of which no doubt conduced to the signs of serious over-work from which of late he suffered. In 1919 he was created K.B.E. in recognition of his valuable war work.

Born in 1855, Woodhead was educated at Huddersfield College, whence he entered the medical faculty of the University of Edinburgh, graduating in 1878. He then spent some time on the Continent, studying in Berlin and Vienna. In 1887 he was appointed superintendent of the research laboratories of the Royal College of Physicians, Edinburgh, resigning this post in 1890 on his appointment as director of the conjoint laboratories of the Royal Colleges of Physicians and Surgeons in London, which he held until his election in 1899 to the chair of pathology in the University of Cambridge in succession to the late Prof. Kanthack. Here it was largely due to his initiative and energy that the new medical school buildings were erected, including the memorial museum to Sir George Humphry.

Woodhead's activities were manifold and untiring; he was a strong supporter of the temperance movement, and was president of both the British Medical Temperance Association and the British Temperance League. He was an hon. LL.D. of Birmingham and Toronto Universities, fellow of Trinity Hall, Cambridge, hon. fellow of the Henry Phipps Institute, Philadelphia, member of the Executive Committee of the Imperial Cancer Research Fund and of the Scottish Universities Committee, and past-president of the Royal Physical Society, Edin. (1878), and of the Royal Microscopical Society (1913-16). It can scarcely be doubted that, had he attempted less, his output of original work in his own special department would have been greater.

Woodhead published in 1883 "Practical Pathology," which reached a fourth edition in 1910; in 1885, "Pathological Mycology" (with Hare); and in 1891, "Bacteria and their Products." He was founder of, and for many years conducted, the *Journal of Pathology and Bacteriology*. In 1894 he published with Dr. Cartwright Wood an investigation on the efficiency of domestic water filters, and during the war devised a method for the chlorination of drinking water. While director of the conjoint laboratories he published a report on diphtheria for the Metropolitan Asylums Board, and devoted much attention to the standardisation of

diphtheria antitoxin. Tuberculosis was also a subject to which Woodhead devoted much attention. He drew up a report to the Royal Commission on Tuberculosis in 1895, and was a member of the Royal Commission on Tuberculosis of 1902. Just before the war he devised an apparatus for the continuous record of the temperature of animals, and published the results of investigations obtained by it. Of late the subject of colonies for the tuberculous occupied much of his time, and he was joint author of "Settlements for the Tuberculous." Woodhead was of a genial and kindly disposition, and he will be greatly missed by a large circle of friends and acquaintances. R. T. H.

PROF. G. S. BRADY, F.R.S.

PROF. GEORGE STEWARDSON BRADY was born in Gateshead on April 18, 1832. His father, Henry Brady, was a surgeon, and he himself was trained for the same career. He was a student of the University of Durham College of Medicine, Newcastle-upon-Tyne, and practised in Sunderland from 1857 to 1906. During the greater part of this period Prof. Brady was also professor of natural history in the University of Durham College of Science, now Armstrong College, Newcastle-upon-Tyne. He began his duties as professor in 1875, and on his retirement in 1906 was elected honorary professor of natural history. In 1906 he went to live in Sheffield, and died there on December 25 last.

Both Prof. Brady and his brother, H. B. Brady, were early interested in natural history, and it is worth remarking that during the time Prof. Brady was studying medicine Tuffen West was an apprentice to his father. All three afterwards attained distinction, Tuffen West as a naturalist artist, H. B. Brady as an eminent authority on Foraminifera, and Prof. Brady for his work on Crustacea, especially on Entomostraca.

Prof. Brady became a member of the Tyneside Naturalists' Field Club in 1849, not long after its inception as a branch of the Natural History Society. He was president in 1871 and again in 1892-93, and he contributed many papers to the Transactions of the Natural History Society. His early papers dealt with algæ and other plant groups, but it was not long before he determined to devote himself to Crustacea and especially to Copepoda and Ostracoda. This work was his hobby, and he devoted his spare time to gathering and to examining his own collections and collections sent to him. The results have been published in a long series of papers, and these brought him into intimate relationship with other workers in the same field here and abroad. But he advanced into a place of prominence when he described the *Challenger* collections of Copepoda and Ostracoda. His reputation was further enhanced when his work on the free and semi-parasitic Copepoda of the British Islands was published by the Ray Society. With the late



Canon Norman he published a monograph of the Ostracoda of the North Atlantic and North-western Europe, and also a catalogue of the Crustacea of Northumberland and Durham.

Prof. Brady's scientific work was done at home. Although he restricted his publications mainly to the results of his examination of Entomostraca from collections made in this and other countries—notably Australia and South Africa—his characteristically neat preparations show that he had interests in all groups which came into the field of his microscope. He was a pioneer in marine dredging, and

took an active part in the Northumberland excursions of the early 'sixties, and in the 'nineties he was as keen as before.

It was a pleasure to know Prof. Brady, to be his friend, to watch him work and hear him talk on men and things, on politics and related subjects, and those who had not this privilege will find from his addresses to the Tyneside Naturalists' Club that he gave a critical and well-thought-out consideration to the important questions which arose during his long life and that he had decided opinions and was fearless in expressing them.

A. M.

### Notes.

We are particularly glad to see the names of Prof. C. S. Sherrington and Prof. W. A. Herdman in the list of New Year honours. Prof. Sherrington, who has been appointed a Knight Grand Cross of the Order of the British Empire (G.B.E.), is the president of the Royal Society, and is to be president of the British Association for the meeting to be held in Hull in September next; and Prof. Herdman, who has received the honour of knighthood, vacated the presidential chair at the Edinburgh meeting last year. The two leading British scientific organisations are thus most appropriately represented in the honours list. Other honours included in the list are:—*Knight-hoods*: Prof. G. E. Cory, professor of chemistry, Rhodes University College, Grahamstown; Dr. G. S. Buchanan, Senior Medical Officer Ministry of Health; and Dr. J. H. Parsons, F.R.S. *K.C.I.E.*: Sir John Biles, professor of naval architecture, University of Glasgow. *C.M.G.*: Dr. R. T. Paton, Director-General of Public Health and President of the Board of Health, New South Wales.

This week we begin the publication of a Calendar of Industrial Pioneers, which is intended to supplement the Calendar of Scientific Pioneers which appeared in our columns last year. It is not necessary here to point out the close association that exists between scientific discovery and industrial progress. The two are inseparable. Problems of communication, transport, mining, agriculture, and manufacture depend for their solution on the co-operation of the laboratory and the works. We believe, therefore, that our readers will welcome the series of biographical notes which will recall the great engineers, inventors, manufacturers, and captains of industry who, by the application of the discoveries of the pioneers of science, have extended existing industries, created new ones, or in some other way contributed to the advancement of civilisation.

A CONFERENCE which commenced on December 12 last was held by permission of the Government at the Ministry of Health, at which delegates from the Health Committee of the League of Nations discussed the international standardisation of therapeutic serums and the sero-diagnosis of syphilis. Prof. Madsen, of Denmark, presided, and Austria, Belgium, France, Germany, Italy, Japan, Poland, Switzerland, Great Britain, and the British Ministry

of Health, the War Office, and the Medical Research Council were represented, and the business was conducted by sub-committees. As regards diphtheria and tetanus antitoxins, it was considered both possible and desirable that international units should be fixed for these serums, and a scheme of work to establish them was drawn up. As regards anti-meningococcic, anti-pneumococcic, and anti-dysentery serums, various criticisms were made of the present technique for standardising these, and a scheme of new investigations to obtain more uniformity was adopted. As regards the sero-diagnosis of syphilis, a scheme for comparing the results obtained by the Wassermann reaction with those of other methods was drawn up. An official luncheon was given by the Government to the delegates and guests, at which Sir Alfred Mond presided. It is understood that the conference will meet again in six months' time, probably at the Pasteur Institute, Paris, to report progress and to make further recommendations.

THE *Times* of December 24 published a telegram from Delhi announcing that Mrs. Aidie, who is the widow of the late Lt.-Col. Aidie, I.M.S., has discovered a parasite in the salivary glands of the bed-bug, which is probably a stage of the *Leishmania Donovanii* parasite of kala-azar. If this important discovery is confirmed it will furnish the final proof of the truth of the theory of Sir Leonard Rogers that the common bed-bug is the carrier of the infection. The human stage of the parasite was first described by Sir William Leishman in 1903, and was found independently by Lt.-Col. Donovan, I.M.S., while in 1904 Rogers cultivated the organism *in vitro* and discovered the flagellate stage of the parasite. In the following year he recorded experiments showing that sterility and a neutral or slightly acid medium, such as he found in the stomach of bed-bugs, were most suitable for this development, while the plan he had advised as early as 1897, of moving healthy coolies out of infected into new lines only a few hundred yards away, had proved so successful in eradicating the disease from tea estates that the infecting agent was not likely to be a flying one, and he pointed out that infection through the ubiquitous bed-bug would explain all the known facts. Major Patton, I.M.S., in Madras next obtained the development of the flagellate stage of the parasite in the

guts of bed-bugs, and certain forms believed to be a post-flagellate stage have since been described by Cornwall, Knowles, and others, but the ultimate development and exact mode of infection have hitherto eluded all workers. Mrs. Aidie has worked for a long time at the Pasteur Institute in Shillong with Major Knowles, I.M.S., so there is every reason to hope that the recent announcement will soon be confirmed. Whether it will help much in dealing with the disease is open to doubt, for long ago Dr. Dodds Price carried out Rogers's suggestion to try to destroy bed-bugs in infected coolie huts in Assam, but without much success, while such very good results in dealing with kala-azar by the tartar emetic treatment are now being obtained in Assam that a vigorous campaign on those lines may be expected practically to stamp out the disease within a few years.

THE following have been elected officers of the third International Congress of the History of Medicine to be held in London on July 17-22 next:—*President of Honour*: Sir Norman Moore, Bart. *President*: Dr. Charles Singer. *Vice-Presidents*: Sir D'Arcy Power and the presidents of the first two congresses, Dr. Tricot-Royer, of Antwerp, and Drs. Jeanselme and Menetrier, of Paris. *Treasurer*: Mr. W. G. Spencer. *General Secretary*: Dr. J. D. Rolleston.

H.S.H. PRINCE ALBERT OF MONACO and Prof. G. O. Sars, of Christiania, were elected foreign members of the Zoological Society of London at its monthly meeting on December 21. The secretary reported that there had been 221 additions to the society's menagerie during November, 104 by presentation, 66 deposited, 5 received in exchange, 44 by purchase, and 2 by birth. The gifts included four lions born in India, presented by the Jam Sahib of Nawanganar. The number of visitors to the gardens during November was nearly seven thousand fewer than during the corresponding month of 1920.

THE annual meeting of the British Medical Association will be held in the University buildings at Glasgow on July 21-28 next. The first three days of the meeting will be taken up by the annual representative meeting, and in the evening of July 25 the new president, Sir William Macewen, will deliver his presidential address. The remaining three days of the meeting will be devoted to scientific and clinical work. Papers and discussions are being arranged for the morning sessions and clinical and laboratory demonstrations for the afternoons. The scientific proceedings of the meeting will be distributed among nineteen sections, each dealing with a particular branch of medicine. In the evening of July 28 a popular lecture will be delivered by Prof. J. Graham Kerr.

At the next ordinary scientific meeting of the Chemical Society, to be held on January 19, at 8 p.m., Prof. Arthur Smithells will give an account of Langmuir's theory of atomic structure, and will exhibit models. In connection with Sir Ernest Rutherford's lecture on "Artificial Disintegration of Elements," to be given before the Chemical Society on Thursday, February 9, at 8 p.m., it has been decided that

visitors will be admitted by ticket only. Fellows of the society will not need tickets for themselves, but those desiring to bring visitors should apply for tickets to the Assistant Secretary, Chemical Society, Burlington House, W.1, not later than January 28. No fellow will be allowed more than two tickets. The lecture will be delivered in the lecture hall of the Institution of Mechanical Engineers, Storey's Gate, S.W.1.

An exhibition of industrial heating apparatus, to be held in April of this year, is being organised by the Office Central de Chauffage Rationnelle, Paris, under the patronage of the Société d'Encouragement à l'Industrie Nationale and the Société des Ingénieurs Civils de France. The exhibition will comprise apparatus and material connected with "la conservation et la récupération" of heat, and it will be divided into two sections, one including refractory materials, insulators, etc., and the other apparatus and plant, such as economisers, heat-recovery plants, etc. Every facility will be given for experimental demonstrations of exhibits. Further information may be obtained from M. L'Ingénieur Directeur de l'Office Central de Chauffage Rationnelle, 5 Rue Michel-Ange, Paris, XVI. We are informed that the director will be glad to receive applications to exhibit from British manufacturers.

At a meeting of the Royal Statistical Society on December 20, Mr. E. A. Rusher read a paper dealing with the statistics of industrial morbidity in Great Britain. From a review of investigations on this subject for the past one hundred years, he concludes that (1) age has the greatest influence upon the rate of sickness, and next to this, occupation; (2) occupation has more influence than has either locality or density of population, but the influence of the latter cannot generally be statistically dissociated from that due to occupation; (3) there are no trustworthy statistics in this country of morbidity among female lives; (4) no statistics exist of the sickness experienced by the community at large corresponding to those for mortality published by the Registrar-General. Mr. Rusher advocated a systematic attempt to investigate the data now available through the operations of approved societies under the National Insurance Acts in order to obtain some measure of occupational incidence of sickness analysed into classes of disease.

COL. T. C. HODSON writes in amplification of our condensed report of his remarks in the discussion which took place at the Royal Anthropological Institute on Prof. Elliot Smith's paper on "The Mound-Builders of Dunstable" (see NATURE of December 15 last, p. 512) to point out in reference to the distinct forms of disposal of the dead associated with the mounds, viz. (1) burial of a woman and child in a flexed position and (2) cremation, that in India many living races have two—in one case four—different modes of disposing of the dead, varying according to (a) cause of death and (b) social status of the dead. Col. Hodson also points out that one of the elemental features of Jhum cultivation in Assam is the use of logs of burnt



trees as retaining walls to hold up the soil and keep in the moisture, and that Mr. Mills's reference to ignorance of the proper ceremonial as a reason alleged for not adopting terrace cultivation throws an interesting light upon the possibilities of the negative aspect of the evidence with regard to this method of cultivation.

In an elaborate paper published in the *Journal of the Royal Institute of British Architects* (third series, vol. 28, No. 3, October, 1921) Mr. Jay Hambridge supplies "Further Evidence for Dynamic Symmetry in Ancient Architecture." The paper gives a careful series of measurements of the Parthenon and other Greek temples which are of permanent value. The writer remarks: "The temple at Aegina is older than the Parthenon, older than the Zeus building at Olympia; therefore the finding of a persistent dynamic theme in the structure which is simply a variation of the themes at Bassæ, Olympia, and Athens suggests that symmetry schemes had some sort of ritual significance. And this is borne out by the record from India. About the time of the erection of the Greek temples of the best period, if not somewhat earlier, there existed in India specific rules for sacrificial altar construction. These have survived as the *Sulvasutra*, or 'rules of the cord,' better, 'rules of the rope.' Some authorities date the *Sulvasutra* about 800 B.C., others place it at 600, 500, 400, and even 200 B.C. The exact date is immaterial, as the point of importance for us is that these rules describe in detail the construction of the root rectangles which constitute the base of classic Greek proportion."

THE year which has just closed will long be remembered for its shortage of rainfall over the British Isles, as well as in many other parts of Europe. At Greenwich Observatory, where records are available for more than a hundred years, there is no previous year since 1815 with so small an amount of rain. In 1921 the total measurement for the twelve months was 12.50 in., which compared with the average 24.41 in. for the hundred years from 1816-1915 is only 51 per cent. of the normal, and compared with the normal for thirty-five years, 1881-1915, in use by the Meteorological Office, viz. 23.50 in., is 53 per cent. of the normal. Compared with the one hundred years' normal, the rainfall in each month was less than the average, but compared with the normal for thirty-five years, January and September had slightly more rain than the average. The month with least rainfall was February, with 0.12 in., followed by July with 0.15 in. In the previous 106 years the year of least rainfall was 1864 with 16.38 in., and this is followed by 1847 with 17.61 in., and 1858 with 17.70 in. The rainfall for the eleven months to the end of November was 68 per cent. of the average in England and Wales, 94 per cent. in Scotland, and 86 per cent. in Ireland. At Tenterden, as representative of Kent, the rainfall for the eleven months to the end of November was 49 per cent. of the average; at Arundel, as representative of Sussex, 53 per cent., and at Oxford 59 per cent. Notwithstanding the wild

and unsettled character of the weather at the close of the year droughty conditions continued in the south and south-east of England.

THE annual report of the Gresham's School, Holt, Natural History Society for 1921 includes a useful list of the flowering plants found in the neighbourhood of Holt, Norfolk, the work of the botanical section, and a preliminary list of the Hemiptera-Heteroptera of the same district, compiled by the entomological section.

IN the *Quarterly Journal of Microscopical Science* (vol. 65, part 4), Prof. Champy and Mr. H. M. Carleton discuss the shape of the nucleus and the various mechanical causes, such as surface tension and the pressure of cytoplasmic inclusions, by which it is determined. They come to the conclusion that the amitotic division which occurs in certain highly specialised nuclei results from the attainment by the nucleus of a degree of differentiation that is incompatible with mitosis.

To the few known cases of flagellate protozoa with trichocysts another has been added by the observations of Dr. W. Conrad, who has found trichocysts in *Reckertia sagittifera*, n.g., n.sp., a colourless Chloromoradine found in an aquarium in the Botanic Garden in Brussels (Bull. Acad. Roy. de Belgique, Classe des Sciences, 1920, No. 11). The organism is about 50 microns in length, and has two flagella, one directed anteriorly and the other posteriorly. In addition to swimming by means of the flagella, the organism can creep by means of blunt pseudopodia, about six in number, which serve also for the capture of food, such as bacteria, flagellates, and algal zoospores. A layer of slender, rod-like trichocysts in the ectoplasm gives this region a fine and regular striation. Trichocysts are not present in the pseudopodia. Close to the insertion of the flagella are two lateral contractile vacuoles which contract alternately and discharge their contents into a median apical vacuole. Food vacuoles, similar in their reaction to neutral red to those of *Paramecium*, are present in the endoplasm. The nucleus is of the vesicular type, and divides by karyokinesis; cell division is, as usual in flagellates, longitudinal.

THE story of Lord Howe Island as told by Mr. Allan R. McCulloch in the *Australian Museum Magazine* (vol. 1, No. 2) is a sad one for the naturalist. Situated three hundred miles to the east of Australia, it was uninhabited by man when discovered in 1788, and, having no indigenous mammals or reptiles, was the home of a vast and interesting bird population which, ignorant of the murderous ways of man, knew not how to protect itself from his ravages. One species, *Notornis alba*, unable to fly, quickly became extinct, and, except for one skin in the Vienna Museum and a few stray notes in journals, nothing is known of this interesting bird. The island is a dependency of New South Wales, and in 1879 was declared a reserve in the hope that what then remained of its fauna would be preserved. Success seemed to have rewarded this excellent measure,

but unfortunately rats were accidentally introduced into the island, and the birds' paradise of two years ago has been reduced to a veritable wilderness beyond all hope of recovery. Mr. McCulloch's account of this tragedy is accompanied by excellent photographs and an interesting description of the natural history of the island, with valuable notes on some of the more interesting birds—magpies, woodhens, and mutton-birds.

In the *Journal of the Federated Malay States Museums* (vol. 10, part 3, June 1921), Major J. C. Moulton publishes the first of a series of articles on Malaysian butterflies, designed to supplement or correct the information of this region given in Seitz's "Macrolepidoptera of the World." The author defines a true Malaysian sub-region as distinct from a wider area, in which a non-Malaysian element is evident, though not necessarily predominant, and defines it as between lat.  $10^{\circ}$  N., and  $10^{\circ}$  S., and long.  $95^{\circ}$  E. and  $120^{\circ}$  E., thus including the Malay Peninsula, Borneo, Sumatra, and Java, with its adjacent islands. Thirteen new forms and combinations are described. Major Moulton continues the innovations introduced into his earlier papers of printing the sub-specific names in less prominent type than the generic and specific names, and of retaining the author's name for a species even when followed by a sub-specific name. Both courses have since received the approval of the British Association Committee on Zoological Nomenclature. Valuable notes on variations and geographical distribution are given, accompanied by useful keys for the discrimination of species, sub-species, and forms. We may specially note the distinction drawn by the author between "sub-species" and "forms"—the former as geographical races inhabiting separate areas, and the latter as well-defined forms occurring together over a wide range of country.

THE difficult question of the drainage of the Vale of Pewsey, a district now so well known to the aviators of Upavon, is dealt with by Mr. W. D. Varney in the Proceedings of the Geologists' Association, vol. 37, p. 189, 1921. The vale seems to have been excavated originally along the Pewsey anticline of Cretaceous rocks, which provided a line of weakness, by a river flowing eastward from the Cotswolds and escaping southward by the present gap of the Avon, the river that passes through Salisbury to the sea at Christchurch. This stream was beheaded during the growth of the Severn valley, when the other Avon of the district, which flows through Bristol, was working its head backwards and capturing in addition some of the head-waters of the Kennet and the Thames. Mr. Varney's sketch-maps indicate also the recession of the southern coastline and the formation of the Isle of Wight.

In a lengthy and most instructive article in the *Geographical Review* for October last on the distribution of population Mr. M. Arousseau directs attention to the fact that three kinds of maps which at present do not exist are much wanted and could be compiled by the geographical survey of countries. The earth-

material map would show the following features: Areas of deep drift soils, areas of residual soils, hydrographical information, fuel deposits, and the location and nature of metallic ores and other economic deposits. The power map should show the distribution of the different power resources—wood, wind, water, coal, oil, etc. Finally, the lowlands map would be a topographical map so coloured that the lowlands, even when of small areas as in the case of intermontane deposits, would stand out prominently. Mr. Arousseau also points out that in taking stock of the world's resources we require to know the expansion ratio of every land—that is to say, the ratio of the extent to which a given area is occupied to the extent to which it may be occupied. He sketches the nature of the geographical survey required in order that this ratio may be obtained.

AN interesting paper on Greek and Roman engineering instruments, read before the Newcomen Society on December 15 last by Mr. R. C. Skyring Walters, illustrates the uses of historical research applied to science. Such research, the product of co-operation between classical scholars and men of science, was also exemplified at a joint meeting of the Textile Institute with the Manchester and District Branch of the Classical Association and Literary and Philosophical Society last November, and it cannot fail to be of great usefulness. In his paper Mr. Walters quotes the description by Vitruvius of the use of the *dioptra*, *chorabates*, and water levels in surveying by the Greeks and Romans up to about 100 A.D., and he gives sectional drawings showing reconstructions of these instruments, of which no complete example remains. The *groma*, an arrangement of two crossed arms at right angles with suspended plumb lines at the ends, used for setting out straight lines and lines at right angles, is also shown. In the case of the *dioptra* the advanced stage of development in constructive detail which was reached at the time of Hero of Alexandria, is remarkable. The conclusion is that there are many striking points of similarity, not only in the instruments, but also in the methods employed 2000 years ago, with those of the present day.

WE have received an advance copy of a Carnegie Research Memoir published by the Iron and Steel Institute on the constitution of chromium steels by Mr. T. F. Russell. During recent years industrial applications of iron-carbon-chromium alloys have increased, and a paper on this subject, therefore, is welcome. It must be confessed, however, that the present one does not do much to advance our knowledge of chromium steels. The author has confined himself to an examination of a very restricted area of the iron-carbon-chromium ternary system, in which the carbon does not exceed 1 per cent., while the limit of chromium is 12 per cent. It would have been better if he had taken into consideration in the first instance the equilibrium conditions observed in the binary systems iron-carbon, chromium-carbon, and iron-chromium. Without this a scientific interpretation



of the effects observed in the ternary system is impossible. It follows, therefore, that many of the data obtained are as yet purely empirical.

WE learn from the *Times* of December 27 that Major Klein is at work on a three-colour printing process in which the chief innovation is in the taking of the colour records. Instead of the usual light-filters attached to the camera he illuminates the object with light of the desired colour obtained by the well-known method of cutting off with opaque screens the light not wanted in a spectrum produced by suitable spectroscopic apparatus. It seems that he proposes to try the effect of reducing the width of the utilised portions of the spectrum so as to get a nearer approach to monochromatic light, and also the division of the spectrum into more than three parts for four or five, etc., colour processes.

IN the December issue of the *Journal of the Society of Chemical Industry* Dr. G. C. Clayton contributes an interesting summary of the effect of the war on the heavy chemical industry. The Leblanc soda in-

dustry is stated to be obsolete, and many of the by-products formerly obtained by it have now to be prepared by other methods. One of the main products, caustic soda, is now made either from ammonia-soda carbonate or by electrolysis. The two chief electrolytic processes operated in this country are the mercury process, by the Castner-Kellner Co., and the Gibbs diaphragm process, by the United Alkali Co. In the manufacture of chlorine the Weldon and Deacon processes have been displaced by the electrolytic methods. Electrolytic chlorine is produced by the Castner-Kellner, Gibbs, and Hargreaves cells, and is often liquefied. Chlorates are now made only by electrolysis of chlorides.

M. GOMBERG and C. C. Buchler describe in the August number of the *Journal of the American Chemical Society* the preparation of benzyl ethers of carbohydrates. Glucose, sucrose, dextrin, starch, and cellulose are readily benzylated, and some of the products may be of technical importance from their colloidal and plastic characters.

### Our Astronomical Column.

THE EINSTEIN TOWER.—The *Observatory* for December contains an illustrated article on this tower, which has just been erected in the grounds of the Potsdam Astrophysical Observatory. It contains a vertical telescope of 50 cm. aperture and  $14\frac{1}{2}$  metres aperture, fed by a cœlostast. There are two spectrographs, one with a plane-grating of  $12\frac{1}{2}$  cm. aperture, the other with two large prisms giving a dispersion of two angstroms to 1 mm. The instrument will be chiefly employed to investigate the presence or absence of the Einstein shift, but it is available for general astrophysical work. It is in charge of Dr. E. Freundlich, under the general control of Prof. Einstein, who has now an appointment at Potsdam. Dr. Freundlich hopes to observe next year's eclipse from Christmas Island, with A. Kohlschütter and Dr. Voûte.

CHANGES IN THE CRAB NEBULA.—One of the very useful researches to which the great American telescopes have been applied is the study of changes in the nebulae, by comparison of photographs taken at intervals of a few years. The changes have been in many cases unexpectedly large, and imply either relative nearness to the solar system or very high internal velocities.

Mr. Lampland had already reported some changes in the Crab Nebula deduced from seventeen photographs taken with the Lowell 40-inch reflector during a period of eight years. Mr. John C. Duncan gives in *Proc. Nat. Acad. Sci.*, June, 1921, the results of a comparison of two photographs taken with the 60-inch reflector at Mount Wilson at an interval of eleven and a half years (1909 and 1921).

Twelve condensations were selected near the outer contour of the nebula, at tolerably equal intervals. Thirteen comparison stars were chosen, one near the centre of the nebula, the others fairly near the selected condensations. The results may be summed up thus: (1) the motions of the condensations are on the average quite three times as great as those of the stars; (2) while the star-motions are at random as

regards direction, those of the condensations are systematically outward from the centre, being greatest at the ends of the long axis of the nebula, where they amount to  $2''$  in eleven and a half years, implying a linear speed of 25 km./sec. at an assumed distance of one hundred light-years. There is some (not very certain) evidence of a counter-clockwise rotation of the nebula. The mean motion of all the nebular condensations in eleven and a half years is  $+0.10''$  in R.A.,  $+0.435''$  in Decl., referred to the mean of the stars.

THE ASTROGRAPHIC CATALOGUE.—The publication of this great work was considerably in arrear even before the war, which, naturally, did not tend to improve the situation. It is satisfactory to note that volumes are now appearing in rapid succession.

Mr. H. B. Curlew, director of Perth Observatory, West Australia, has catalogued the whole of zone  $-35^\circ$ , the numbers of stars in each quadrant being 6879, 24,753, 22,139, 19,277. The paucity in the first quadrant is explained by its proximity to the South Galactic Pole. The magnitudes are given by letters, A denoting 8.5, B 9.0, and so on; the scale used is that of Chapman and Melotte, and differs from that used in earlier Perth volumes.

Mr. T. P. Bhaskaran has produced vol. 4 of the Hyderabad section, which catalogues the whole of zone  $-20^\circ$ , the number of stars being 79,590. This volume completes the zone originally allotted to Hyderabad, about half the plates of which had been taken and measured before the death of Mr. Pocock in 1918. The work has been completed on the lines laid down by him. Standard co-ordinates of all stars contained in the Algiers Astr. Gesells. Catalogue are given at the end of the volume.

Señor Leon Herrero, director of San Fernando Observatory, has produced the first half of the catalogue for zone  $-3^\circ$  (R.A. oh. to 12h.). It contains 58,387 stars, and differs from most of the catalogues in containing  $X_\alpha$ ,  $Y_\alpha$  co-ordinates for all stars, in addition to the measured  $x$ ,  $y$ .

## Agriculture at the British Association.

AS was to be expected in an important agricultural district such as Edinburgh, the meetings of the Agricultural Section created a good deal of interest, and were well attended throughout the whole of the meeting.

One or two departures from the usual routine have to be noted. Dr. E. J. Russell, of Rothamsted, delivered a popular address to farmers on "Science and Crop Production" on the day before the formal work of the section began. There was a large attendance from the district, including many representative farmers, and the address was much appreciated. A report of Dr. Russell's address has already appeared in *NATURE* of September 22, p. 116. The second change was that the presidential address, instead of being read at the opening meeting, was circulated amongst the members. At the meeting on Monday, September 12, the president, Mr. C. S. Orwin, gave an abstract of his address, which was followed by a most useful discussion.

The number of papers offered to the committee was almost embarrassingly large; they were grouped, so far as possible, according to subject. On the opening day they dealt mostly with soil problems. Dr. Winifred E. Brenchley spoke on "The Effect of Long-continued Manuring of Grassland," and described the results of experiments which had been carried out at Rothamsted on permanent meadow-land for a period of sixty-six years—long enough to allow a true estimate to be made of the effect of the different fertilisers apart from the influences of season. The effects of complete manuring, one-sided manuring, no manure, and of lime were considered in detail. Dr. W. G. Smith discussed "Methods of Grassland Analyses," and described the results obtained from plots laid down with various grass mixtures in 1914. The plots were analysed annually, and figures were given showing the composition of the plots now as compared with what was laid down.

Dr. W. G. Smith and Dr. A. Lauder gave the results of a soil survey which had been carried out in the Lothians. More than 100 square miles have been surveyed and the vegetation recorded on 6-in. survey maps. Definite relations have been established between the types of vegetation and the productivity of the holdings, and simple methods of improving the grass were described. Dr. Lauder directed attention to the relation between the amount of organic matter and the lime requirement of the soil—a connection which had been noticed by other workers. Mr. M. M. Monie gave an account of a photographic survey of soils which he had carried out in the west of Scotland. His paper was illustrated with an excellent series of lantern-slides, and the method he proposes, while of limited use by itself, should have a useful place in soil-survey work.

Prof. Hendrick dealt with "The Absorption and Retention of Manurial Substances by Granitic Soils." These soils are free from carbonate of lime, have a slightly acid reaction, and a high lime requirement. Notwithstanding these conditions, it was found that, even in very heavy dressings, ammonia was almost completely fixed and an equivalent quantity of nitrates recovered in the drainage. The phosphate was also completely retained. The potash was less firmly held, and in the later periods of the experiment the retention was very slight.

Mr. H. J. Page and Mr. H. G. Thornton contributed an important paper on "The Rapid Fluctuations in Bacterial Numbers and Nitrate Content of Field Soil and their Interrelation."

On Friday the papers dealt largely with dairying

problems. Prof. R. A. Berry dealt with the important commercial question of "The Production and Utilisation of Whey." He showed that on a moderate estimate the amount of whey produced annually is worth 337,000*l.* He emphasised the great loss involved under the present methods of disposal, where large quantities are allowed to run to waste, and discussed the possibility of new methods of utilisation. In addition to pig-feeding, the possibility of preparing milk-sugar and whey powders was considered.

Prof. R. H. Leitch described the recent work he had carried out with starters in cheese-making, as well as experiments in the manufacture of rennet, methods of standardising rennet extracts, and some new developments in butter-making. Dr. W. Taylor and Mr. A. D. Husband contributed a note on "The Varying Rates of Secretion of Milk on its Percentage Composition." They come to the conclusion that the interrelationship of volume and composition may be summarised thus:—The percentages of protein, fat, and ash vary inversely, and the percentage of lactose varies directly as the daily volume of milk secreted. Two papers were contributed by Dr. Tocher, one dealing with "The Statistical Analyses of Scottish Milk Records," and another dealing with "The Methods of Determining the Significant Differences of Yield of Milk."

Prof. Hendrick described "A New Scheme for the Determination of Unexhausted Manurial Values," and dealt in particular with the question of cumulative fertility. Dr. Tocher gave the results of experiments on "The Citric Solubility of Manurial Phosphates," and concludes that citric solubility is a worthless test from the agricultural point of view. The only practical tests are:—(1) The total phosphatic content, (2) the degree of fineness of grinding, and (3) freedom from substances of an injurious character to plants.

Mr. J. Alan Murray described some recent experimental work which he had carried out on "The Composition of Ensilage." Mr. Murray dealt with the loss involved in the making of ensilage, and considered that it was a fallacy that farmers can save money by dispensing with root crops and substituting ensilage in the rations of farm animals. He considered that it was not possible to reduce the allowance of concentrated food by substituting ensilage for roots. In the discussion which followed some exception was taken to Mr. Murray's estimates as to the cost of producing ensilage.

The meeting on Monday was devoted to economic questions, and began with the discussion on the president's address, to which reference has already been made. Lord Bledisloe followed with a paper on "Wheat as the Basis of Britain's Food-Supply in Time of War." He pointed out the advantages of potatoes, supplemented by pig-meat, over wheat. Great Britain is self-contained in its potato requirements and an exporter, while under normal conditions she imports four-fifths of her wheat requirements from abroad. The normal production of wheat is preponderantly in the eastern counties of Great Britain (ten counties out of eighty-six provide more than half the total output), while potatoes are grown in every part of the kingdom. Many farmers are wholly unfamiliar with wheat production, and have neither the implements nor the buildings necessary for its production and storage, but every farmer, gardener, and allotment-holder knows how to grow potatoes. Then again, the wheat crop may be wholly lost for human requirements through bad weather or incendiarism. Potatoes, though subject to disease (which can be minimised by spraying), are less vulnerable, as the edible tuber is beneath the ground. Potatoes provide an



immense quantity of starchy food, far exceeding wheat in output per acre, and the crop can be obtained in shorter time and harvested at different periods of spring, summer, and autumn. Potatoes are, however, relatively deficient in fat and protein, but these can be supplied, by way of supplement, by pig-meat. The production of pigs in war-time should, therefore, be encouraged, and not discouraged as during the late war; their capacity for rapid reproduction, large families, high percentage of fat-yield, and great variety of food products render them invaluable meat-providers in a national emergency. Grazing varieties deserve special encouragement. Another reason for the encouragement of potato-growing lies in the large areas of permanent and temporary pasture, valuable storehouses of accumulated fertility, which can be utilised in time of war when fertilisers are bound to be scarce; no crop thrives better in newly-turned pasture than potatoes. Potato-flour is also useful, for it can be converted into wholesome and palatable bread, scones, and cakes, while surplus or unsuitable potatoes can be utilised both as stock food and as the source of motor spirit, commercial starch, etc. The home production of breadstuffs in the form of potatoes will reduce to a minimum the costs and risks of marine transport, and their production in every part of the kingdom for local needs will largely reduce the strain on internal transport.

In the discussion which followed some doubt was expressed as to whether it would be wise to rely so exclusively on one crop as a source of food, especially in view of the danger of the total failure of the crop by disease.

Sir Henry Rew communicated a paper on "Agricultural Statistics: Their Collection and Use" (Journal of the Ministry of Agriculture, vol. 28, p. 636, 1921); Mr. A. W. Ashby dealt with "Standards of Production in Agriculture," and Mr. Pryse Howell with "Economic Surveys of Agriculture in Wales."

On Tuesday the papers contributed dealt mostly with nutrition problems. Dr. W. E. Elliot and Mr. Arthur Crichton contributed a paper describing a series of feeding and metabolic experiments which had been conducted on pigs with the object of determining the cause of a disease variously known as "rheumatism," "cramp," or "rickets." They conclude from the results of their experiments that the condition is produced in animals deprived of access to earth or other mixtures of minerals, and fed only on grains and certain other concentrates commonly used in pig-feeding. The inorganic constituents in these feeding-stuffs do not correspond with the requirements of the growing pig, for there is a marked deficiency of calcium and an excess of acid radicles. If the mineral matter of a ration composed of these feeding-stuffs be adjusted to the requirements of the animal by a mixture of salts compounded to correct the deficiencies the disease does not occur. The addition of fat soluble A or of water soluble C to a ration that produces the condition does not prevent the onset of the symptoms. Mr. John Golding exhibited photographs of a litter of pigs from a sow which was fed on a diet deficient in vitamins; they all suffered from serious malformation of the hindquarters. In the discussion which followed exception was taken to the conclusions arrived at by Dr. Elliot and Mr. Crichton, and it was considered by some speakers that it had not been proved that the disease in question was solely due to a deficiency in mineral matter in the ration.

Dr. J. B. Orr then gave an account of "The Application of an Indirect Method of Calorimetry to the Ruminant," and described the apparatus as adapted for experiments with goats.

Major C. C. Hirst gave a paper on "The

Genetics of Egg-production in Poultry." Major Hirst described the results of five years' experimental breeding on Mendelian lines, and showed that the first year's egg-production of a hen depends on the combined action of at least seven main genetic factors. The economic significance of the results was discussed in detail, and the effects of the old methods of grading by winter and annual records were pointed out. The new system of grading production has a double value to the practical breeder, because the descriptive somatic gradings, being based on the genetic factors concerned, give a line also to the breeding value of the bird, for the extreme grades tend to breed true. The adoption of this grading system for laying competitions would lead to rapid progress in poultry-breeding, and be of educational value to poultry-keepers in general, for the winning birds would breed winners with more frequency than they do now.

Miss Dorothy J. Jackson described an investigation which she had carried out in the genus *Sitones* with the object of investigating which species were injurious to leguminous crops in Britain; the life-history of these species has also been determined. No satisfactory method of control is at present known. In the case of the species which breed on clover control would be extremely difficult on account of their prolonged period of egg-laying, but this difficulty would not apply to the species which breed upon peas and beans. Laboratory experiments on infection with the various fungus spores of *Botrytis bassiana* (*Balsamo*), Montagne, have proved successful, death invariably occurring in from nine to thirteenth days.

In a paper by Miss M. S. G. Breeze "The Degeneration in Anthers of Potato" was discussed. Two definite types of degeneration have been observed:—(1) Where the pollen-grains are formed, but degenerate at various stages of development, and (2) in which the pollen mother-cells are apparently normal, but no reduction division takes place. The question of the inheritance of degenerate condition of anthers was also discussed.

In addition to the formal meetings a visit was paid to the Station for Research in Animal Breeding, where a demonstration on the wools of primitive breeds of sheep was given by Dr. F. A. E. Crew. Dr. R. Stewart MacDougall had an interesting exhibit of insects injurious to stock, while in the library of the Agricultural Department there was an exhibition of early works dealing with agriculture and kindred subjects.

On the Friday afternoon the new Plant-Breeding Station at East Craigs, Corstorphine, was inspected. The party was received by Dr. C. M. Douglas, of Auchloch, chairman of the committee, and Mr. Drummond described the work of the station. Afterwards the farm of Mr. John Cowper at Gogar Mains was visited.

On the Saturday a whole-day excursion took place to typical farms in East Lothian. The concluding visits were to the well-known farms of East Barns and Barneyhill, where the party was received by Sir Harry and Lady Hope.

If a word of criticism may be indulged in, attention might be directed to the fact that few of the readers of papers seriously tried to confine themselves to the time allotted to them in the programme or made a real endeavour to prepare an abstract of their work suitable for presentation to the meeting. In this way the amount of time available for discussion was much too short. The number of papers accepted was probably rather large, but much time would have been saved had some of the readers appreciated the fact that the time at their disposal was necessarily very limited.

A. LAUDER.

## The Megalithic Monuments of Malta.

AT a meeting of the Royal Anthropological Institute held on November 15 last Miss M. A. Murray gave an account of her recent excavations in Malta. The excavations were carried out with the consent and kind help of Prof. Zammit. Three sites were explored, all three being in the south-east of the island. The first excavation was of a mound called Santa Sfia, near the village of Hal Far; this proved to be a megalithic site re-used later, and yielded no result. The second excavation was at Santa Maria tal Bakkari, about half a mile away. Here the remains of a double edifice, locally supposed to be two churches, were found. But various indications, amongst others a torba floor, suggest that the building was pre-Christian, and the form and position of many of the stones show that it was originally a megalithic structure. The supposed dedication of the double building to Santa Maria and Santa Katerina may indicate that the shrine was dedicated to two goddesses, and may therefore throw some light on the early deities of Malta. The name of St. Mary is too universal to be any guide, but as St. Katherine has taken the place of a goddess of beacons and light-houses, we may have here a sanctuary of that divinity. The position of the shrine lends itself to this conjecture, as it stands on high ground in a direct line with a tiny creek, now unused, but sufficiently large for the small fishing-boats of Neolithic times. The name Tal Bakkari is probably connected with the Arabic Fagr, "dawn, daybreak"; the name "St. Mary (or the goddess) of the daybreak" would be appropriate for a shrine built on a hill, from which the open sea due eastward across the Bay of Marsa Scirocco is clearly visible. The first rays of the rising sun strike directly on the shrine.

The third excavation was at Borg en Nadur, close to St. George's Bay. A group of megaliths have always been a well-known feature of the site; this group consists of two dolmenic structures and a building which now appears to be a semi-circular apse, like the apses at Tarxien and the other Maltese temples. In the short time that could be devoted to this excavation it was possible only to prove that the building extended over a wide area, and may possibly be a double temple like those already known. Behind the uncovered apse and on a level with its highest stones is a field, terraced up to its present height in the usual way by a wall of stones. The axis of the "temple" runs directly into this field, and it is very probable that the whole building remains intact hidden under the soil, as was the case at Tarxien. Excavations in the field in which the uncovered apse stands showed a megalithic building extending more

than a hundred feet northward from the apse, and a broken bætyl was found *in situ*. Time did not permit of more than a cursory examination of this portion of the site, and it is still uncertain how far or in what way this building is connected with the apse. South-eastward from the apse is another dolmenic structure built into the wall of the field, and adjoining it in the field behind is an apse filled in and covered with stones, but retaining the characteristic semi-circular form. Excavations on the site will be continued next year.

In the course of the discussion which followed the paper Sir Arthur Evans said that, taking the megalithic monuments in Malta as a whole, it was clear that they belonged to a western Mediterranean province which included Sardinia, the Balearics, and possibly the African side. In the Bronze age the evidence was clear; the implements fitted on to the Spanish group. In Spain are found small segmented beads of faience which were a stage in similar forms found in Scotland and parts of England, and began in Egypt with the XVIIIth Dynasty, and appeared in Crete at about the same time. Possibly they were diffused by the Cretans. Although the segmented beads had not been found in Malta, an imitation, associated with them in Spain, had been found there, and it was probable that the segmented beads would also be found. The Neolithic ornament showed a regular progression, starting from Hagia Kim, but it appeared at so advanced a stage that it could not have originated there, and was, possibly, to be derived from Egypt. A vase from Kamares showed strong affinities with a vase from the Neolithic chambers of Malta. The deduction was that the later stage of this culture in Malta came down to about 1600 B.C.

Mr. Peake referred to the rapid development which had taken place in our knowledge of the prehistory of Malta. In 1913 nothing was known of the Bronze age, but the knowledge of an independent type of pottery had now been developed. The evidence pointed to 1800 B.C. as a possible date for Hal Tarxien. The culture was identical with that found all over the megalithic area. The pottery, for instance, was common to Taranto, Spain, Brittany, Guernsey, Arran, Scandinavia, and also Algiers. The only locality outside the megalithic area in which it occurred was Sicily, where, however, a double spiral stone occurred, similar to one from Hal Tarxien, showing that it belonged to the same order. In connection with his suggestion that this culture came from the East, it was interesting to note that Prof. Zammit had also suggested a connection between Malta and the Persian Gulf.

## Graft-Hybrids.

AMONG the departures in procedure which marked the Edinburgh meeting of the British Association was the prominence given to a botanic lecture which aimed at a scientific, but non-academic, account by Prof. Weiss of "Graft-Hybrids." Grafting had been a horticultural practice from very ancient times, and was said to date from that of the Phœnicians, and was certainly practised by the Romans, who believed that the stock exercised considerable influence over the scion.

The question of the production of hybrids by grafting first came to the notice of scientific observers in connection with the *Bizzaria orange*, raised in Florence in 1664, and described in the second volume of

the Philosophical Transactions of the Royal Society of London. In this case an orange grafted on a lemon stock bore a large variety of fruits, some resembling oranges, some lemons, while others were intermediate in shape and colour. The most curious combination appeared to consist of an orange shell with lemon pulp. This latter feature was significant in relation to the "graft-hybrids" afterwards obtained, probably the best known and most frequently discussed of which is *Cytisus Adami*, obtained in Paris in 1825 by grafting a small purple-flowered *Cytisus purpureus* on an ordinary yellow laburnum. The graft did not succeed, but from a small bud arising close to the place of insertion a branch was produced inter-



mediate in character between scion and stock. The graft-hybrid is generally sterile, and therefore is usually kept going by grafting. On the rare occasions when seed is set it produces normal yellow laburnum.

In the account given by McFarlane in the Transactions of the Royal Society of Edinburgh for 1892 the suggestion was made that the distribution of characters is such that the graft-hybrid consists apparently of a core of laburnum wrapped in a skin of *Cytisus*. This supposition has been confirmed in the more recent production of graft-hybrids by grafting common nightshade on the stem of a tomato and *vice versa*. In all cases the stock would appear to furnish the core and the scion the epidermal tissues of the "hybrid."

This simple explanation, however, does not appear to cover fully the graft-hybrids between medlar and hawthorn obtained by Prof. Daniel, in one case of which, at any rate, tissues were present which differed from those of either parent.

In general, therefore, graft-hybrids represent shoots produced adventitiously near the point of grafting and containing representation of the tissues of both plants, in many cases, e.g. *Cytisus Adami*, so arranged that the external tissues resembled those of the scion and the internal those of the stock. There were, however, instances—e.g. quince and pear—in which an intimate mixture of the characters of stock and scion appeared in the graft-hybrid which may have been accompanied by vegetative union of the cells, but no clear case of this cytological process had yet been established.

The whole phenomenon of graft-hybrids requires further investigation, particularly in relation to cases in which the "hybrid" is said to occur on the scion far removed from the point of grafting, which may turn out to be instances of bud variation, possibly with reversion.

### Fauna of African Lakes.

DR. W. A. CUNNINGTON, leader of the third Tanganyika Expedition (1904-5), has contributed to the Proceedings of the Zoological Society of London (December, 1920), a comparative study of the fauna of the African lakes—Tanganyika, Victoria Nyanza, Nyasa, Albert Nyanza, Edward Nyanza, and Kivu, with special reference to the first-named. The results of recent investigation, admirably summarised in this memoir, lend no support to the view put forward in 1898 by Mr. J. E. S. Moore, leader of the first and second expeditions, that Tanganyika represents an old Jurassic sea, and that its fauna is of relict nature. Of the six lakes, Tanganyika has by far the most remarkable fauna—of its 402 species 293 are endemic, and 57 of its 168 genera are peculiar to its waters; of the 146 species of fishes 121 are endemic, and a notable feature is the high degree of specialisation of the Cichlidæ, the lake presenting the richest known assemblage of this family. There is a large molluscan fauna, and of the species of gastropods more than two-thirds—the halolimnic forms (Moore)—exhibit a marine-like appearance, and these are, without exception, endemic. Noteworthy is the absence of Cladocera, and the relative scarcity of rotifers, which may be correlated with the salinity of the water, and especially with the excess of magnesium salts. Dr. Cunnington points out that geological investigation indicates that the extensive beds of sandstone and conglomerate which occur in the lake regions were probably formed under fresh-water and terrestrial conditions, that the trough in which Tanganyika lies

was apparently not formed until middle tertiary times, and that the lake had no outlet until recent geological times. Experts have not accepted Moore's comparison of shells from the lake with marine fossil shells of Jurassic age, or his views as to the primitive nature of the halolimnic gastropods. The endemic species in the fauna of Tanganyika are now held to be specialised rather than primitive. The conclusion reached is that Tanganyika owes its remarkable fauna to a long period of isolation, sufficiently extensive for the inhabitants of the lake to assume the characters of species and even genera distinct from those of the neighbouring parts of the continent.

### University and Educational Intelligence.

IN connection with the Conference of Educational Associations which is being held at University College, Gower Street, W.C.1, the annual general meeting of the Education Guild of Great Britain and Ireland took place on December 30. The president of the guild, Sir Wilmot Herringham, delivered the presidential address, taking university education as his topic. He commented on the lack of interest in university education shown by the majority of people, and emphasised the value of the inclusion of natural sciences in a general education as a training in inductive reasoning. There is also material gain by the training of a number of skilled practitioners in chemistry, physics, engineering, medicine, etc., but the most important function of the university is discovery. Taking examples from medical science only, gas gangrene, surgical shock, and the effects of poison gas were mentioned as specific problems arising during the war in which investigations were undertaken with success in university laboratories. Another interesting fact mentioned was that between 1838 and 1851 out of every million people born in Great Britain 500,000 died before the age of forty-five years; in 1881 that age had risen to forty-eight; and by 1891 it was fifty-two years—an increase in average life due, at any rate in part, to research and discovery accomplished by men of science working in the laboratories of our universities.

ACCORDING to the December issue of the *School Science Review*, the representatives of the Science Masters' Association met the Joint Standing Committee of the Headmasters' Conference and Association of Preparatory Schools in June last and made certain suggestions for the teaching of science in preparatory schools. As a result it was recommended that (1) in the Common Entrance Examination the scope of the geography paper be widened, that some of the questions in the mathematical paper should test a boy's knowledge of practical mathematics, and that in the composition paper candidates should have an opportunity of showing a knowledge of natural science; (2) candidates for scholarships should be given an opportunity of answering questions on natural science in a *viva voce* examination as well as in the general paper; and (3) at least one, and if possible two, periods a week should be devoted in preparatory schools to science. The council of the Association of Preparatory Schools was at first unwilling to adopt any of these proposals, but after they had been approved by the Headmasters' Conference the council of the Association of Preparatory Schools agreed to them by 12 votes to 3. When this decision is carried into effect boys in preparatory schools will have an opportunity of gaining some knowledge of science at an age when all natural phenomena are of absorbing interest to them—a privilege boys in secondary schools have enjoyed for some time.

## Calendar of Industrial Pioneers.

**January 1, 1890. Horatio Allen died.**—A pioneer among American locomotive engineers, Allen visited the Stockton and Darlington Railway in 1828, and afterwards conveyed to the United States the locomotive "The Stourbridge Lion." In 1871-73 he served as president of the American Society of Civil Engineers.

**January 2, 1875. Eber Brock Ward died.**—In 1864 Ward erected an experimental steel plant at Wyandotte, Michigan, where the first Bessemer steel made in the United States was produced. He was among the earliest to erect a works laboratory and to employ a works chemist. He also did important work in connection with water and rail transport.

**January 3, 1795. Josiah Wedgwood died.**—The friend of Watt, Erasmus Darwin, and Priestley, and a fellow of the Royal Society, Wedgwood by his experiments added several new species of pottery ware to English manufacture and turned the current of importation of the finer earthenwares into that of exportation. "He was the most successful and original potter the world has ever seen."

**January 5, 1887. Sir Francis Bolton died.**—The inventor of a system of signalling for the Army and Navy, Bolton was widely known for his electrical work, and he took a prominent part in founding the Society of Telegraph Engineers and Electricians, now the Institution of Electrical Engineers.

**January 6, 1911. Sir John Aird died.**—For sixty years Aird was engaged on important engineering schemes, his crowning work being the famous Assuan dam on the Nile built for the Egyptian Government in 1898-1902. The dam is 2200 yards long, it has 180 sluice-gates, and contains more than 1,000,000 tons of masonry.

**January 6, 1886. Alh  mar Jean Claude Barr   de Saint Venant died.**—Engaged for many years on practical work as an *ing  nieur des ponts et chauss  es*, Saint Venant was an eminent elastician, contributing much to the study of the strength of structures.

**January 8, 1861. Samuel Clegg died.**—A pupil of Dalton, Clegg while an apprentice at Birmingham witnessed Murdoch's experiments on gas lighting and himself became one of the pioneers of the gas industry.

**January 8, 1825. Eli Whitney died.**—Holding a pre-eminent place among the early inventors of America, Whitney, though originally a blacksmith, graduated at Yale, and while a private tutor in 1793 produced his cotton gin. This enabled one man to clean a thousand pounds of cotton a day instead of five or six pounds. In twelve years the export of cotton rose from 189,000 lb. to 4,000,000 lb. per annum.

**January 9, 1843. William Hedley died.**—With Trevithick, Stephenson, Blenkinsop, and Hackworth, Hedley was one of the pioneers of the locomotive. In 1813 at Wylam Colliery, near Newcastle, he built the "Puffing Billy," the first practical and efficient locomotive ever constructed. This engine is now in the Science Museum at South Kensington.

**January 9, 1862. Samuel Colt died.**—In 1835, at the age of twenty, Colt patented his repeating pistol or revolver, for the manufacture of which he built a factory where automatic and semi-automatic machinery was used.

**January 11, 1877. Alfred Smee died.**—Surgeon to the Bank of England, Smee was best known for his work on electricity. The Smee battery was devised by him, and he did pioneering work in electric metallurgy, including the art of electrotyping. E. C. S.

## Societies and Academies.

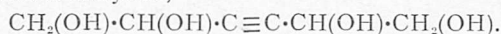
## PARIS.

**Academy of Sciences, December 19, 1921.**—M. Georges Lemoine in the chair.—The president announced the death of M. Henry Parenty, correspondant for the section of mechanics.—E. Borel: The theory of games of chance and integral equations with symmetrical nucleus.—P. Termier and L. Joleaud: Summary of our knowledge of the Suzette layer (exact age, constitution, and extent): the question of its origin. This layer came from the Alps in the Aquitanian period, and is exclusively formed of Triassic elements.—C. Richet: The psychological unity of time.—G. Gouy: The surface tension of electrified electrolytes. In a recent communication M. F  lix Michaud has proved that the surface tension of an electrolyte is not changed by the electrification of the surface, and hence raises an objection to the ionic hypothesis, since the ions, by accumulating at the electrified surface, should modify the capillary forces. The author states that it is not the ionic theory that is at fault, but the view that the charge is constituted by the ions accumulated at the surface. The latter hypothesis is inadmissible, since a small charge does not diminish the osmotic pressure in the interior of the electrolyte nor the total number of ions per unit of volume.—G. Friedel and L. Royer: Mixtures of anisotropic liquids and the identity of the stratified liquids of Grandjean with liquids of the azoxyphenetol type.—R. Lagrange: The absolute differential calculus.—J. Wolff: The series

$\sum \frac{A_k}{z - a_k}$ .—A. Denjoy: Quasi-analytical functions with real variable.—E. Delassus: Closed articulated chains.—H. Abraham and R. Planiol: An astronomical chronograph of precision. An auxiliary electrical clock, controlled by an astronomical clock, beats tenths and twentieths of a second, and these are marked on a smoked strip by a recording galvanometer; the same instrument records the observed times on the same strip, and an accuracy of 0.01 sec. (or greater if required) is readily attained by a direct reading without a micrometer.—J. P. Lagrula: The principle and scheme of a recording chronograph with geometrical synchronisation.—J. Guillaume: Observations of the sun made at the Lyons Observatory during the third quarter of 1921. Ninety days' observations are summarised in three tables, showing the number of spots, their distribution in latitude, and the distribution of the faculae in latitude.—E. Esclangon: The relativity of time.—J. Le Roux: Interference and reflection in a mobile system.—J. Chappuis and M. Hubert-Desprez: Electrolysis by stray currents. Two metal plates forming the electrodes were placed in sawdust or earth moistened with an electrolyte contained in a wooden box. The course of the corrosion was followed continuously by X-ray photographs.—M. Taffin: The measurement of double refraction in tempered glass.—M. Siegbahn: New measurements of precision in the X-ray spectrum. A description of an improved instrument of a type described in 1918, capable of measuring a wave-length with an accuracy of 0.002 per cent.—A. Sellerio: Analogies and differences between the total galvanomagnetic effect and its correlative thermomagnetic effect.—J. Duclaux: The mechanism of continuous-light radiation.—B. Bogitch: The expansions of some refractory materials at high temperatures. Refractory bricks of silica, bauxite, clay, chromite, and magnesia and their expansions were studied up to 1500   C. Bauxite bricks had the lowest coefficient of expansion. Silica gave an irregular curve and lost



its strength at about 600° C. The highest expansions were shown by magnesia and chromite bricks, and hence these are suitable only for furnaces in continuous work.—A. Charriou: The lime carried down by ferric hydroxide precipitates. To reduce the amount of lime adsorbed by precipitated ferric hydroxide to a minimum the calcium chloride solution should be very dilute and the ammonia added only just sufficient to precipitate the iron.—M. Grandmougin: The halogen derivatives of indigo.—J. B. Senderens and J. Aboulenc: The catalytic hydrogenation of the polyphenols in the wet way. Hydroquinone, resorcinol, pyrocatechol, pyrogallol, and phloroglucinol can be reduced in the presence of nickel by hydrogen under pressure (30 to 50 atmospheres) at temperatures between 115° C. and 145° C. At higher temperatures secondary reactions take place; thus resorcinol at 120° C. gives resorcite (1:3-cyclohexanediol), but at 180° C. some cyclohexanol is produced.—M. Lespiau: Derivatives of erythritol-acetylene,



—R. Fosse: The synthesis of a nitrogenous principle of plants, hydrocyanic acid, by the oxidation of ammonia and carbohydrates, glycerol, or formaldehyde. Potassium (or calcium) permanganate, in presence of silver nitrate, with ammonia and various organic bodies, gives cyanides as one of the oxidation products.—C. Jacob and M. Remouille: A fall of meteorites in Cochin China.—P. Viennot: The southern edge of the north Pyrenean Flysch, between the valleys of Aspe and Saison.—J. Yung: The Hercynian tectonic of the Vosges.—P. Corbin: New observations on the eastern border of the mountains of Lans.—Mlle. J. Pfender: The presence of pebbles not of local origin at Alon (Var).—E. de Martonne: Erosion platforms of the metalliferous mountains of Banat.—Mlle. Yvonne Boisse de Black: Researches on the Mindelian alluvium in the high valley of Cère and on the plateau of Lacapelle-Barrez (Cantal).—P. Loisel and R. Castelnau: The radio-activity of the waters from Mont-Dore. Determinations of the radio-activity of the water from twelve hot springs are given; the gases from eight springs have also been examined. The gases contain a higher proportion of radium emanation than the waters, and this proportion varies with the spring and with the date of collection.—A. Boutaric: The nocturnal radiation at Mont Blanc.—G. Arnaud: The affinities of the Erysiphæ and the Paradiopsidæ.—L. Blaringhem: Heredity and physiological characters in the hybrids of barley.—G. André: The transformations undergone by oranges on keeping. The ripening of oranges by keeping is due to a reduction of acidity, the loss of sugars being relatively small. These changes cannot be wholly due to oxidation, since they are produced in a vacuum. Diastatic action is suggested as possible.—P. Dangeard: The evolution of the aleurone grains in castor-oil seed during germination.—M. Bridel and Mlle. Marie Braecke: The presence of saccharose and aucubine in the seeds of *Melampyrum arvense*. Full details are given of the method of extracting saccharose and the glucoside aucubine from the seeds. Rhinanthine, extracted by Ludwig from the seeds of *Rhinanthus Crista-Galli*, was also stated by Ludwig and Müller to be present in the seeds of *Melampyrum arvense*. The identity of rhinanthine with aucubine has not yet been proved.—H. Hérissé: The biochemical synthesis of  $\alpha$ -methyl-*D*-mannoside. By the action of the ferment present in germinated lucerne seeds upon *D*-mannose in dilute methyl alcohol solution,  $\alpha$ -methyl-*D*-mannoside is formed. Details of method of isolation and proofs of identity are given.—A. Demolon: The sulphur-oxidising power of soils.

—L. Mercier: The larva of *Limnophora aestuum*, a marine Diptera.—A. Michel: The interpretation of the profound histological differentiation of the dorsal elytra and cirrus of the Aphroditian Annelids.—J. L. Lichtenstein: The determination of egg deposition in *Habrocytus cionica*.—L. Roule: The periodic changes of habitat of the common tunny fish (*Orcynus thynnus*) and their connection with the changes of medium. The migrations of the tunny fish are determined by the temperature and salinity.—L. Léger and E. Hesse: Microsporidia with spherical spores.—L. Ravaz and G. Vergé: The germination of the spores of vine mildew. Lime solutions are carbonated too rapidly on exposure to air to exert any toxic action on the mildew spores. Copper-lime mixtures resist the action of rain and dew and preserve their toxic power.—R. Legroux and J. Jimenez: The factor of growth in cultures of *Leishmania Donovanii*.—G. Bourguignon and A. Radovici: Chronaxy of the sensitive rachidian nerves of the upper limb in man.—E. Nicolas and P. Rinjard: The vaccination of cattle against bovine plague.

#### WASHINGTON, D.C.

National Academy of Sciences, Proceedings, vol. 6, No. 11 (November, 1920).—A. Weinstein: Homologous genes and linear linkage in *Drosophila virilis*. A long and detailed study with numerous bibliographic references, not lending itself to recapitulation.—F. C. Hoyt: The intensities of X-rays of the L-series, III. Critical potentials of the platinum and tungsten lines. A continuation of an earlier work to the classification of some lines that were doubtful.—E. B. Stouffer: Semi-variants of a general system of linear homogeneous differential equations.—A. G. Webster: Some new methods in interior ballistics. A résumé of extended experiments on the principal problem of interior ballistics, namely, to determine the position and velocity of the shot, and the mean temperature and pressure of the gases in the gun. Graphical and analytical methods are used.—C. B. Bridges: The mutant crossveinless in *Drosophila melanogaster*.—J. A. Dettlefsen: Is crossing over a function of distance? The author differs from the conclusion of many students of genetics, and believes that linkage is not a function of distance, that the distance between the two genes may remain fairly constant, and that the crossing over depends upon hereditary factors.—E. E. Babcock and J. L. Collins: Interspecific hybrids in *Crepis*. The behaviour of the seven-chromosome *Crepis* hybrid leads to the belief that there is not such a direct relationship between the two parent species as has been suggested.—C. G. Abbot: New observations on the variability of the sun. A discussion of an extended set of observations from July, 1919, to March, 1920, revealing a wide fluctuation in the sun's radiation.—L. P. Eisenhart: The permanent gravitational field in the Einstein theory.—G. A. Linhart: A simplified method for the statistical interpretation of experimental data.—C. B. Lipman and G. A. Linhart: A critical study of fertiliser experiments. From a statistical study of fertiliser experiments the authors conclude that no fertiliser experiment as ordinarily conducted is possessed of sufficient practical value to justify the large amount of money, time, and energy involved.

No. 12 (December, 1920).—H. Shapley: Preliminary report on pterergates in *Pogomyrmex Californicus*.—J. F. McClendon: Hydrogen-ion concentration of the contents of the small intestine. Criticism of the general erroneous impression that the intestinal contents are alkaline.—F. P. Underhill and M. Ringer: Blood concentration changes in influenza. Both

physiologically and pathologically there is a marked resemblance between influenza and war-gas poisoning, with a marked increase in the concentration of the blood.—E. L. Nichols and D. T. Wilbur: Luminescence at high temperatures. Announcing the discovery of luminescence at temperatures which are, roughly speaking, above the beginnings of a visible red heat.—S. R. Detwiler: Functional regulations in animals with composite spinal cords. The evidence indicates that the factor which is involved in the over-production of motor cells is the stimulus afforded by the connection with the central neurones.—A. S. King: Experiments with the tube resistance furnace on the effect of potential difference. The conclusion is that the potential difference acting on the tube is not effective in modifying the spectrum in certain temperature ranges.—J. H. McDonald: An application of the porism of four tangents of a twisted cubic.—H. A. Cheplin and L. F. Rettger: Studies on the transformation of the intestinal flora, with special reference to the implantation of *Bacillus acidophilus*, II. Feeding experiments on man. Attempts to implant *Bacillus bulgaricus* failed, as in the feeding experiments on rats. It appears that *Bacillus acidophilus* milk possesses several advantages over ordinary sour and *Bacillus bulgaricus* milk.—Kilauea Volcano Observatory: A report by the committee of the National Academy of Sciences at the request of the Secretary of Agriculture with reference to desirability of the control of the observatory being assumed by the Weather Bureau.

### Official Publications Received.

Legislative Document No. 39: State of New York. Thirty-second Annual Report of the New York State College of Agriculture at Cornell University and of the Agricultural Experiment Station established under the Direction of Cornell University, Ithaca, New York, 1919. Vol. 1. Pp. civ+1074+30+8+57 plates. Thirty-third Annual Report, 1920. Transmitted to the Legislature, January 15, 1921. Pp. 79+4. (Ithaca: Cornell University.)

Cornell University: Agricultural Experiment Station. Memoir 34: An Economic Study of Farm Layout. By W. T. Myers. Pp. 383-564. Memoir 35: Some Effects of Potassium Salts on Soils. By R. S. Smith. Pp. 565-606. Memoir 36: Resistance of the Roots of some Fruit Species to Low Temperature. By D. B. Carrick. Pp. 607-662. Memoir 37: A Modified Babcock Method for Determining Fat in Butter. By N. W. Hepburn. Pp. 663-690. (Ithaca: Cornell University.)

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 113, Special Publication No. 60: A Study of Map Projections in General. By O. S. Adams. 5 cents. Serial No. 121, Special Publication No. 62: Triangulation in Rhode Island. By Earl Church. 30 cents. Serial No. 143, Special Publication No. 67: Latitude Developments Connected with Geodesy and Cartography. By O. S. Adams. 20 cents. Serial No. 146, Special Publication No. 68: Elements of Map Projection, with Applications to Map and Chart Construction. By C. H. Deetz and O. S. Adams. 50 cents. Serial No. 150, Special Publication No. 69: Modern Methods for Measuring the Intensity of Gravity. By C. H. Swick. Pp. 96. 15 cents. Serial No. 155: Results of Observations made at the U.S. Coast and Geodetic Survey Magnetic Observatory, near Tucson, Arizona. By D. L. Hazard. 20 cents. (Washington: Government Printing Office.)

Department of the Interior: United States Geological Survey. Water Supply Paper 449: Ground Water in the Meriden Area, Connecticut. By G. A. Waring. 466: Ground Water in the Southington-Granley Area, Connecticut. 468: Records of Water Levels in Wells in Southern Carolina. By F. C. Ebert. (Washington: Government Printing Office.)

Department of the Interior: United States Geological Survey. Bulletin 719: Preliminary Report on Petroleum in Alaska. By G. C. Martin. 50 cents. Bulletin 721: Geology and Petroleum Resources of North-Western Kern County, California. By W. A. English. 10 cents. Bulletin 715-M: Permian Salt Deposits of the South-Central United States. By N. H. Darton. (Washington: Government Printing Office.)

Smithsonian Miscellaneous Collections. Vol. 72, No. 8: A Review of the Interrelationships of the Cetacea. By H. Winge. Translated by G. S. Miller, Jr. (Publication 2650.) Pp. ii+97. Vol. 72, No. 11: The Echinoderms as Aberrant Arthropods. By A. H. Clark. (Publication 2653.) Pp. ii+20. (Washington: Smithsonian Institution.)

Canada. Department of Mines. The Preparation, Transportation, and Combustion of Powdered Coal. By J. Blizard. Pp. 131+3 plates. (Ottawa: Department of Public Printing and Stationery.)

Tide Tables for the Eastern Coasts of Canada for the Year 1922, including the River and Gulf of St. Lawrence, the Atlantic Coast, the Bay of Fundy, Northumberland and Cabot Straits, and Information on Currents. Issued by the Tidal Current Survey in the Department of the Naval Service of the Dominion of Canada. (Twenty-sixth Year of Issue.) Pp. 68. (Ottawa: Department of Public Printing and Stationery.)

Experiment Station of the Hawaiian Sugar Planters' Association. The Improvement of Plants through Bud Selection. By A. D. Shamel. Pp. iv+28+41 plates. (Honolulu.)

Madras Agricultural Department. Year Book, 1920-21. Pp. vi+123. (Madras: Director of Agriculture.) 10 annas.

Office scientifique et technique des Pêches Maritimes. Notes et Mémoires No. 8: Rapport sur la campagne de Pêche de l'Orvet dans les Eaux tunisiennes. Par Prof. G. Pruvot. Pp. 12+1 map. 3 francs. Notes et Mémoires No. 9: Recherches sur le Régime des Eaux Atlantiques, au large des Côtes de France et sur la Biologie du Thon Blanc ou Gernon (Observations faites pendant la seconde croisière de la Tanche, Août et Septembre, 1921). Par Ed. le Danois. Pp. 16+6 plates. 4 francs. (Paris: Ed. Blondel la Rougery.)

Department of the Interior: United States Geological Survey. Professional Paper 121: Helium-bearing Natural Gas. By G. S. Rogers. Pp. 113. (Washington: Government Printing Office.)

Departement van Landbou, Lijverheid en Handel. "S Lands Plantentum." (Jardin Botanique de Buitenzorg.) Treubia: Recueil de Travaux Zoologiques, Hydrobiologiques et Oceanographiques. Vol. 1, Livraison 4. Pp. 139-300+plates 8-12. (Buitenzorg.) 4 francs.

The Botanical Society and Exchange Club of the British Isles. (Vol. 6, Part 1.) Report for 1920. By the Secretary, G. C. Druce. Pp. 207. (Oxford: The Secretary, Yardley Lodge.) 10s.

Fourteenth Annual Report (1920-21) presented by the Council to the Court of Governors at a Meeting held in Cardiff on October 28, 1921. Pp. 35. (Cardiff: The Museum.)

Canada. Department of Mines: Mines Branch. Bulletin No. 33: Gas Producer Trials with Alberta Coals. By J. Blizard and E. S. Malloch. (Supplementing Report No. 331.) Pp. 40. (Ottawa: Department of Public Printing and Stationery.)

Department of Scientific and Industrial Research. Building Research Board. Special Report No. 2: Experiments on Floors. An Extract from the Report of the Building Materials Research Committee. Pp. 21. 1s. 3d. net. Special Report No. 3: The Stability of Thin Walls. An Extract from the Report of the Building Materials Research Committee. Pp. 13. 6d. net. Fuel Research Board. Fuel for Motor Transport. Second Memorandum by the Fuel Research Board. Pp. iv+16. 6d. net. (London: H.M. Stationery Office.)

Mines Department: Miners' Lamps Committee. Memorandum No. 4: Record of Research on the Passage of Flame through Perforated Plates and through Tubes of Small Diameter. Pp. 19. 9d. net. Memorandum No. 5: Record of Research on the Passage of the Flame of an Explosion from within Miners' Lamps fitted with Chimneys. Pp. 13. 6d. net. (London: H.M. Stationery Office.)

Department of Commerce. Scientific Papers of the Bureau of Standards. No. 421: Wave Lengths longer than 5500A in the Arc Spectra of Yttrium, Lanthanum, and Cerium, and the Preparation of Pure and Rare Earth Elements. By C. C. Kiess and others. Pp. 315-352. (Washington: Government Printing Office.) 5 cents.

Union of South Africa. Department of Mines and Industries: Geological Survey. Sheet 52: Johannesburg. (Pretoria: Geological Survey.)

Proceedings of the Royal Irish Academy. Vol. 36, Section A, No. 1: On Polygons to Generate Diagrams of Max. Stress on Girders due to Locomotives and Dead Loads, together with an Extension of Rankine's Conjugate Load Areas to the Design of Masonry Arches. By T. Alexander and J. T. Jackson. Pp. ii+30. (Dublin: Hodges, Figgis & Co.; London: Williams and Norgate.) 1s.

Proceedings of the Geologists' Association. Vol. 33, Part 1. Pp. 80+4 plates. (London: E. Stanford, Ltd.) 5s. net.

Agricultural Research Institute, Pusa. Bulletin No. 117: Experiments with Castor Seed conducted at Sabour. By C. S. Taylor. Pp. ii+10. 3 annas. No. 119: The Agricultural Development of Baluchistan. By A. Howard and G. L. C. Howard. Pp. iv+27. 6 annas. No. 122: Pusa 12 and Pusa 4 in the Central Circle of the United Provinces. By B. C. Burt and others. Pp. iv+34. 11 annas. No. 124: Safflower Oil. By A. Howard and J. S. Remington. Pp. ii+14. 4 annas. (Calcutta: Government Printing Office.)

### Diary of Societies.

THURSDAY, JANUARY 5.

GEOGRAPHICAL ASSOCIATION (at Birkbeck College), at 11.45 a.m.—R. L. Thompson and others: Discussion: Geography and History in Schools.

ASSOCIATION OF ASSISTANT MASTERS IN SECONDARY SCHOOLS (at London Day Training College), at 2.30.—Prof. T. P. Nunn: The Purposes of Education.

GEOGRAPHICAL ASSOCIATION (at Birkbeck College), at 2.30.—Sir Halford J. Mackinder: Problems of the Pacific.

ROYAL INSTITUTION, at 3.—Prof. J. A. Fleming: Electric Waves and Wireless Telephony: Electric Oscillations.

GEOGRAPHICAL ASSOCIATION (at Birkbeck College), at 4.—E. N. Fallaize: The Anthropological Institute and the Services it can render to Geographical Students.



CENTRAL ASSOCIATION FOR THE CARE OF THE MENTALLY DEFECTIVE (at University College), at 5.—Dr. G. A. Auden: The Possibility of Co-operation between the School Medical Officer and the Teacher in the Training of Subnormal and Mentally Defective Children. LONDON HEAD TEACHERS' ASSOCIATION (at University College), at 5.30.—D. J. Collar and T. G. Tibbey: Intelligence Tests in Schools.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 5.30.—Wing-Comdr. W. D. Beatty: Specialised Aircraft. GEOGRAPHICAL ASSOCIATION (at Birkbeck College), at 5.45.—Lord Robert Cecil: Presidential Address.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. S. P. Smith: Single and Three-phase Commutator Motors with Shunt and Series Characteristics.

PHYSICAL SOCIETY AND OPTICAL SOCIETY (at Imperial College of Science and Technology), at 8.—A. A. Campbell Swinton: The Johnsen-Rahbek Electrostatic Telephone and its Predecessors.

ROYAL SOCIETY OF MEDICINE (Obstetrics and Gynaecology Section), at 8.—B. Whitehouse: Salpingotomy *versus* Salpingectomy in the Treatment of Tubal Gestation.—J. B. Hunter: Short History and Post-mortem Notes of an Interesting Case of Diffuse Carcinoma following Cancer of Cervix.—A. W. Bourne: Hyperthyroidism in Functional Menorrhagia.

#### FRIDAY, JANUARY 6.

GEOGRAPHICAL ASSOCIATION (at King's College), at 10.20 a.m.—Dr. Fleure: The Co-operation of Historians and Geographers.

GEOGRAPHICAL ASSOCIATION (at Birkbeck College), at 3.—Miss L. Winchester: Some Climate Problems of Modern Palestine.—At 4.—Dr. Hogarth: The Hedjaz.

ROYAL GEOGRAPHICAL SOCIETY (Christmas Lectures to Young People) (at Æolian Hall), at 3.30.—Sir Francis Younghusband: Pictures from Mount Everest.

INSTITUTION OF MECHANICAL ENGINEERS (Joint Meeting with the Society of Chemical Industry), at 6.—G. M. Gill: The Co-operation of the Engineer and Chemist in the Control of Plants and Processes.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—A. E. Bingham: Stone and Marble-working Machinery.

#### SATURDAY, JANUARY 7.

COLLEGE OF PRECEPTORS, at 11.30 a.m.—Prof. J. Adams: Psychoanalysis and its Value and Limitations from the Standpoint of the Practical Teacher.

ROYAL INSTITUTION, at 3.—Prof. J. A. Fleming: Electric Waves and Wireless Telephony: Electric Waves.

GILBERT WHITE FELLOWSHIP (at 4 Queen Square, W.C.1), at 3.—E. Kay Robinson: British Wild Life.

#### MONDAY, JANUARY 9.

ARISTOTELIAN SOCIETY (at 21 Gower Street, W.C.1), at 8.—Dr. F. C. S. Schiller, C. Joad, and Prof. R. F. A. Hoernlé: Discussion: Mr. Russell's "Analysis of Mind."

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8. SURVEYORS' INSTITUTION, at 8.—W. R. Davidge: Problems of Greater London.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—Sir Philip Broeklehurst: Across Wadai.

#### TUESDAY, JANUARY 10.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Prof. J. A. Fleming: Electric Waves and Wireless Telephony: Wireless Telephony.

MINERALOGICAL SOCIETY (at Geological Society), at 5.30.—C. E. Tilley: Density, Refractivity, and Composition Relations of Some Natural Glasses.—A. Russell: Laurionite and Paralaurionite from Cornwall.—W. A. Richardson: A Simplification of the Roseval Method of Micro-analysis.

INSTITUTION OF CIVIL ENGINEERS, at 6.—A. W. Rendell: Control of Trains in Relation to Increased Weight and Speed combined with Reduced Headway.—Sir Henry Fowler and H. N. Gresley: Trials in Connection with the Application of the Vacuum-brake for Long Freight Trains.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Technical Meeting), at 7.—Dr. B. T. J. Glover and others: Discussion: Should the Manufacturers Supply Figures indicating the Contrast Grading of Gas-light and Bromide Papers?—A. F. Kitching: Demonstration of Some Effects with Ultra-violet Light.—The General Electric Co., Ltd.: Developments Rendered Possible in Projection Work by the Introduction of the Osram Gas-filled Projector Type Lamp.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—Dr. C. Turney: Mosquito Investigation.

RÖNTGEN SOCIETY (at Institution of Electrical Engineers), at 8.15.—Prof. A. O. Rankine: The Structure and Dimensions of Molecules.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—J. Whatmough: Rehtia, the Venetic Goddess of Healing.

ROYAL SOCIETY OF MEDICINE (Psychiatry Section), at 8.30.—Dr. R. G. Rows: The Application of Modern Methods in the Treatment of Psychoses.

#### WEDNESDAY, JANUARY 11.

ROYAL SOCIETY OF ARTS (Mann Juvenile Lecture), at 3.—Dr. W. R. Ormandy: Clay: What it is, where it comes from, and what can be done with it.

INSTITUTION OF CIVIL ENGINEERS (Students' Meeting), at 6.—E. W. Monkhouse: The Economic Aspects of Various Methods of Power-transmission.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Institution of Mechanical Engineers), at 8.—Dr. F. W. Lanchester and R. H. Pearsall: An Investigation of Certain Aspects of the Two-stroke Engine for Automobile Vehicles.

#### THURSDAY, JANUARY 12.

ROYAL AERONAUTICAL SOCIETY (Juvenile Lecture) (at Royal Society of Arts), at 3.—Major D. C. H. Hume: Boats that Fly.

LONDON MATHEMATICAL SOCIETY (at Royal Astronomical Society), at 5.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Exhibition of Cinematograph Films.—P. Torchio, with explanatory notes by Dr. C. C. Garrard: Investigations and Tests on High-tension Switchgear.—F. Gill: Telephone Inventors of To-day.—F. Gill: The Audion.—F. Gill: Electricity in the Home.

OIL AND COLOUR CHEMISTS' ASSOCIATION (at Food Reform Club, 2 Furnival Street, E.C.), at 7.30.—A. H. Keable: Super Centrifugal Force and its Application to the Clarification of Varnish and Dehydration of Oil.

OPTICAL SOCIETY (at Imperial College of Science and Technology), at 7.30.—Dr. C. J. Peddle: The Manufacture of Optical Glass.—Dr. J. W. French: The Barr and Stroud 100 ft. Self-contained Base Rangefinder.—T. Smith: The Optical Three Apertures Problem.

INSTITUTE OF METALS (London Section) (at Sir John Cass Technical Institute), at 8.—Col. N. Beliaev: The Inner Structure of the Crystalline Grain.

HARVEIAN SOCIETY (Annual General Meeting) (at 11 Chandos Street, W.1), at 8.15.—Dr. G. de Bee Turtle: Some Points on Spasm in the Alimentary Tract (Presidential Address).

#### FRIDAY, JANUARY 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.—J. S. Paraskévopoulos: Jupiter in 1915 and 1916: Rotation Period in Different Latitudes, from Observations at the National Observatory, Athens.—Prof. G. Forbes: Solar Motion from 1922 Radial Velocities.—Major W. J. S. Lockyer: The Use of a Graduated Wedge in Stellar Classification and Parallax Work.

## CONTENTS.

PAGE

Education and the Nation . . . . .	1
Fifty Years of Electrical Science . . . . .	3
Fermat's Last Theorem. By G. B. M. . . . .	4
Chemistry of Coke-oven and By-product Works. By E. V. Evans . . . . .	4
Lichens. By O. V. D. . . . .	5
British Mineral Resources. By Prof. H. Louis . . . . .	6
Our Bookshelf . . . . .	7
Letters to the Editor:—	
Atmospheric Refraction. ( <i>With Diagram.</i> )—Dr. John Ball; Instr.-Comdr. Thos. Y. Baker, R.N. . . . .	8
The Message of Science.—W. Robertson . . . . .	9
Cohesion.—Wilson Taylor . . . . .	10
The Resonance Hypothesis of Audition.—C. R. G. Cosens and Dr. H. Hartridge . . . . .	11
The Action of Sunlight.—Dr. C. W. Saleeby . . . . .	11
Units in Aeronautics.—A. R. Low . . . . .	12
Self-fertilisation in Mollusca.—G. C. Robson . . . . .	12
The Law of the Heart. By Prof. E. H. Starling, C.M.G., F.R.S. . . . .	13
A Summer Visit to Jan Mayen Island. ( <i>Illustrated.</i> ) By J. M. Wordie . . . . .	15
Obituary:—	
Sir German Sims Woodhead, K.B.E. By R. T. H. . . . .	19
Prof. G. S. Brady, F.R.S. By A. M. . . . .	19
Notes . . . . .	20
Our Astronomical Column:—	
The Einstein Tower . . . . .	24
Changes in the Crab Nebula . . . . .	24
The Astrographic Catalogue . . . . .	24
Agriculture at the British Association. By Dr. A. Lauder . . . . .	25
The Megalithic Monuments of Malta . . . . .	27
Graft-Hybrids . . . . .	27
Fauna of African Lakes . . . . .	28
University and Educational Intelligence . . . . .	28
Calendar of Industrial Pioneers . . . . .	29
Societies and Academies . . . . .	29
Official Publications Received . . . . .	31
Diary of Societies . . . . .	31