Nature, Feb. 2. 1882.

A. E. Nordenskiöld.

Engraved by G. J. Stodart.

London, Published by Macmillan & Co.

NATURE

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

VOLUME XXV.

NOVEMBER 1881 to APRIL 1882

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

London and New York:
MACMILLAN AND CO.
1882

LONDON :
R. CLAY, SONS, AND TAYLOR, PRINTERS,
BREAD STREET HILL, E.C.

INDEX

Abbott (Chas. C.), "Primitive Industry, or Illustrations of the Handiwork in Stone, Bone, and Clay, of the Native Races of the Northern Atlantic Seaboard of America," 27
Abel and Roscoe's (Profs.), Reception at the Crystal Palace, 491
Aberdeen, Sir Erasmus Wilson's Chair of Pathological Anatomy at, 301
Abney (Capt., F.R.S.), Solar Physics, 162, 187, 252
Absolute Sine Electrometer, Geo. M. Minchin, 290
"Abyssinia," Father Lobo's, 365
Accidents in Mines Commission, 97
Accumulators, Planté and Faure, Chemistry of the, Dr. J. H. Gladstone, F.R.S., and Alfred Tribe, 221, 461
Acetylene, the Spectrum of, 290
Acoustics, Light and Heat, Thomas W. Piper, 51
Actinium, a New Metal, 394
Adams (Prof. W. Grylls, F.R.S.), Magnetic Disturbances, Auroras, and Earth Currents, 66
Africa: Dr. Stecker's Exploration of Lake Tana, 209; Reimer's "Beiträge zur Entdeckungsgeschichte Afrika's, 232; Ravenstein's New Map of East Central, 250; Relief Map of the Equatorial Region of, 275; German Exploration of, 302; Dr. Max Buchner's exploration of the Lunda District, 395
Agram, Earthquake at, 63, 186, 326
Ainos, Bear Festival among the, 345
Air, Essays on the Floating Matter of the, in Relation to Putrefaction and Infection, John Tyndall, F.R.S., 6
Algæ, British Freshwater, Dr. M. C. Cooke's Work on, 565
Algæ and Animals, Symbiosis of, 377
Algebra, E. J. Gross, 458
Algerian System of Meteorological Observàtions, 492
Alglave (Ém.), and J. Boulard, "La Lumière Electrique son Histoire, sa Production, et son Emploi," 359
Algol Type, Variable of the, 186
Allen (Chas. H.), Parhelia in the Mediterranean, 339
Allen (Grant), "Vignettes from Nature," 381, 435, 459, 480, 554
Alps, Prof. Civiale's work on the, 519
Amazons and Andes, between the, or Ten Years of a Lady's Travels in the Pampas, Gran Chaco, Paraguay and Matto Grosso, Mrs. M. G. Mulhall, 457
America: "American Naturalist," 47, 210, 426; "American Journal of Science," 257; American Association for the Advancement of Science, 324; "The Honey Ants of the Garden of the Gods, and the Occident Ants of the American Plains," Dr. Henry C. McCook, G. J, Romanes, F.R.S., 405
Amorphophallus Titanum, 206
Ancient Monuments, Preservation of, 393
Andaman Islands, Earthquake in the, Col. H. H. Godwin-Austen, 386
Andromeda, the Great Nebula in, Rev. T. W. Webb, 341
Anemometers: Integrating, V. Ventosa, 79; Proposed Exhibition of, 249, 450; J. K. Laughton on, 547
Animals: Illustrations of New or Rare, in the Zoological Society's Living Collection, 295, 391, 608
Animals Containing Chlorophyll, Researches on, Patrick Geddes, 303, 361; Prof. H. N. Moseley, F.R.S., 338; Dr. E. Percival Wright, 361
Animals, Symbiosis of Algæ and, 377
Animals, on the Sense of Colour among some of the Lower Animals, Sir J. Lubbock Bart., F.R.S., 422
Animals, Aristotle on the Parts of, translated by W. Ogle, Dr. B. W. Richardson, F.R.S., 453 505
Annalen der Physik und Chemie, 142, 282, 401, 522
Ant Trap, Natural, J. Harris Stone, 151
Antarctic Expeditions, 473, 613
Anthropological Institute, 71, 143, 235, 355, 380, 451, 475, 499, 571, 619
Antiseptic, New, Prof. Barff's, 535
Anti-vivisection, *versus* Humanity, 73
Antlers in the Ruminants, Evolution of, Prof. W. Boyd Dawkins, F.R.S,, 84
Ants, Sound-producing, H. F. Blanford, 32; J. Fotheringham, 55; D. M. Lewis, 266
Apiculture, International Exhibition of, 493
"Appalachia," 493
Apus, Limulus and Scorpio, Studies on, Prof. E. Ray Lankester, F.R.S., 479
Archæological Discovery at Angleur, near to Liége, 419
Archer (F.), Replacing Flint Flakes, 8
Archibald (E. Douglas), Variations in the Sun's Heat, 316; Conservation of Solar Energy, 504
Architects, Institution of Naval, 533
Archives des Sciences Physiques et Naturelles, 257, 401, 522, 618
Arctic Research: Dr. J. Rae, F.R.S., 53, 102; Clements R. Markham, C.B., F.R.S., 78; D. Wetterham, 102; General Hazen on, 112; the Search for the *Jeannette*, 44, 62, 89, 275, 326, 350, 375; the *Eira* Expedition, 123, 209; the Season of 1881, 136; International Polar Research, 113; Ice Fields in the Arctic Regions, 536; an Arctic Night at the Geograghical Society, 159; Arctic Success and Disaster, 169
Arendts (Dr. Carl), Death of, 63
Argentine Republic, Cameos from the Silver Land; or, the Experiences of a Young Naturalist in the, E. W. White, 480
Argyll (Duke of, F.R.S.), Struggle of Parts in the Organism, 6
Aristotle on the Parts of Animals translated by W. Ogle, Dr. Benjamin Ward Richardson, F.R.S., 453, 505
Aristotle on the Heart, W. Ogle, 528
Aristology; or, the Art of Dining, Thos. Walker, 478
Aroid, a Gigantic, 206
Arosenius (Herr J. N.) on the Ethnographical Frontier between Finns and Swedes in Northern Sweden, 113
Artificial Deformation of the Human Skull in the Malay Archipelago, Dr. A. B. Meyer, 132
Asbestos Paint, Experiments with, at the Crystal Palace, 276
Asia, Central, Dr. Regel's Journey in, 349
Askabad and Sarakhs, Levelling of the Country between, 421
"Astral Origin of the Emblems and Hebrew Alphabet," J. H. Broome, Prof. A. H. Sayce, 525
Astronomy: Astronomical Column, 19, 43, 94, 114, 126, 186, 209, 218, 278, 326, 349, 375, 421, 450, 471, 493, 519, 538, 566, 593, 616; Webb's Celestial Objects for Common Telescopes, 98; Observatory added to the University of St. Petersburg, 230; Astronomical Observations, on the Climate of North Northumberland as regards its fitness for, Rev. Jevon J. Muschamp Perry, 317, 364; J. Lingwood, 339; New Astronomical Magazine; "Les Etoiles et les Curiosités du Ciel," C. Flammarion, 456; "Populäre Astronomie von Sim. Newcomb, Astronom in Washington," Dr. Phil, 456
Atacama, Climate of, Hyde Clarke, 9
Atkinson (A. S.), Telescopic Definition in a Hazy Sky, 483
Atlantic, Chemistry of the, J. Y. Buchanan, 387, 411
Atlas of Universal Geography, Stanford's London, 383
Atmosphere, Movements of Jupiter's, W. Mattieu Williams, 338; G. H. Darwin, F.R.S., 360
Atmospheric Phenomenon, J. B. Hannay, 125
Atomic Weights, Prof. F. W. Clarke's Recalculations of, 537
Atti della R. Accademia dei Lincei, 305, 353, 545
Attitudes retained by Soldiers who have Died on the Battlefield, 230
Audible Photometer, J. W. Giltay, 125
Aurora, the, 319, 368
Auroras, Earth Currents, and Magnetic Disturbances, Prof. W. Grylls Adams, F.R.S., 66
Aurora and its Spectrum, J. Rand Capron, 53
Auroral Display, Thos. Gwyn Elger, 386; W. G. Koch, 461
Australia, Water in, F. T. Mott, 507; Sparrows in South, 18
Autumn Sky, Rev. T. W. Webb, 9, 36
Aveling (Edward B.), Natural Philosophy for London University Matriculation, 76
Awned Carpels of Erodium, Prof. G. Macloskie, 174
Axon (W. E. A.), Pronunciation of Deaf-Mutes who have been Taught to Articulate, 101, 409
Ayrton (Prof. W. E., F.R.S.), on the Economical Use of Gas-Engines for the Production of Electricity, 280; Storage of Energy, 495

Baboon, Pet, Julia Wedgwood, 217
Badcock (J., jun.), Red Flints in the Chalk, 529
Baildon (Sam.), "Tea Industry in India; a Review of Finance and Labour, and a Guide for Capitalists and Assistants," 551
Balfour's (F. M., F.R.S.), Treatise on Comparative Embryology, Prof. E. Ray Lankester, F.R.S., 25
Ball (Prof. Robert S., F.R.S.), a Glimpse through the Corridors of Time, 79, 103
Balloons: Accident to W. Powell, M.P., 159, 185, 208; Rime Cloud observed in a Balloon, W. de Fonvielle, 337, 436, 529; Dr. Hermann Kopp, 385, 507; Proposed Balloon Journey across the Channel, 373; Balloon Ascent from La Villette Gasworks, Paris, 373; Col. Brine and Mr. Simmons' Expedition, 449; Col. Burnaby's Trip across the Channel, 518
Barff's (Prof.) New Antiseptic, 535
Barnard (E. E.), Meteors, 173
Barometer, New, Marshall Delaey, 290; Simple Registering, 374; Electric Barometer, J. Joly, 559
Barrett (Prof. W. F.), Antoine Breguet's Appropriations, 364
Basque Provinces of Spain, on the Whale Fishery of the, Clements B. Markham, F.R.S., 365
Basque Whale in the Mediterranean, Prof. Henry Hillyer Giglioli, 505
Bast Fibre, Chemistry of, C. F. Cross and E. J. Bevan, 351
Bastian (Adolf.), "Die heilige Sage der Polynesier-Kosmogonie und Theogonie," Edward B. Tylor, F.R.S., 28; "Der Völkergedanke in Aufbau einer Wissenschaft vom Menschen, und seine Begründung auf ethnologische Sammlungen, 77; "Die Vorgeschichte der Ethnologie," 77
Batoum, Shock of Earthquake at, 250
Batrachia, Salientia, and Ecaudata in the Collection of the British Museum, Catalogue of the, G. A. Boulenger, 601
Battery, New Electrical Storage, Henry Sutton, 198
Bauerman (Hilary), "Text-Book of Systematic Mineralogy," L. Fletcher, 49
Bavaria, Earthquakes in, 375
Bear Festival among the Ainos, 345
Bees, Dangers arising from, 420
Bela Lime Alps, Cave discovered in, 89
Belgium, Astronomy in, 537
Bell (Alex. Melville), Sounds and their relations, 503
Bell (F. Jeffrey), Teaching of Practical Biology, 8
Bell (Prof. Graham), Probing by Electricity, 40; Pronunciation of Deaf-Mutes who have been taught to articulate, 124, 458
Ben Nevis, Meteorology of, Alex. Buchan, 11; the Meteorological Observatory on, 135; Clement L. Wragge's Meteorological Observations on, 491; Ascent of, 372
Berlin: Geographical Society, 44; Zeitschrift of, 538; Banquet in Honour of Prof. Virchow at, 62, 87; Aëronautical Society founded at, 89; Philosophical Society of, 114; African Society of, 302; Society of Commercial Geography, 492; Physiological Society, 620
Beryl and Tourmaline, Specimens of, at the Florence Institute, 373
Bevan (E. J.) and C. F. Cross, Chemistry of Bast Fibre, 351
"Bilderschriften des Ostindischen Archipels und der Südsee," 17
Bilek, Earthquake at, 537
Billet (M. Felix), Death of, 395
Binary Stars, 421; γ Virginis, 19; η Cassiopeiæ, 186
Binney Edward William, F.R.S.), Obituary Notice of Dr. J. P. Joule, F.R.S., 293
Biology: Teaching of Practical, F. Jeffrey Bell, 8; Biology in Schools, Geo. W. Peckham, 151; Biological Notes, 327; "Biologische Probleme, zugleich als Versuch einer rationellen Ethik," W. H. Rolph, 336
Birds: Jurassic, and their Allies, Prof. O. C. Marsh, 22; Dr. R. W. Schufeldt on the Osteology of, 136; New Birds from the Solomon Islands, 282; Intelligence in Birds, 410; Mrs. E. Hubbard, 461
Birmingham (J.), New Red Star in Cygnus, 198, 484
Birt (W. R.), Death of, 219
Bischoffsheim Observatory, 199
Bivalves, on the Dispersal of Freshwater, Chas. Darwin, F.R.S., 529; D. Pidgeon, 584; Frank J. Rowbotham, 605
Bjerknes' Hydrodynamic Experiments, 271
Black Bass, Book of the, Dr. J. A. Henshall, 216
Blackley (Chas. H.), Heads and Hats, 55
Blanford (H. F.), Sound-producing Ants, 32
Bloxam (Prof.) and the Royal Military Academy, 591
Blum (R.), Current Meter, Prof. Harlacher, 494
Bock (Carl), "Head-Hunters of Borneo: a Narrative of Travel up the Mahakkam and down the Barito, also Journeyings in Sumatra," Alfred R. Wallace, 3
Bokorny (Thos.) and Oscar Loew, "Chemical Cause of Life Theoretically and Experimentally Examined," 457
Bolometer, the, 14
Bonney (Rev. T. G.) Silurian Fossils in the North-West Highlands, 603
Borneo, Head-Hunters of: a Narrative of Travel up the Mahakkam and down the Barito, also Journeyings in Sumatra, Carl Bock, Alfred R. Wallace, 3
Boston, U.S.A., American Academy of Arts and Sciences, 260, 523; Society of Natural History, 1830-1880, 389
Boston Church, Meteorological Observations made on, 470
Boué (Ami), Obituary Notice of, by Prof. A. Geikie, F.R.S., 109
Bouillaud (Dr.), Death of, 42
Boulard (J.), and Em. Alglave "La Lumière Electrique son Histoire sa Production et Son Emploi," 359
Boulenger (G. A.), Catalogue of the Batrachia, Salientra and Ecaudata in the Collection of the British Museum, 601
Bowman (W., F.R.S.), elected Honorary Secretary to the Royal Institution, 346
Brady (Sir Antonio), Obituary Notice of, Dr. Henry Woodward, F.R.S., 174
Bramsen (William), Death of, 160
Breguet's (M. Antoine) Appropriations, Prof. W. Barrett, 364
Bress (Dr. A.), Abriss der Zoologie für Studirende Ärzte und Lehrer, 337
Brewster (Sir David), his Scientific Work, 157
Bridges, Tay and the Forth, 246
Brighton Health Congress, and Domestic and Scientific Exhibition, 18, 161, 175
Bristol Naturalists' Society, Proceedings, 208
British Association, Meeting for 1882, 324
British Museum, Fossil Fishes at the, 418
Brittany, disappearance of the Sardine from the Coast of, 493
Broome (J. H.), "Astral Origin of the Emblems and Hebrew Alphabet," Prof. A. H. Sayce, 525
Brown (Robert, Jun.), the Unicorn and Mythological Investigation, Prof. A. H. Sayce, 525
Brownell (J. T.), Solar Halo, 290
Bubbles, Phenomena of the Bursting of, M. Plateau on, 160
Buchan (Alex.), Meteorology of Ben Nevis, 11
Buchanan (J. Y.), Chemistry of the Atlantic, 387, 411
Budden (W.), Vignettes from Nature, 529
Buenos Ayres, Continental Exhibition at, 591
"Bugs, Overflow," in California, C. V. Riley, 386
Bulletin de l'Academie Royale des Sciences de Belgique, 48, 257, 545, 617
Bulletins de la Société d'Anthropologie de Paris, 545
Bulletin de la Société Impériale des Naturalists de Moscou, 571
Bulletin of the Terry Botanical Club, 571
Burg (Adam von), Death of, 372
Burnaby (Col.), Balloon Trip across the Channel, 518
Burrowing Larvæ, V. T. Chambers, 529
Bussy (M. Antoine Alexander Brutus), Death of, 395
"Butterflies: their Structure, Changes, and Life Histories, with Special Reference to American Forms," being an application of the "Doctrine of Descent" to the Study of Butterflies, Sam. H. Scudder, 5

Cable, the Dover and Calais, 206
Cœsium, the Isolation of, 419
California, "Overflow Bugs" in, C. V. Riley, 386
Callaway (C.), Hypothetical High Tides, 385, 436
Caltanisetta, Sicily, Series of Caverns Discovered at, 250
Cambridge, the New Professorship of Morphology, 543
Cameos from the Silver Land: or, the Experiences of a Young Naturalist in the Argentine Republic, E. W. White, 480
Cameron (Donald), a Strange Phenomenon, 437
Canada, Proposed Academy for, 326
Capron (J. Rand), Aurora and its Spectrum, 53; Solar Gas-flame and Electric Light Spectra, 152; Temporary Retinal Effects, 507
Carbon, Electrical Resistance of, under Pressure, H. Tomlinson, 459; Prof. Silvanus P. Thompson, 482
Carbon, on the Spectrum of, Prof. Liveing and Dewar, 545
Carbonate of Ammonia, Action of, on the Roots of Certain Plants, and on Chlorophyll Bodies, Chas. Darwin, F.R.S., 489
Carnac, Excavations at, James Miln, 99

Carpels, Awned, of Erodium, Prof. G. Macloskie, 174
Carpenter (Dr. William B., F.R.S.), Struggle of Parts in the Organism, 6, 52, Vignettes from Nature, 435, 480, 554, the Microscope and its Revelations, 502
Cassell's Popular Natural History, Edited by P. Martin Duncan, F.R.S., 107
Cassiopeiæ, Binary Star η, 186
Castelfrentano, Earthquake at, 420
Cat, the, St. George Mivart, F.R.S., 286
"Catalytic Action," so-called, 567
Caucasus, the Geology of, 277
Cave discovered in the Bela Lime Alps, 89
Cecil (Henry), Meteor, 78
"Celestial Objects for Common Telescopes," Rev. T. W. Webb, 98
Cell, on an Experimental Form of Secondary, Prof. A. S. Herschel, 363, 527
Centaurea jacea, Polymorphism of the Flower Heads of, Dr. Hermann Müller, 241
Central Asia, Dr. Regel's Journey in, 349
Ceraski's Variable Star U Cephei, 493
Cerebral Localisation, Prof. Sigmund Exner, Dr. David Ferrier, 214
Cerium Metals, New Compounds of, 568
Ceylon, the Lepidoptera of, Henry Trimen, 32, 338; F. Moore, 79; the New Ceylon, 315
Chalk, Red Flints in the, W. Fream, 437; J. Badcock, jun., 437
Challenger, Echinoids of the, Prof. H. W. Mackintosh, 41; Pressure Errors of the *Challenger* Thermometers, Prof. P. G. Tait, 90, 127
Chambers (V. T.), Burrowing Larvæ, 529
Channel Tunnel, A. Strahan, 463; Tele-dynamics and the Accumulation of Energy—their Application to the, E. Walker, 152
Charts, Daily Weather, in the North Atlantic, 605
Chemistry: an Error in the commonly-accepted Theory of, Prof. A. W. Williamson, F.R.S., 21; Chemical Society, 48, 95, 167, 192, 331, 379, 427, 474, 546, 547, 595, 619; "A Treatise on Chemistry," H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S., H. Watts, F.R.S., 50; Student's Handbook of Chemistry, H. Leicester Greville, 123; Inorganic Chemistry, Theoretical and Practical, W. Jago, 150, 364; Practical Chemistry, J. Howard, 150; Chemistry of the Planté and Faure Accumulators, Dr. J. H. Gladstone, F.R.S., and Alfred Tribe, 221, 461; Annals of Chemical Medicine, Dr. J. L. W. Thudicum's 263; Chemistry of Bast Fibre, C. F. Cross and E. J. Bevan, 351; Chemistry of the Atlantic, J. Y. Buchanan, 387, 411; "Chemical Cause of Life Theoretically and Experimentally Examined," Oscar Loew and Thos. Bokorny, 457; Chemical Notes, 567; "Chemical Repulsions," 567
Chesterfield, Electric Light at, 42
Chieti, Earthquake at, 420
China: Telegraph in, 88; Competitive Examinations in, 160; Medical Women in, 206; Experiments in the Culture of Chinese Soja Bean, 250; Earthquakes in, 325; Gray's Anatomy translated into Chinese, 394; Scientific Lectures in Chinese at the Schools in Peking, 449; E. C. Baber's Travels and Researches in Western, 472; Railways in, 493; a System of Meteorological Observations in the China Seas, 368; Dr. A. Woeikof, 410; Chinese Burial in Former Times, 518; Dr. Bretschneider on Chinese Botany, 614
Chios, Earthquake at, 492
Chisholm (G. G.), the Two Hemispheres: a Popular Account of the Countries and Peoples of the World, 337
Chlorophyll, Researches on Animals containing, Patrick Geddes, 303, 361; Prof. H. N. Moseley, F.R.S., 338; Dr. E. Perceval Wright, 361
Chlorophyll Bodies, Action of Carbonate of Ammonia on the Roots of certain Plants and on, Chas. Darwin, F.R.S., 489
Christie (W. H. M., F.R.S.), Sun-Spots, 337
Christison (Sir Robert), Death of, 324; Obituary Notice of, 339
Chrystal (Prof. G.), Treatise on Electricity and Magnetism, 237
"Cinchona," 420
City and Guilds of London Institute, Distribution of Prizes and Certificates in the Schools connected with, 161
Clark (J. Edmund), Phenological Observations on Early Flowers and Winter Temperatures, 552
Clarke (Hyde), Climate of Atacama, 9; Alleged Diminution in the Size of Men's Heads, 32
Clenching of Hands from Emotional and other Causes in the two Sexes, on the, Arthur Stradling, 364
Climate of Atacama, Hyde Clarke, 9
Climate of North Northumberland as regards its Fitness for Astronomical Observations, Rev. Jevon J. Muschamp Perry, 317, 364; J. Lingwood, 339
Climate, Glaciers and Glacial Periods in their Relation to, Dr. A. Woeikof, 424
Cloud, Rime, observed in a Balloon, W. de Fonvielle, 337, 436, 529; Dr. Hermann Kopp, 385, 507
Coal-Seams, Possibility of finding, workable under the London Area, Prof. J. W. Judd, F.R.S., 311, 361
Cobbe (Miss Frances Power), and Vivisection, H. H. Johnston, 459; Muffs and Vivisection, 483
Cohn (Dr. Ferdinand), "Die Pflanze. Vorträge aus dem Gebiete der Botanik," W. Botting Hemsley, 359
Coins, Old, Transformation of, in a Lake, 93
Coins of the Jews, International Numismatic Orientalia, Fred. W. Madden; Dr. John Evans, F.R.S., 549
Cole (Sir Henry), Death of, 590; Obituary Notice of, 611
Collet (A.), "Traité Théoretique et Pratique de la Régulation et de la Compensation des Compas, 382
Collieries, Dust-Explosions in, Prof. T. E. Thorpe, F.R.S., 488
Colliery Explosions, Means of Saving some Lives in, D. Rhys Jones, 508
Colorado River, Excavations of the Grand Cañons, 565
Colour, Experiments on, Lord Rayleigh, F.R.S., 64
Colour and Sound, Karl Pearson, 339
Colour, on the sense of, among some of the Lower Animals, Sir J. Lubbock, Bart., F.R.S., 422
Colours of Flowers, Seasonal Order in, Dr. J. C. Costerus, 481
Colours of Low-growing Wood Flowers, J. Innes Rogers, 554
Colour Perception, J. B. Hannay, F.R.S., 604
Colour-Disks, on Combining, Char. K. Wead, 266
Coltsfoot, T. S. Maskelyne, 290
Comets: Comet 1881 *f* (Denning), 19, 126, 413; Great Comet of 1861, 94; Photograph of Comet B, 1881, 132, 218; the Great Comet of 1881, 278, 349, 519; a New Comet, 126, 521; Comets of Short Period, 209; Comet 1882 *a*, 538, 593; Systematic Search for Comets, 566; the Present Comet. 616
Comparative Embryology, Treatise on, F. M. Balfour's, F.R.S., Prof. E. Ray Lankester, F.R.S., 25
Compass, "Traité Théorique et Pratique de la Régulation et de la Compensation des Compas," A Collet, 382
Compressed Air upon Tramways, W. D. Scott Moncrieff, 266
Comstock Lode, Temperatures of the Ground in, 592
Conductivity, Thermal, Specific Heat and, H. G. Madan, 507
Coniferæ, Chapter in the History of, the Podocarpeæ, J. Starkie Gardner, 228
Conservation of Solar Energy, Dr. C. W. Siemens, F.R.S., 440, 504, 603; E. Douglas Archibald, 504; Prof. Chas. Morris, 601; Dr. J. Sterry Hunt, 602
Constable (Samuel), Geometrical Exercises for Beginners, 457
Constance, the Lake of, 348
Consumption, Physiognomy of, Francis Galton, F.R.S., and Dr. F. A. Mahomed, 389
Copper, on the Electrolysis of Sulphate of, G. Gore, LL.D., F.R.S., 473
Coral, Precious, Prof. H. N. Moseley, F.R.S., 510; Prof. Henry Hillyer Giglioli, 552
Cordoba, Observatory of, 349
Corfield (W. H.), Fumifugium, 151
Corridors of Time, a Glimpse through, Prof. Robert S. Ball, LL.D., F.R.S., 79, 103; Dr. A. Dupré, 217; Prof. T. H. Huxley, F.R.S., 241
Costa Rica, Earthquake in, 471
Costerus (Dr. J. C.), Seasonal Order in Colours of Flowers, 481
Cricket's Chirp varying with the Temperature, 229
Cross (C. F.) and E. J. Bevan, Chemistry of Bast Fibre, 351
Crystal Palace Electrical Exhibition, 16, 62, 135, 275, 292; Lectures in Connection with, 394; Edison's Electric Light at, 446; Land Telegraphy, 515; Experiments with Asbestos Paint at the, 276; "Electrical Accumulators" at, 561
Crystallography: "Rammelsberg's Handbuch der Krystallographisch; Physikalischen Chemie," 287
Cumming (G. F. Gordon), Lady's Cruise in a French Man-of-War, 289
Currents, Earth-, W. H. Preece, F.R.S., 289; William Ellis, 315; Rev. S. J. Perry, F.R.S., 316; G. M. Whipple, 316; J. Parnell, 316
Current Meter of Prof. A. R. Harlacher, R. Blum, 494
Cyanogen, Prize for the Investigation of the Chlorides, &c., of, 420

Cygni, New Red Star in, J. Birmingham, 198; Variable, 1881, J. Birmingham, 484

D'Abbadie (Antoine), Function of the Ears on the Perception of Direction, 172
Danish Society for the Protection of Animals, 300
Dakota Group, Fossil Insects of the, Dr. H. A. Hagen, 266
Daltonism, Curious Case of, 492
Dante and the Southern Cross, Dr. Samuel Wilks, 173; J. J. Walker, 173, 217; N. Perini, 197
Darkness, Mid-day, of Sunday, January 22, J. Herschel, 289
Darwin (Chas., F.R.S.), Parasitic Habits of Molothrus, 51; Action of Carbonate of Ammonia on the Roots of Certain Plants and on Chlorophyll Bodies, 489; on the Dispersal of Freshwater Bivalves, 529; Obituary Notice of, by Prof. T. H. Huxley, F.R.S., 597
Darwin (Francis), Prof. Wiesner on the Power of Movement in Plants, 578, 597; Geotropism and Growth, 616
Darwin (G. H., F.R.S.), Lunar Disturbance of Gravity, 20; Geological Importance of the Tides, 213; Movements of Jupiter's Atmosphere, 360
Davis (Geo. E.), Practical Microscopy, 502
Dawkins (Prof. W. Boyd, F.R.S.), on tke Evolution of Antlers in the Ruminants, 84
Dawson (J. W., F.R.S.), Erect Trees in Coal Formations, 354
Daylight Observation of Stars, Earliest, 421
Deaf Mutes who have been taught to Articulate, Pronunciation of, W. E. A. Axon, 101, 409; Dr. Alex. Graham Bell, 124, 458; F. J. Faraday, 458
Decaisne (Prof. Joseph), Death of, 372; Obituary Notice of, W. T. Thiselton Dyer, 390
Deep-Sea Exploration in the Mediterranean, Prof. Henry Hillyer Giglioli, 505
Defences, our National, 261
Deformity, Fashion in, as Illustrated in the Customs of Barbarous and Civilised Races, W. H. Flower, F.R.S., 480
De La Rue's Diaries, &c., 161
De La Rue (Dr. Warren, F.R.S.), Elected Manager of the Royal Institution, 346
Delta, Proposed Excavations in the, 537
Denning (W. F.), Markings on Jupiter, 223; Remarkable White Spot on Jupiter, 265; Comet *f* 1881, 126, 413
Desor (M.), Death of, 449
Determinants, Introduction to, with numerous Examples, William Thomson, 216
Determinants, Treatise on the Theory of, with Graduated Sets of Exercises for use in Colleges and Schools, T. Muir, 551
Deutsche Geographische Blätter, 232
Dewar (Prof.), and Prof. Liveing on the Spectrum of Carbon, 545
Dillinger, near Saarlouis, Discovery at, 250
Dining, Aristology; or the Art of, Thos. Walker, 478
Dinosauria, Classification of the, Prof. O. C. Marsh, 244
Dioneæ, the Electromotive Properties of the Leaf of, Prof. Burdon Sanderson, F.R.S., 258
Dipladenia amabilis, Mrs. Mulholland, 79
Diseases of the Nervous System, Treatise on, Dr. James Ross, 172
Dispersal of Freshwater Bivalves, Charles Darwin, F.R.S., 529; D. Pidgeon, 584; Frank J. Rowbotham, 605
Distant (W. L.), "Rhopalocera Malayana," 300
Dixon (William Gray), "Land of the Morning; an Account of Japan and its People," 384
Döderlein (Dr. L.), on Oshima, 43
Double Stars, 43; Observations of, made at the United States Naval Observatories, Prof. Asaph Hall, 122
Draper (Prof. J. W.), Death of, 248; Obituary Notice, 274
Du Chaillu (Paul B.), "Land of the Midnight Sun," 59
Duncan (P. Martin, F.R.S.), Popular Natural History, 107; Morphology of the Temnopleuridæ, 257
Dungeness or Denge-nesse, Sea-shore Alluvion, J. B. Redman, 583
Dupré (Dr. A.), Glimpse through the Corridors of Time, 217
Dust, Collection of Meteoric—a Suggestion, B. J. Hopkins, 339
Dust-Explosions in Collieries, Prof. T. E. Thorpe, F.R.S., 488
Dutch East Indies, New Map of, 19
Duthie (J. F.), Curious Formations of Ice, 78
Dutton (Capt. C. E.), the Excavations of the Grand Cañon of the Colorado River, 565
Dyer (W. T. Thiselton, F.R.S.), Obituary Notice of Prof. Joseph Decaisne, 390

Ears, Function of the, or the Perception of Direction, S. E. Peal, 124; Antoine D'Abbadie, 172
"Earth's Crust, Physics of the," Rev. Osmond Fisher, Rev. E. Hill, 433; Prof. A. H. Green, 481
Earth-Currents, W. H. Preece, F.R.S., 289; William Ellis, 315; Rev. S. J. Perry, F.R.S., 316; G. M. Whipple, 316; J. Parnell, 316
Earth-Currents, Magnetic Disturbances, Auroras, and, Prof. W. Grylls Adams, F.R.S., 66
Earthquakes: at Agram, 63, 186, 326; on the Continent, 87; at Izentes and Izarvas, 87; in Switzerland, 137, 208; at Sion and Sierre, 161; at Kiangari in the Province of Kastamoumi, 231; at Iquique, 302; in China, 325; in Bavaria, Roumania, and Hungary, 375; in the Andaman Islands, Col. H. H. Godwin-Austen, 386; in North Schleswig and South Jutland, 396; at Chieti and Castelfrentano, 420; at Tongatabu, 450; in Costa Rica, 471; at Chios, 492; at Roverado, Olivone, Bellinzona, St. Johann, and Metkovich, 492; at Ljubinge, Trebinje, and Bilek, 537; Earthquake Vibrations, Prof. John Milne, 126
Eaton (Rev. A. E.), *Eira* Arctic Expedition, 123
Echinoids of the *Challenger*, Prof. H. W. Mackintosh, 41
Eclipses: Lunar Eclipse on December 5, 114; Total Solar Eclipse of May 17, 375, 450, 472, 587, 594; Eclipse Notes, J. Norman Lockyer, F.R.S., 573
Edinburgh: Royal Society, 120, 192, 259, 380, 403, 427, 476, 523, 572, 595; the Chair of Natural History at, 469, 607; Fishery Exhibition at, 530, 589; Pisciculture in the, 606; Honorary Degrees, 517
Edison's Electric Light, Electricity at the Crystal Palace, 446
Education Code, the New, and Science-teaching, 536
Education in Japan, 186; Science in Education, Sir Stafford Northcote, 206; Scientific Education in Liverpool, 270; Technical Education, 477
Eel, Life History of the, 610
Egg, Double, E. Howarth, 174
Egypt of the Past, Erasmus Wilson, F.R.S., 74
Eira Arctic Expedition, 112, 209; Rev. A. E. Eaton, 123
Electricity: Electric Tramway, 13; Electrical Exhibition at the Crystal Palace, 16, 62, 135, 275, 292; Lectures in connection with the, 394; Edison's Electric Light, 446; Land Telegraphy, 515; Jurors, 536; "Electrical Accumulators," 561; List of the Rare and Curious Books relating to Electricity, 18; Probing by Electricity, Prof. Graham Bell, 40; Exhibition at St. Petersburgh, 230; Electric Light at the Paris Opera, 18, 42; Photographic Experiments with Electric Light, 54; Spectrum of the Electric Light, J. Hopkins Walters, 103; J. Rand Capron, 152; Fire Risks of Electric Lighting, 223; Electric Light in a Paris Bank, 347; Flashing Signals by Electric Light, 493; Electric Light between Hatton Garden and the Old Bailey, 564; Siemens' Electrical Railway, 42; Train of Pullman Carriages Lighted by Electricity, 138; Scheme for Lighting the Quarters of the Prefecture of the Seine in the Tuileries with Electricity, 230; Prof. J. Clerk Maxwell's Electricity and Magnetism, Prof. G. Chrystal, 237; New Electrical Storage Battery, Henry Sutton, 198, 331; Edmund P. Toy, 289; on the Economical Use of Gas-engines for the Production of Electricity, Prof. W. E. Ayrton, F.R.S., 280; "La Lumière Electrique, son Histoire, sa Production et son Emploi," Em. Alglave and J. Boulard, 359; Electrical Resistance of Carbon under Pressure, H. Tomlinson, 450; Prof. Silvanus P. Thompson, 482; a New Electric Regulator, 450; the Discharge of Electricity by Heat, 475; Exhibition of Electricity at Vienna, 518; Medical Electricity 521; Elementary Lessons in Electricity and Magnetism, Silvanus P. Thompson, 550; Electric Barometer, J. Joly, 559; Application of Electricity to Ship's Logs, 584
Electrolysis of Sulphate of Copper, on the, G. Gore, M.D., F.R.S., 473
Electrolytic Diffusion of Liquids, Dr. G. Gore, F.R.S., 234
Electrometer, Absolute Sine, Geo. M. Minchin, 290
Electromotive Force, Determination of, in Absolute Electrostatic Measure, Geo. M. Minchin, 278
Electromotors, Little, 226
Elements, New, 394
Elger (Thos. Gwyn), Auroral Display, 386
Ellis (William), Earth-Currents, 315
Elm, Annihilation of, 63
Elsden (J. Vincent), Hypothetical High Tides, 408
Elton (Chas.), "Origins of English History," Edward B. Tylor, F.R.S., 501

Embryo of Azolla, Prothalluim and, 327
Embryology, Treatise on Comparative, F. M. Balfour's, F.R.S., Prof. E. Ray Lankester, F.R.S., 25
Encyclopædia Britannica, 313
Encyclopædic Dictionary, a New and Original Work of Reference to all the Words in the English Language, Robert Hunter, 288
Encyklopædie der Naturwissenschaften, 114
Energy, Accumulation of and Tele-dynamics, their Application to the Channel Tunnel, E. Walker, 152
Energy, Storage of, Prof. W. E. Ayrton, F.R.S., 495
England, Geology of the Counties of, and of North and South Wales, W. Jerome Harrison, 408
England, Making of, J. Richard Green, 415
English History, Origins of, Chas. Elton, Edward B. Tylor, F.R.S., 501
Entomological Society, 120, 235, 332, 403, 475, 619
"Eophyton," A. G. Nathorst, 483
Epping Forest Field Club, Transactions of, 208
Equatorial Solar Spot, Wentworth Erck, 481
Erck (Wentworth), Equatorial Solar Spot, 481
Erodium, Awned Carpels of, Prof. G. MacLoskie, 174
Essex Field Club, 394; at the Natural History Museum, 537
Ethnographical Sciences, International Congress for at Geneva, 208
Etna, Mount, Proposed Railway to the Summit of, 395; Active Condition of, 565, 615
Etna Observatory, 301, 394
Eubœa, Island of, reported Discovery of Fossil Human Remains, 346
Evans (W. F.), Solar halo, 386
Evolution of the Palæozoic Vegetation, J. S. Gardner, 8
Evolution of Antlers in the Ruminants, Prof. W. Boyd Dawkins, F.R.S., 84
Exner (Prof. Sigmund), "Untersuchungen über die Localisation der Functionen in der Grosshirnrinde des Menschen," Dr. David Ferrier, 214
Explosions, Dust-, in Collieries, Prof. T. E. Thorpe, F.R.S., 488
Eye, Gas-Flame, Electric and Solar Spectra and their Effects on the, Prof. W. H. Pickering, 340

Faber (Rev. E.), the Mind of Mencius, 99
Fairbairn (Sir William), Death of the Widow of, 277
Falling Water, Moths attracted by, J. Starkie Gardner, 436
Faraday (F. J.), Pronunciation of Deaf Mutes who have been taught to Speak, 458
Fashion in Deformity, as illustrated in the Customs of Barbarous and Civilised Races, W. H. Flower, F.R.S., 480
Fata Morgana observed at Rügenwalde, 88
Fauna and Flora of the White Sea, 328
Feeding, Food and, Sir Henry Thompson, 478
Ferrier (Prof.) charged with a Breach of the Vivisection Act, 42; Cerebral Localisation, Prof. Sigmund Exner, 214
Fiji, a Year in; or, an Inquiry into the Botanical, Agricultural, and Economical Resources of the Colony, John Horne, 527
Fire-Extinguishers, Maxim's Self-Acting, 511
Fire-flies, the Spectrum of the Light of, 277
Fire Risks of Electric Lighting, 223
Fish, New and very Rare, from the Mediterranean, Prof Henry H. Giglioli, 535
Fisher (Rev. O., F.R.S.), Physical Cause of the Ocean Basins, 243; "Physics of the Earth's Crust," Rev. E. Hill, 433; Prof. A. H. Green on, 481
Fisheries, Report of the German Union, 208
Fisheries Exhibition, International, 410
Fishery Exhibition at Edinburgh, 530, 589
Flammarion (C.), "Les Étoiles et les Curiosités du Ciel, 456
Fletcher (L.), "Text-Book of Systematic Mineralogy," by Hilary Bauerman, 49
Flint Flakes, Replacing, F. Archer, 8
Flints, Red, in the Chalk, W. Fream, 437; J. Badcock, jun, 529
Floating Matter of the Air, Essays on, in Relation to Putrefaction and Infection, John Tyndall, F.R.S., 6
Floors Palæolithic, Worthington Geo. Smith, 460
Flora of New South Wales in its Geological Aspect, 543
Flower (W. H., F.R.S), Fashion in Deformity, as illustrated in the Customs of Barbarous and Civilised Races, 480
Flowers Phenological Observations on Early and Winter Temperatures, J. Edmund Clark, 552
Flowers, Seasonal Order in Colours of, Dr. J. C. Costerus, 481
Flowers, Colours of Low-growing Wood, J. Innes Rogers, 554
Fluor-spar of Switzerland, Lenses from, 290
Fonvielle (W. de), Rime Cloud observed in a Balloon, 357, 436, 529
Food and Feeding, Sir Henry Thompson, 478
Forth and Tay Bridges, 246
Fossil Flora of Sumatra, Dr. Oswald Heer, 200
Fossil Insects of the Dakota Group, Dr. H. A. Hagen, 266
Fossil Fishes at the British Museum, 418
Fossils, Indian, 218
Fossils, Silurian, in the North-West Highlands, W. H. Huddleston, 582; Rev. T. G. Bonney, 603; Chas. W. Peach, 603
Fotheringham (J.), Sound-producing Ants, 55
France, Provincial Observatories of, 18, 126
France and Germany, Scarcity of Water in, 593
French Man of War, Lady's Cruise in, G. F. Gordon Cumming, 289
French Metropolitan Railway, 346
Fream (W.), Red Flints in the Chalk, 437
Freshwater Medusa, Further Observations on the, made during the Summer, 1881, Prof. E. Ray Lankester, F.R.S., 444
Freshwater Bivalves, on the Dispersal of, Chas. Darwin, F.R.S., 529; Frank J. Rowbotham, 605
Froth, Sea, Capt. S. P. Oliver, 268
Fulminate of Mercury, the expulsion of, 568
Fumifugium, W. H. Corfield, 151

Gaine (William Edward), Death of, 565
Galle's Method for Solar Parallax, 472
Gallium, the Atomic Weight of, 394
Galton (Francis, F.R.S.), Physiognomy of Consumption, 389
Gardner (J. S.), Evolution of the Palæozoic Vegetation, 8; Chapter in the History of Coniferæ—the Podocarpeæ, 228; Moths attracted by Falling Water, 436
Gas-Flame, Solar and Electric Light Spectra, J. Rand Capron, 152; Prof. W. H. Pickering, 340
Gas-Engines, on the Economical use of, for the Production of Electricity, Prof. W. E. Ayrton, F.R.S., 280
Gases, Resistance of, to the Motion of a Solid Body, 325
Gases and Liquids, Action of, on the Vitality of Seeds, Prof. Italo Giglioli, 328
Gautier (Jean Alfred), Death of, 137 219
Geddes (Patrick), Further Researches on Animals containing Chlorophyll, 303, 361
Gegenbaur's Morphologisches Jahrbuch, 23
Geikie (Arch., LL.D., F.R.S.), a Recent Find in British Palæontology, 1; Obituary Notice of Ami Boué, 109; Appointed Director-General of the Geological Surveys of the United Kingdom, 159; Presentation of an Address to, 544
Geminorum, Variable Star U, 450
Geneva Observatory, Micro-Telephone in the, 207
Geneva, Earthquake at, 615
Geography: Bibliography of, 19; Geographical Congress at Venice, 19, 20; Geographical Notes, 19, 43, 89, 209, 232, 302, 349, 375, 421, 472, 538; Society of Tokio, 232; Jena Geographische Gesellschaft, 346; Geographical Society, *see* Royal
Geology: International Geological Congress, 34; Geological Results of the late Gales, Prof. G. A. Lebour, 79; Geological Survey of Italy, W. Topley, 86; Prof. G. A. Lebour, 126; Geological Society, 120, 143, 235, 259, 307, 379, 451, 475, 523, 547, 618; Presentation of Medals by, 448; Geological Importance of the Tides, Dr. G. H. Darwin, F.R.S., 213; Geological Discovery at Leghorn, 249; Tidal Evolution and Geology, Dr. Samuel Haughton, F.R.S., 265; Geologists' Association, 403; Geology of the Counties of England and of North and South Wales, W. Jerome Harrison, 408; Geological and Mineralogical Map of Sutherland, M. Foster Heddle, 526; Economic Geology of India, 508, 554; Flora of New South Wales in its Geological Aspect, 543
Geometrical Exercises for Beginners, Samuel Constable, 457
Geotropism and Growth, Francis Darwin, 616
Gerland (Dr. E.), Papin, 125
Geyser, New, Discovery of, at St. Etienne (France), 493
Geysers, Models of, 374
Giebel (Dr. Chr. G. A.), Death of, 137
Giffard (Henry), Death of, 591
Giglioli (Prof. Henry Hillyer), Basque Whale in the Mediterranean, 505; Deep-Sea Exploration in the Mediterranean,

505; New and very Rare Fish from the Mediterranean, 535; Precious Coral, 552
Giglioli (Prof. Italo), Action of Liquids and Gases on the Vitality of Seeds, 328
Gilchrist Educational Trust, Lectures, 229
Giltay (J. W.), Audible Photometer, 125
Gilyaks of Eastern Siberia, 209
Glaciers: the Morteratsch, Hugo Leupold, 77; Glacier action in Finland, 301; Study of the Rhone, 593; M. Forel on, 184; Glaciers and Glacial Periods in their Relations to Climate, Dr. A. Woeikof, 424; Changes of Movement observable in Norwegian Glaciers, 449; J. Innes Rogers, 460
Gladstone (Dr. J. H., F.R.S.), Sea Froth, 33; and Alfred Tribe, Chemistry of the Planté and Faure Accumulators, 221, 461
Glarus, Landslip at, 277
Glimpse through the Corridors of Time, Dr. R. S. Ball, F.R.S., 79, 103; Dr. A Dupré, 217; Prof. T. H. Huxley, F.R.S., 241
Godwin-Austen (Col. H. H.), Earthquake in the Andaman Islands, 386
Gore (Dr. G., F.R.S.), Electrolytic Diffusion of Liquids, 234; on the Electrolysis of Sulphate of Copper, 473
Göttingen Royal Society of Sciences, 48
Government, the, and Science, 87, 89
Gramineæ, Mr. Bentham's Paper on, 229
Grass Barriers of the Nile, 130
Gravitation, the Balance and, 137
Gravity, Lunar Disturbance of, G. H. Darwin, F.R.S., 20
Green (Prof. A. H.), "Fisher's Physics of the Earth's Crust," 481
Green (J. Richard), "Making of England," 415
Greenland, Exploration of, 209
Greville (H. Leicester), Student's Handbook of Chemistry, 123
Gross (E. J.), Algebra, 458
Growth, Geotropism and, Francis Darwin, 616
"Guesses at Truth," Some, of the Emperor Khang-hi, 82
Guppy (H. B.), Yellow River and the Pei-ho, 584
Guthrie (Fred., F.R.S.), First Book of Knowledge, 288

Haeckel (Prof.), Researches on the Coast of Ceylon, 469
Hagen (Dr. B.), Exploration of Sumatra, 89
Hagen (Dr. H. A.), Fossil Insects of the Dakota Group, 266
Hailstorm, Solar Spectrum in a, C. H. Romanes, 507
Hailstorms, Tornadoes, Whirlwinds, Waterspouts, and, 155, 291
Hale (A.), Hypothetical High Tides, 385
Haliburton (R. G.) Primitive Traditions as to the Pleiades, 100, 317
Hall (Prof. Asaph Hall), "Observations of Double Stars made at the United States Naval Observatory, 122
Hall (Maxwell), and Jamaica Meteorology, 17
Halo, Solar, J. T. Brownell, 290: W. F. Evans, 386
Hands, on the Clenching of, from Emotional and other Causes in the two Sexes, Arthur Stradling, 364
Hann (Dr.), on the Temperature of the Southern Hemisphere, 395
Hannay (J. B), Atmospheric Phenomenon, 125; Colour Perception, 604
Harlacher (Prof. A. R.), Current Meter of, R. Blum, 494
Harrison (Park), on an Incised Slate, 18
Harrison (W. Jerome), Geology of the Counties of England, and of North and South Wales, 408
Harvard College, U.S., Observatory of, 326
Harvey (Dr. Reuben J.), Death of, 248
Hats, Heads and, Dr. W. B. Kesteven, 8; Hyde Clarke, 32; F. F. Tuckett, Chas. Roberts, Chas. H. Blackley, W. G. Smith, Edward F. Willoughby, 55
Haughton (Dr. Samuel, F.R.S.), Tidal Evolution and Geology, 265
Hayes (Dr. Isaac J.), Death of, 184
Hazen (Gen. W. B.), International Polar Research, 112
Hazy Sky, Telescopic Definition in a, Dr. G. W. Royston Pigott, F.R.S., 77; A. S. Atkinson, 483
Heads, Men's, an Alleged Diminution in the Size of, Dr. W. B. Kesteven, 8; Hyde Clarke, 32; F. F. Tuckett, Chas. Roberts, Chas. H. Blackley, W. G. Smith, Edward F. Willoughby, 55
"Head-Hunters of Borneo: a Narrative of Travel up the Mahakkam and down the Barito, also Journeyings in Sumatra," by Carl Bock, Alfred R. Wallace, 3
Health Congress, Brighton, and Domestic and Scientific Exhibition, 161, 175
Heart, Aristotle on the, W. Ogle, 528
Heat, and Light, Acoustics, Thomas W. Piper, 51
Heat, Variations in the Sun's, E. Douglas Archibald, 316
Heat, Influence of, on the Molecular Structure of Zinc, 374
Heat, Specific and Thermal Conductivity of, H. G. Madan, 507
Heddle (M. Foster), Geological and Mineralogical Map of Sutherland, 526
Heer (Dr. Oswald), Fossil Flora of Sumatra, 200
Heights of the Rivers Nile and Thames, Prof. Balfour Stewart, F.R.S.: 261, 268
Heine (Dr. Eduard Simon), Death of, 63
Helium, the Element, discovered in Lava, 185
Helophyton Williamsonis, Prof. Wm. C. Williamson, F.R.S., 124, 173
Hemispheres, the Two, Popular Account of the Countries and Peoples of the World, G. G. Chisholm, 337
Hemsley (W. Botting), "Die Pflanze. Vorträge aus dem Gebiete der Botanik," von Dr. Ferdinand Cohn, 359
Hennessey (J. B. N.), Outburst of Sun-Spots, July 25, 1881, 241
Henshall (Dr. J. A.), Book of the Black Bass, 216
Herbaceous Stem on a Palæolithic Implement, Worthington G. Smith, 173
Herbarium of Plants taken from Mummies, 493
Herschel (Prof. A. S.), on an Experimental Form of Secondary Cell, 363; on a Perpetual Form of Secondary Cell, 527
Herschel (Major J.), Pendulum Observations in London, 197; Mid-day Darkness of Sunday, January 22, 289
Higgens (Henry H.), Meteor, 78
Highlands North-West, Silurian Fossils in, W. H. Hudleston, 582; Rev. T. G. Bonney, 603; Chas. W. Peach, 603
High Tides, Hypothetical, C. Callaway, 436
Hill (Rev. E.), "Physics of the Earth's Crust," Rev. Osmond Fisher, 433
Hoffmann (Dr. H.), Phaenology—an Appeal, 506
Holden (Prof. Edward S.), New Red Star, 410
Holtz Electrical Machine, 232; the unequal Heating of the Electrodes of, 376
Hongkong, an Observatory for, 39
Honolulu, Earthquake at, 250
Hopkins (B. J.), Collection of Meteoric Dust—a Suggestion, 339
Horne (John), "A Year in Fiji; or, an Inquiry into the Botanical, Agricultural, and Economical Resources of the Colony," 527
Horse-power given to any Part of a Circuit by Intermittent Light, John Perry, 198
"Horse in Motion," Dr. J. B. D. Stillman, 591; J. Muybridge, 605
Hoskyns-Abrahall (Rev. John), Meteor, 198
Hospitals in Japan, 63
Housman (Rev. Henry), "The Story of our Museum, how we Formed it, and what it Taught us," Alrred R. Wallace, 407
Howard (J.), Practical Chemistry, 150
Howarth (E.), Meteors, 173; Double Egg, 174
Hubbard (A. J.), Igneous Rocks of Iceland, 8
Hubbard (Mrs. E.), Intelligence in Birds, 461
Hudleston (W. H.), Silurian Fossils in the North-West Highlands, 582
Huggins (William, F.R.S.), Photographic Spectrum of the Great Nebula in Orion, 489
Hughes (Prof. Thos. McKenny, F.R.S.), Steno, 484
Hulke (T. W., F.R.S.), the Osteology of *Hypsilophodon Foxii*, 426
Hull (Prof. Edward, F.R.S.), Ancient Tidal Action and Planes of Marine Denudation, 177; Palæo-geological and Geographical Maps, 518
Humanity, Anti-Vivisection *versus*, 73
Hungary, Earthquakes in, 375
Hunt (Dr. J. Sterry), Honorary Degree conferred on, by the University of Cambridge, 119; on the Conservation of Solar Energy, 602
Hunter (Robert), Encyclopædic Dictionary, 288
Huxley (Prof. T. H., F.R.S.), Resignation of the Secretaryship of the Royal Society, 16; "Science and Culture," Geo. J. Romanes, F.R.S., 333; on a Glimpse through the Corridors of Time, 241; Salmon Disease, 437; Charles Darwin, 597
Hydrodynamic Experiments, Bjerknes', 271
Hygrometer, Integrating, MM. Mignan and Renard's, 565
Hypothetical High Tides: Prof. J. S. Newberry, 357; A. Hale, 385; C. Callaway, 385, 436; S. V. Wood, 408; J. Vincent Elsden, 408

Hypsilophodon Foxii, the Osteology of, J. W. Hulke, F.R.S., 426

Ice: Curious Formations of, J. F. Duthie, 78; Severance of Rocks by, 347
Iceland, Igneous Rocks of, A. J. Hubbard, 8
"Icones Floræ Danicæ," Completion of, 347
Igneous Rocks of Iceland, A. J. Hubbard, 8
Ihne (Dr. Egon), Phænology—an Appeal, 506
Imperial Dictionary of the English Language, Dr. J. Ogilvie, 288
India: Rod in, H. S. Thomas, 215; Economic Geology of, 508, 554; Wild Silks of, W. Odell, 563
Indian Fossils, 218
Indigo, Baeyer's Method for Preparing Artificial, 593
Indium, the Physical Properties of, 290
Infection and Putrefaction, Essays on the Floating Matter of the Air in Relation to, John Tyndall, F.R.S., 6
Inoculations, Pasteur's, a Student, 483
"Inorganic Chemistry," William Jago, 364
Insects, Fossil, of the Dakota Group, Dr. H. A. Hagen, 266
Institute of Jamaica, 419
Institution of Civil Engineers, 144, 355, 403
Institution of Mechanical Engineers, 301, 350
Institution of Naval Architects, 517, 533
Integrating Anemometer, V. Ventosa, 79
Integrating Hygrometer, MM. Mignan and Ranard's, 565
Intelligence in Birds, 410; Mrs. E. Hubbard, 461
Intermittent Light, Horse-Power given to any part of a Circuit by, John Perry, 198
International Geological Congress, 34
International Medical Congress, Transactions, 43
International Polar Research, General W. B. Hazen on, 112
International Fisheries Exhibition, 410
Iquique, Earthquake at, 302
Irawaddy, Exploration of the Sources of the, 421
Isotherms, Displacement of, 185
Italy, Geological Survey of, W. Topley, 86; Prof. G. A. Lebour, 126; Public Instruction in, 396
Izeutes and Izarvas, Earthquakes at, 87

Jackson (James), Bibliography of Geography, 19
Jago (W.), Inorganic Chemistry, Theoretical and Practical, 150, 364
Jamaica, Meteorological Observations in, 17; Jamaica Petrel, D. Morris, 151; the Colony of, 152; Institute of, 419
Japan: Modern, Japanese Porcelain, 17; Hospitals in, 63; Education in, 186, 325; a Society for the Protection of Ancient Monuments in, 301; Ernest Satow and Lieut. Hawes' Work on, 374; "Land of the Morning: an Account of Japan and its People," William Gray Dixon, 384; Fires in, 396; Prof. Milne on the Volcanoes of, 420; Telegraph Lines in, 450; Art Metal Work of, 514; Works licensed to be Printed in, 518; Tokio University Calendar, 519; Distribution of Seismic Activity in, 613
Jeannette, the Search for, 44, 62, 89, 275, 326, 350, 375
Jena, Geographical Society of, 346
Jews, Coins of the International Numismata Orientalia, Fred. W. Madden, Dr. John Evans, F.R.S., 549
Johnstone (H. H.), Miss Cobbe and Vivisection, 459, 506
Joly (J.), Electric Barometer, 559
Jones (John), First Steps to a New Selenograph, 288
Jones (D. Rhys), Means of Saving some Lives in Colliery Explosions, 508
Joule (Dr. J. P., F.R.S.), Obituary Notice of Edward William Binney, F.R.S., 293
Journal of the Asiatic Society of Bengal, 23, 211, 401
Journal de Physique, 48, 282, 353, 522
Journal of the Franklin Institute, 142, 257, 522, 545, 617
Journal of Anatomy and Physiology, 210, 378
Journal of the Russian Chemical and Physical Society, 211, 426
Journal of the Royal Microscopical Society, 305
Journal of Physiology, 378
Journal of the Royal Agricultural and Commercial Society of British Guiana, 419
Judd (Prof. J. W., F.R.S.), "Life, Letters, and Journals of Sir Chas. Lyell, 145, 170; Possibility of finding Workable Coal-seams under the London Area, 311, 361
Jumbo, 386, 393; Zoological Society, and, 487
Jupiter, Markings on, W. F. Denning, 223, 265; G. P. Serviss, 436; Movements of Jupiter's Atmospheres, W. Mattieu Williams, 338; G. H. Darwin, F.R.S., 360
Jura, Movements of the Ground in, 471
Jurassic Birds and their Allies, Prof. O. C. Marsh, 22

Kæstner (M. Eugene Frederic), Death of, 612
Keller (M.), Accident in his Laboratory, to, 42
Kesteven (Dr. W. B.), an Alleged Diminution in the Size of Men's Heads, 8
Kew Gardens, Report of, 206
Khang-hi (Emperor), some "Guesses at the Truth" of the, 82
Kiangari, in the Province of Kastamoumi, Earthquake at, 231
Kingsford (Dr. Anna), Vivisection, 482
Kippist (Richard), Death of, 275
Kleciak (Blasinus), Death of, 395
Kletzinsky (Prof. Vincenz), Death of, 565
Knowledge, First Book of, Fred. Guthrie, F.R.S., 288
Knowles (W. J.), Palæolithic Man and Löss, 409
Koch (W. S.), Auroral Display, 461
König's Great Tonometer, 346
Kopp (Dr. Hermann), Rime Cloud observed in a Balloon, 385, 507
Krapf (Rev. Dr. John Ludwig), Death of, 184
Krause, Brothers, safe arrival at San Francisco, 44
Kufra, Reise von Tripolis, nach der Oase Kufra, Dr. Gerhard Rohlf's, 264
Kunnungs, the, S. E. Peal, 529

Lacustrine Relics, discovery of, at Steckborn, on Lake Constance, 470
Lady's Cruise in a French Man-of-War, G. F. Gordon Cumming, 289
Lake, Transformation of Old Coins in a, 93
Lake Constance, 348
Lake Tanganyika, Mr. E. C. Hore's Paper on, 112
"Land of the Midnight Sun," Paul B. Du Chaillu, 59
"Land of the Morning; an Account of Japan and its People," William Gray Dixon, 384
Land und Leute in der brasilianischen Provinz Bahia, 240
Landslip at Glarus, 277
Lankester (Prof. E. Ray, F.R.S.), Treatise on Comparative Embryology, by F. M. Balfour's, F.R.S., 25; Obituary Notice of Theodor Schwann, 321; Further Observations made on; the Freshwater Medusa made during the Summer, 1881, 444 Studies on Apus, Limulus, and Scorpio, 479; and Edinburgh Chair of Natural History, 607
Lansdell (Henry), through Siberia, 582
Larvæ, Burrowing, V. T. Chambers, 529
Lebour (Prof. G. A.), Geological Results of the late Gales, 79 Geological Society of Italy, 126
Leeds Naturalists' Club and Scientific Association, 419
Leghorn, Geological Discovery at, 249
Leichhardt (Dr. Ludwig), alleged Discovery of Relics and Journals of, 112; Letters of, 230
Lena, Russian Expedition to the Mouth of the, 135
Lennep (John H. van), Nepotism, 266
Lenz (Dr.), on the Sahara, 210
Lepidoptera of Ceylon, Henry Trimen, 32, 338; F. Moore, 79
Lepidoptera, Rare, Table of the Appearance of, in this Country in Connection with the Sun-spots, A. H. Swinton, 584
Lepidosteus, Dr. F. M. Balfour on, 305
Lepidosteus osseus, Development of the Skull in, W. K. Parker, F.R.S., 330
Leupold (Hugo), the Morteratsch Glacier, 77
Level of the Mediterranean, L. Luiggi, 436
Lewis (D. M.), Sound-producing Ants, 266
Lick Observatory, 298; the large Flint-Glass disk for, 537
Liebig (Baron Justus von), Monument of, 471
Life, Chemical Cause of, Theoretically and Experimentally examined, Oscar Loew and Thos. Bokorny, 457
Life-History of the Eel, 610
Light, Velocity of, Lord Rayleigh, F.R.S., 52
Light, Intermittent, Horse-Power given to any Part of a Circuit, by John Perry, 198
Light and Heat, Acoustics, Thomas W. Piper, 51
Lightning, Injury from, near Geneva, 160
Lightning, Effect of, on trees near a Telegraph Wire, 593
Lightning-rod Conference, 184
Liquids, on the Application of Photometry in the Study of the Phenomena of Diffusion in, Dr. S. Wroblewski, 45
Liquids and Gases, Action of, on the Vitality of Seeds, Prof. Italo Giglioli, 328
Limulus, Prof. H. N. Moseley, F.R.S., 582

Limulus, Apus, and Scorpio, Studies on, Prof. E. Ray Lankester, F.R.S., 479
Lingwood (J.), Climate of North Northumberland as regards its Fitness for Astronomical Observations, 339
Linnean Society, 94, 166, 211, 331, 379, 517, 522
Linnean Society of New South Wales, 42
"Limnocodium Sowerbii," Further Observations on the, made during the Summer, 1881, Prof. E. Ray Lankester, F.R.S., 444
Liveing (Prof.) and Prof. Dewar, on the Spectrum of Carbon, 545
Liverpool, Literary, Scientific, and Art Societies, *Soirée*, 208; Scientific Education in, 270; Royal Commissioners on Technical Education at, 346
Lives, Means of Saving some, in Colliery Explosions, D. Rhys Jones, 508
Lizard, Song of the, Francis P. Pascoe, 32; Capt. S. P. Oliver, 174
Ljubinge, Earthquake at, 537
Lobo's (Father), "Abyssinia," 365
Lockyer (J. Norman, F.R.S.), Eclipse Notes, 573
London University Matriculation, Natural Philosophy for, Edward B. Aveling, 76
London, a Smokeless, Edmund McClure, 173
London, Pendulum Observations in Major J. Herschel, 197
London Area, Possibility of finding Workable Coal-Seams under the, Prof. J. W. Judd, F.R.S., 311, 361
Lös, Palæolithic Man and, W. J. Knowles, 409
Loew (Oscar) and Thos. Bokorny, "Chemical Cause of Life Theoretically and Experimentally Examined," 457
Lubbock (Sir J. W., Bart., F.R.S.), an Elementary Treatise on the Tides based upon that of the Late, Rev. J. Pearson, 360; on the Sense of Colour among some of the Lower Animals, 422
Lubomirski (Prince Wladislaus), Death of, 565
Luiggi (L.), Level of the Mediterranean, 436
Lunar Disturbance of Gravity, G. H. Darwin, F.R.S., 20
Lunar Eclipse on December 5, 114
Lung Capacity of Children, Researches on the, 114
Lyell (Sir Chas), Life, Letters, and Journals of, Prof. J. W. Judd, F.R.S., 145, 170

McClure (Edmund), A Smokeless London, 173
McCook (Dr. Henry C.), "The Honey Ants of the Garden of the Gods and the Occident Ants of the American Plains," Geo. J. Romanes, F.R.S., 405
Mackintosh (Prof. H. W.), Echinoids of the *Challenger*, 41
McLachlan (R., F.R.S.), the Weather, 241
Macloskie (Prof. G.), Awned Carpels of Erodium, 174
Madan (H. G.), Tables of Qualitative Analysis, 264; Specific Heat and Thermal Conductivity, 507
Madden (Fred. W.), "International Numismata Orientalia, Coins of the Jews, Dr. John Evans, F.R.S., 549
Maggiore, Lake Examination of the Water of, 348
Magnetic Survey of Missouri, Francis E. Nipher, 40
Magnetic Disturbances, Auroras, and Earth Currents, Prof. W. Grylls Adams, F.R.S., 66
Magnetic Declination, New Determination of the, 230
Magnetic Storm, G. M. Whipple, 583, 604
Magneto-Electric Action, Matter and, Dr. W. Spottiswoode, Pres.R.S., 539
Magnetism, Electricity, and, Elementary Lessons in, Silvanus P. Thompson, 550
Mahomed (Dr. F. A.), Physiognomy of Consumption, 389
"Making of England," J. Richard Green, 415
Makua and Lomwe Countries, Exploration of, 472
Malay Archipelago, on Artificial Deformation of the Human Skull in the, Dr. A. B. Meyer, 132
Mallet (Robert, F.R.S.), Obituary Notice of, 59
M'Alpine (D.), Zoological Atlas (including Comparative Anatomy), with Practical Directions and Explanatory Text for the Use of Students. Invertebrata, 122
Man, Palæolithic, and Löss, W. J. Knowles, 409
Manchester: Literary and Philosophical Society, 23
Manitoba, Books on, 538
Map, Relief, of the Equatorial Regions of Africa, 275
Marine Denudation, Ancient Tidal Action and Planes of, Prof. Edward Hall, F.R.S., 177
Markham (Clements B., C.B., F.R.S.), Arctic Research, 78; on the Whale Fishery of the Basque Provinces of Spain, 365
Marreco (Prof. A. Freire), Death of, 469
Mars, Satellites of, 94, 209; Solar Parallax from Observations of, 278; Photography of, 493
Marsh (Prof. O. C.), Jurassic Birds and their Allies, 22; Classification of the Dinosauria, 244; Wings of Pterodactyles, 531
Maskelyne (T. S.), Coltsfoot, 290
Mathematical Society, 95, 167, 283, 336, 379, 475, 571
Mathematics, Influence of, on the Progress of Physics, Dr. Arthur Schuster, F.R.S., 397
Matter and Magneto-Electric Action, Dr. W. Spottiswoode, Pr.R.S., 539
Maxim's Self-Acting Fire-Extinguishers, 511
Maxwell (Prof. James Clerk), 229; Treatise on Electricity and Magnetism, Prof. G. Chrystal, 237
Measurements, Wind, 486; C. H. Romanes, 505; Richard B. Prosser, 505
Medical Congress, International, Transactions, 43
Medical Women in China, 206
Medical Electricity, 521
Mediterranean, Parhelia in the, Chas. H. Allen, 339; Albert Riggenbach, 364; Level of the, L. Luiggi, 436; Basque Whale in the, Prof. Henry Hillyer Giglioli, 505; Deep-Sea Exploration in the, Prof. Henry Hillyer Giglioli, 505; New and Rare Fish from the, Prof. Henry H. Giglioli, 535
Medusæ of the White Sea, 300
Melbourne, Observatory of, 349
Melting Point, on, E. G. Mills, F.R.S., 354
Mémoires de la Société des Sciences Physiques et Naturelles de Bordeaux, 408
Mencius, the Mind of, Rev. E. Faber, 99
Men's Heads, an Alleged Diminution in the Size of, 55; Dr. W. B. Kesteven, 8; Hyde Clarke, 32
Menelaus (William), Death of, 536
Mercury, Transit of, November 8, 19, 375
Meridian Distances from Vladivostok to Madras, 394
Merrifield (Mrs.), Weather in South Australia, 483
Metal, Art, Work, of Japan, 514
Metals, Various, Rotational Co-efficient in, 46
Meteorology: of Ben Nevis, Alex. Buchan, 11; Meteorological Observations in Jamaica, 17; Meteorological Society, 119, 259, 307, 427, 450, 547, 619; Weather of November, 1881, 131; Ben Nevis Observatory, 135; the *Comptes rendus* on Polar Meteorological Stations, 159; a System of Observations in the China Seas, 368; Dr. A. Woeikof, 410; Report of the Weather, 1881, 449; Meteorological Observations on Boston Church, 470
Meteors: Rev. S. J. Perry, F.R.S., 78; M. L. Rouse, 78; Henry Cecil, 78; Henry H. Higgens, 78; E. E. Barnard, 173; E. Howarth, 173, Rev. John Hoskyns-Abrahall, 198; seen at Byejetsk, 250
Meteoric Dust, Collection of—a Suggestion, B. J. Hopkins, 339
Meteoric Stones, Fall of, at Vevey, 88; in Transylvania, 420; at Mirotch Planina, 471
Meyer (Dr. A. B.), on Artificial Deformation of the Human Skull in the Malay Archipelago, 132
Michigan Catalogue of the Phaenogamous and Vascular Cryptogamous Plants of, Indigenous, Naturalised, and Adventive, Chas. F. Wheeler and Edwin F. Smith, 182, 196
Microscope and its Revelations, W. B. Carpenter, F.R.S., 502
Microscopical Science, Quarterly Journal of, 6
Microscopy, Practical, Geo. E. Davis, 502, 545
Micro-Telephone in the Observatory, Geneva, 207
Mid-day Darkness of Sunday, January 22; Major J. Herschel, 289
Midnight Sun, Land of the, Paul B. du Chaillu, 59
Mills (E. J., F.R.S., on Melting Point, 354
Miln, (James), Excavations at Carnac, 99
Milne (Prof. John), Earthquake Vibrations, 126; Volcanoes of Japan, 420; on the "Koro-pok-guru," 470
Minchin (Geo. M.), Determination of Electromotive Force in Absolute Electrostatic Measure, 278; Absolute Sine Electrometer, 290
Mineralogical Society, 212
Mineralogy, Systematic Text-Book of, Hilary Bauerman, L. Fletcher, 49
Mines, Accidents in, Commission, 97
Minor Planets in 1882, 218
Mirotch Planina, Fall of a Meteorite at, 471
Missouri, Magnetic Survey of, Francis E. Nipher, 40
Mivart (St. George, F.R.S.), the Cat, 286
Moir (James), a Strange Phenomenon, 410
Molecules, Action of Free, on Radiant Heat and its Conversion thereby into Sound, J. Tyndall, F.R.S., 232

Mollusca of India, Col. Godwin-Austen's Papers on, 373
Molothrus, Parasitic Habits of, Charles Darwin, F.R.S., 51
Moncrieff (W. D. Scott), Compressed Air upon Tramways, 266
Mongolia, Proposed Telegraph Across, 301
Monos Island, Trinidad, 57
Moon, the Apparent Size and Distance of, 347
Moore (F.), Lepidoptera of Ceylon, 79
Moore (Chas), Death of, 184
More (A. G.), appointed Curator of the Dublin Natural History Museum, 249
Morgan (Lewis H.), Death of, 248
Morphologisches Jahrbuch, 378
Morphology of the Temnopleuridæ, Prof. P. M. Duncan, F.R.S., 257
Morris (D.), Jamaica Petrel, 151
Morris (Prof. Chas.), on the Conservation of Solar Energy, 601
Morrelli (Dr. Henry), Suicide; an Essay on Comparative Moral Statistics, Geo. J. Romanes, F.R.S., 193
Morteratsch Glacier, Hugo Leupold, 77
Moscow Society of Naturalists, 326
Moscow, Observatory of, 616
Moseley (H. N., F.R.S.), Elected to the Linacre Chair of Physiology in the University of Oxford, 112; Researches on Animals containing Chlorophyll, 338; Precious Coral, 510; Limulus, 582
Moths attracted by Falling Water, J. Starkie Gardner, 436
Mott (F. T.), Water in Australia, 507
Mouchez's (Admiral) *Soirée* at the Paris Observatory, 493
Mount Etna, 565, 615; Observatory, 301, 394; Proposed Railway to the Summit of, 395
Mount Vesuvius, Eruption of, 218
Mueller (Ferd. Baron von, F.R.S.), Select Extra Tropical Plants Readily Eligible for Industrial Culture or Naturalisation, with some indications of their Native Countries, and some of their Uses, 480
Müller (Dr. Hermann), Polymorphism of the Flower-heads of *Centaurea jacea*, 241
Muffs and Vivisection, Frances Power Cobbe, 483
Muir (J.), Treatise on the Theory of Determinants; with Graduated Sets of Exercises for Use in Colleges and Schools, 551
Mulhall (Mrs. M. G.), "Between the Amazons and Andes; or, Ten Years of a Lady's Travels in the Pampas, Gran Chaco, Paraguay, and Matto Grosso, 457
Mulholland (Mrs.), *Dipladenia Amabilis*, 79
Mummies, Herbarium of Plants taken from, 493
Museum, the Story of our, showing how we Formed it and what it Taught us, Rev. Henry Housman, Alfred R. Wallace, 407
Muybridge (J.), Horse in Motion, 605

Nachet (M. Camille Sebastian), Death of, 87
Nagy-Look (Hungary), Discovery of the Remains of a Roman Car, 63
Natal, Proposed Observatory at, 394
Nathorat (A. G.), "Eophyton," 483
National Defences, Our, 261
Natura, La, 522
Natural History, Popular, Edited by P. Martin Duncan, F.R.S., 107; Rev. W. Tuckwell's Lecture on, at the Birmingham Town Hall, 348; Boston Society of 1830-1880, 389; Edinburgh Chair of, Prof. E. Ray Lankester, F.R.S., 607
Natural Philosophy for London University Matriculation, Edward B. Aveling, 76
Naturalists, Institute for, Dr. J. Rae, F.R.S., 126
Nature, Vignettes from, Alfred R. Wallace, 381; Grant Allen, 381, 459; Dr. W. B. Carpenter, F.R.S., 435, 480, 554; W. Budden, 529
Naval Architects, Institution of, 533
Naval and Marine Engineering Exhibition, 587
Nebula in Andromeda, the Great, Rev. T. W. Webb, 341
Nebula in Orion, Photographic Spectrum of the Great, William Huggins, F.R.S., 489
Nepotism, John H. Van Lennep, 266
Nervous System, Treatise on the Diseases of the, Dr. James Ross, 172
Nettleton (J. A.), Study of the History and Meaning of the Expression "Original Gravity," 384
Newberry (Prof. J. S.), Hypothetical High Tides, 357
Newcastle-on-Tyne Free Library Report, 347
New Code and the Teaching of Science, 491, 536
New Guinea, the Maiwa District) 376
New South Wales, Science in, 44; Royal Society of, 324; Flora of, in its Geological Aspect, 543
New Zealanders, the Vegetable Food of, in Prehistoric Times, 318
New Zealand Journal of Science, 591
Nicols (Arthur), Vivisection, 506
Niederlandisches Archiv für Zoologie, 378
Nile, Grass Barriers of the, 130
Nile and Thames, Heights of the Rivers, Prof. Balfour Stewart, F.R.S., 268
Nipher (Francis E.), Magnetic Survey of Missouri, 40
Nöggerath (Prof. Jakob), Monument to, 137
Nomenclator, Steudel's, 223
Nordenskjöld (Baron), Visit to London, 112; "Voyage of the *Vega*," 179, 200; Notice of (*with Portrait*), 309
Nordrup, near Ringsted, Discovery at, 249
Norfolk and Norwich Naturalist's Society, 615
North Atlantic, Daily weather Charts in the, 605
North Middlesex Natural History Association, 208
North Schleswig, Earthquake in, 396
Northcote (Sir Stafford), on Science in Education, 206
Northumberland, on the Climate of North, as regards its Fitness for Astronomical Observations, Rev. Jevon J. Muschamp Perry, 317, 364; J. Lingwood, 339
Norway, the Ancient Floras of, 207; Changes of Movement Observable in Norwegian Glaciers, 449; J. Innes Rogers, 460
Notelephas australis, Owen, 571
Notornis Mantelli, 568
November, 1881, Weather of, 131
Nürnberg Natural History Society, 62

Observatories: French Provincial Observatories, M. Loewy on, 18, 126; Observatory for Hongkong, 39; Bischoffsheim Obsérvatory, 199; Microtelephone in the Geneva, 207; Lick Observatory, 298; Etna Observatory, 301, 394; Observatory of Harvard College, U.S., 326; of Cordoba, 349; of Melbourne, 349; Proposed Observatory at Natal, 394; Observatory at Paisley, 471; Temple Observatory, Rugby, 472; Observatory of Moscow, 616; of Trinity College, Dublin, 616
Ocean Basins, Physical Cause of the, Rev. O. Fisher, F.R.S., 243
Odell (W.), Wild Silks of India, 563
Ogilvie (Dr. John), Imperial Dictionary of the English Language, 288
Ogle (W.), Aristotle on the Parts of Animals, translated by, Dr. B. W. Richardson, F.R.S., 453; Aristotle on the Heart, 528
Oleo-Margarine, 269
Oliver (Capt. S. P.), Song of the Lizard, 174; Sea Froth, 268
Organ-pipe, the Investigation of the Nodes in an, 290
Organic Chemistry, Adolph Strecker's Short Text-book of, Dr. Johannes Wislicenus, H. Watts, F.R.S., 148
Organism, Struggle of Parts in the, Duke of Argyll, F.R.S., 6; Dr. William B. Carpenter, F.R.S., 6, 52; George J. Romanes, F.R.S., 29
"Original Gravity," Study of the History and Meaning of the Expression, J. A. Nettleton, 384
"Origins of English History," C. Elton, E. B. Tylor, F.R.S., 501
Orion, Photographic Spectrum of the Great Nebula in, William Huggins, F.R.S., 469, 489
Oshima, Dr. L. Döderlein on, 43; Notes on the Island of, 43
Otago (New Zealand), Trout in, 18; Notes from the University Museum, Prof. T. Jeffery Parker, 352, 568
"Overflow Bugs" in California, C, V. Riley, 386
Owen (Prof., C.B., F.R.S.), Description of Portion of a Tusk of an Australian Proboscidian Mammal, 571
Oxford, H. N. Moseley, F.R.S., elected to the Linacre Chair of Physiology in the University of, 112
Oxygen, Manufacture of, 229; Delicate Test for, 327
Ozonised Air as an Anæsthetic, 470

Paisley, New Observatory at, 471
Palæo-geological and Geographical Maps, Prof. Hull, F.R.S., 518
Palæolithic Implement, Herbaceous Stem on a, Worthington G. Smith, 173
Palæolithic Man and Löss, W. J. Knowles, 409
Palæolithic Floors, Worthington G. Smith, 460
Palæontology, British, a Recent Find in, Prof. Arch. Geikie, F.R.S., 1

Palæozoic Vegetation, Evolution of the, J. S. Gardner, 8
Palliser (Major Sir William, C.B.), Death of, 346
Palms, Growth of, 328
Papin, Dr. E. Gerland, 125
Parallax, Galle's Method for Solar, 472
Parasitic Habits of Molothrus, Chas. Darwin, F.R.S., 51
Parhelia, Francis Porro, 437
Parhelia in the Mediterranean, Chas. H. Allen, 339; Albert Riggenbach, 364
Paris: Electric Light at the Opera, 18, 42; Academy of Sciences, 23, 48, 72, 96, 120, 144, 168, 212, 235, 260, 284, 308, 332, 356, 404, 428, 452, 476, 500, 524, 548, 595, 620; Prizes of, 350, 375, 377; Paris Observatory, the Astronomical Museum at the, 113; Admiral Mouchez's *soirée* at, 250, 493; Observatory of Popular Astronomy, 518; Success of Lectures at Exhibition of Electricity, 183; the Electric Light at the Comptoir d'Escompte, 347; Annual Meeting of the Geographical Society, 186; *Comptes Rendus* of, 473; Balloon Ascent from La Villette Gasworks, 373
Parker (Prof. T. Jeffery), Notes from the Otago University Museum, 352, 568
Parker (W. K., F.R.S.), on the Development of the Skull in *Lepidosteus osseous*, 330
Parts, Struggle of, in the Organism, Duke of Argyll, F.R.S., Dr. William B. Carpenter, F.R.S., 6
Pascoe (Francis P.), Song of the Lizard, 32
Pasteur's Inoculations, 483
Patent Bill, Society of Arts, 30
Pathological Research, Society for aiding, 517
Peach (Chas. W.), Silurian Fossils in the North-West Highlands, 603
Peal (S. E.), Function of the Ears, or the Perception of Direction, 124, the Kunnungs, 529
Pearson (Karl), Colour and Sound, 339
Pearson (Rev. J.), an Elementary Treatise on the Tides, based upon that of the late Sir J. W. Lubbock, Bart., F.R.S., 360
Peckham (Geo. W.), Biology in Schools, 151
Pei-ho, Yellow River, the, H. B. Guppy, 584
Peking, Scientific Lectures in Chinese at the Schools in, 449
Pendulum Observations in London, Major J. Herschel, 197
Perception of Direction, Function of the Ears on Atomic, D'Abbadie, 172
Perception, Colour, J. B. Hannay, F.R.S., 604
Perini (N.), Dante and the Southern Cross, 197
Peroxidised Wire, a pretty Experiment with, 112
Perry (Rev. S. J., F.R.S.), Meteor, 78; Earth Currents, 316; Sun-Spots, 337
Perry (John), Horse-Power given to any Part of a Circuit by Intermittent Light, 198
Perry (Rev. Jevons J. Muschamp), on the Climate of North Northumberland as regards its Fitness for Astronomical Observations, 317, 364
Persia, Dr. Polak's Exploring Tour to, 137
Perthshire Natural History Society, 208
Petermann's Mittheilungen, 44, 302, 538
Peters (Dr. Karl), Death of, 87
Petrel, Jamaica, D. Morris, 151
Petroleum, Solidifying, 325
Pflanze, Die. Vorträge aus dem Gebiete der Botanik, Dr. Ferdinand Cohn, W. Botting Hemsley, 359
Pflanzen, Elemente der Anatomie und Physiologie der, Dr. Julius Wiesner, 503
Phaenogamous and Vascular Cryptogamous Plants of Michigan, Catalogue of the, Indigenous, Naturalised, and Adventive, Chas. F. Wheeler and Edwin F. Smith, 196
Phænology—an Appeal, Dr. Hoffmann, Dr, Egon Ihne, 506
Phenological Observations on Early Flowers and Winter Temperatures, J. Edmund Clark, 552
Phenomenon, a Strange, 410, 484, 437
"Philosophische Studien herausgegeben," Wilhelm Wundt, 336
Photograph of Comet B, 1881, 132
Photographic Experiment with Swan's Incandescent Light, H. Baden Pritchard, 54
Photographic Spectrum of the Great Nebula in Orion, William Huggins, F.R.S., 489
Photography, Year-Book of, for 1882, 249
Photometer, Audible, J. W. Giltay, 125
Photometric Studies, Report on, 17
Photometry, on the Application of, in the Study of the Phenomena of Diffusion of Liquids, Dr. S. Wroblewski, 45
Phyllomic Nectar Glands in Poplars, 327
Phylloxera at Elba, Sardinia, &c., 250
Physical Society, 95, 167, 355, 403, 426, 475, 571
Physical Notes, 231, 290, 376
Physical Cause of the Ocean Basins, Rev. O. Fisher, F.R.S., 243
Physicians and Chinese Authorities, 301
Physics, Solar, Capt. Abney, F.R.S., 162, 187, 252
Physics, Influence of Mathematics on the Progress of, Dr. Arthur Schuster, F.R.S., 397
"Physics of the Earth's Crust," Rev. Osmond Fisher, Rev. E. Hill, 433; Prof. A. H. Green on, 481
Physiognomy of Consumption, Francis Galton, F.R.S., and Dr. F. A. Mahomed, 389
Physiology, University College Course of Practical Exercises in, Dr. J. Burdon Sanderson, F.R.S., 408
Piaggia (Signor Carlo), Death of, 299
Pickering (Prof. W. H.), Gas-Flame, Electric and Solar Spectra and their Effects on the Eye, 340
Pidgeon (D.), Dispersal of Bivalves, 584
Pimento Tree and Umbrella Sticks, 299
Piper (Thomas W.), Acoustics, Light, and Heat, 51
Pisciculture in the Edinburgh Fishery Exhibition, 606
Planets, Minor, in 1882, 218
Plant Labels, Prize for the best, 42
Plants, the Power of Movement in, Prof. Wiesner, Francis Darwin, 578, 597
Planté Accumulators, 376
Planté and Faure Accumulators, Chemistry of the, Dr. J. H. Gladstone, F.R.S., and Alfred Tribe, 221, 461
Plateau (M.), on the Bursting of Bubbles, 160
Platinum, Dr. Nichols' Experiments on, 291
Pleiades, Primitive Traditions as to the, R. G. Haliburton, 100, 317; Edward B. Tylor, F.R.S., 150
Pterodactyles, Wings of, Prof. O. C. Marsh, 531
Podocarpeæ, the, A Chapter in the History of Coniferæ, J. Starkie Gardner, 228
Polymorphism of the Flower-heads *Centaurea jacea*, Dr. Hermann Müller, 241
"Polynesier, Die heilige Sage der, Kosmogonie und Theogonie," Adolf Bastian, Edward B. Tylor, F.R.S., 28
Poplars, Phyllomic Nectar Glands in, 327
Porro (Francis), Parhelia, 437
Port (Dr. A. Dodel), Anatomisch-physiologischer Atlas der Botanik, 300
Preece (W. H., F.R.S.), Earth-Currents, 289
Primitive Industry, or Illustrations of the Handiwork in Stone, Bone, and Clay, of the Native Races of the Northern Atlantic Seaboard of America, Chas. C. Abbott, M.D., 27
Primitive Traditions as to the Pleiades, R. G. Haliburton, 100, 317; E. B. Tylor, F.R.S., 150
Pritchard (H. Baden), Photographic Experiment with Swan's Incandescent Light, 54
Probing by Electricity, Prof. Graham Bell, 40
Proctor (Richard A.), "Easy Star Lessons, 358
Pronunciation of Deaf Mutes who have been taught to Articulate, W. S. A. Axon, 101, 409; Dr. Alex. Graham Bell, 124, 458; F. J. Faraday, 458
Prosser (Richard B.), Wind Measurements, 505
Prothallium and Embryo of Azolla, 327
Purification of Sewage, 410
Putnam (J. D.), Death of, 277
Putrefaction and Infection Essays on the Floating Matter of the Air in Relation to, John Tyndall, F.R.S., 6

Qualitative Analysis, Table of, H. G. Madan, 264
Quarterly Journal of Microscopical Science, 6, 378
Question for Naturalists, Dr. J. Rae, F.R.S., 126
Quillaia Tree, Commercial Value of the, 373

Rae (Dr. J., F.R.S.), Arctic Research, 53, 102; Question for Naturalists, 126
Radiant Heat, Action of Free Molecules on, and its Conversion thereby into Sound, J. Tyndall, F.R.S., 232
Railway, Success of Siemens' Electrical, 42
Rammelsberg's (Prof.) Handbuch der Krystallographisch-Physikalischen Chemie, 287
Ravenstein's Map of East Central Africa, 250
Rayleigh (Lord, F.R.S.), Velocity of Light, 52; Experiments on Colour, 64
Reale Istituto Lombardo di Scienze e Lettere, 48, 258, 353, 522; New Subjects for Prize Competition announced by, 348
Red Flints in the Chalk, W. Fream, 437; J. Badcock, jun., 529

Red Star, New, in Cygnus, J. Birmingham, 198
Red Star, New, Prof. Edward S. Holden, 410
Redman (J. B.), Seashore Alluvion—Dungeness or Denge-nesse, 583
Refuges, Winter—the South of England, 11, 154
Regel (Dr.), Journey in Central Asia, 349
Rendiconti della Sessioni dell' Academia delle Scienze dell' Istituto di Bologna, 1880–81, 48
Retinal Effects, Temporary, J. Rand Capron, 507
Revue des Sciences Naturelles, 211
Revue Internationale des Sciences biologiques, 211, 379
Revue d'Anthropologie, 618
Rheometer, a New, 290
Rhone Glacier, Study of, 593
"Rhopalocera Malayana," W. L. Distant, 300
Ricci (General Marquis J.), Death of, 17
Richardson (Dr. B. W., F.R.S.), Aristotle on the Parts of Animals translated by W. Ogle, 453, 505
Riggenbach (Albert), Parhelia in the Mediterranean — the Weather in Switzerland, 364
Riley (C. V.), "Overflow Bugs" in California, 386
Rime Cloud observed in a Balloon, W. de Fonvielle, 337, 436, 529; Dr. Hermann Kopp, 385, 507
Rivers, Tidal, Velocities in, 280
Rivista Scientifico-Industriale, 48, 211, 282, 401,
Roberts (Chas.), Heads and Hats, 55
Robinson (Rev. Dr. Thomas Romney), Death of, 449; Obituary Notice of, 468
Rocks, Igneous, of Iceland, A. J. Hubbard, 8; Severance by Ice of Rocks in Iceland, 347
Rod in India, H. S. Thomas, 215
Rogers (J. Innes), Advance of Norwegian Glaciers, 460; Colours of Low-growing Wood Flowers, 554
Rohlfs (Dr. Gerhard), Kufra, Reise von Tripolis nach der Oase Kufra, 264
Rolph (W. H.), "Biologische Probleme zugleich als Versuch einer rationellen Ethik, 336
Roman Car, Discovery of the Remains of a, at Nagy-Look (Hungary), 63
Romanes (Geo. J., F.R.S.), Struggle of Parts in the Organism, 29; Suicide; an Essay on Comparative Moral Statistics, Dr. Henry Morselli, 193; Prof. Huxley's "Science and Culture," 333; "The Honey Ants of the Garden of the Gods and the Occident Ants of the American Plants," Dr. H. C. McCook, 405
Romanes (C. H.), Wind Measurements, 505; Solar Spectrum in a Hailstorm, 507
Rookeries, 508
Roots of Certain Plants, Action of Carbonate of Ammonia on the, and on Chlorophyll Bodies, Chas. Darwin, F.R.S., 489
Roscoe (Prof. H. E., F.R.S.), and C. Schorlemmer, F.R.S., "A Treatise on Chemistry," H. Watts, F.R.S., 50
Ross (Dr. James), "Diseases of the Nervous System," 172
Rotational Co-efficient in various Metals, 46
Roumania, Earthquakes in, 375
Rouse (M. L.), Meteor, 78
Rowbotham (Frank J.), Dispersal of Freshwater Bivalves, 605
Royal Society: 142, 211, 234, 258, 283, 305, 330, 354, 401, 426, 545, 571, 594; Prof. Huxley's Resignation of the Secretaryship of the, 16; Anniversary Meeting, 42; Medals awarded by, 61; Annual Meeting of, 112; Address of the President, Dr. W. Spottiswoode, Pres..R.S, 115, 138
Royal Geographical Society, 89; Proceedings, 19, 210, 349, 472, 539; Arctic Night at, 159; Medals of, 612
Royal Institution, 113, 517, 591
Royal Microscopical Society, 143, 259
Royal Horticultural Society, 192, 283, 451, 572, 595
Royal Astronomical Society, 278
Royston-Pigott (Dr. G. W., F.R.S.), Telescopic Definition in a Hazy Sky, 77
Rugby School Natural History Society, 593; Temple Observatory, 472
Rügenwalde, Fata Morgana observed at, 88
Ruminants, Evolution of Anthers in the, Prof. W. Boyd Dawkins, F.R.S., 84
Russia: Expedition to the Mouth of the Lena, 135; Provincial Museums in, 277; Telephone in Russian Turkestan, 277; Severe Weather in South-Eastern, 449; Existence of a Bottom Moraine in Northern, 470; Russian Geographical Society, 472; *Izvestia* of, 472, 539, 593; Medals awarded by, 539
Sahara, Dr. Lenz on the, 210
St. Gothard Tunnel, the *Times* on the present Condition of, 18
St. Petersburg, Electrical Exhibition at, 230; Astronomical Observatory for, 613
St. Etienne (France), Discovery of a new Geyser at, 493
Salmon Disease, Prof. T. H. Huxley, F.R.S., 437
Sanderson (Dr. J. Burdon, F.R.S.), University College Course of Practical Exercises in Physiology, 408
Sanitary Assurance Association, 42
Sanitary Institute of Great Britain, 43, 160, 161; Exhibition of Sanitary Apparatus and Appliances at Newcastle-on-Tyne, 449
Sanitary Protection Society, 418
Sardine, Disappearance of the, from the Coast of Brittany, 493
Satellites of Mars, 94, 209
Saturnian System, 114
Sayce (Prof. A. H.), "The Unicorn: a Mythological Investigation," Robert Brown, jun.; "Astral Origin of the Emblems and Hebrew Alphabet, J. H. Broome, 525
Schlegel (Dr. Franz), Death of, 395
Schliemann (Dr.), his Trojan Excavations, 420
Schorlemmer (C., F.R.S.), and H. E. Roscoe, F.R.S., "A Treatise on Chemistry, H. Watts, F.R.S., 50
Schuster (Dr. Arthur, F.R.S.), the Influence of Mathematics on the Progress of Physics, 397
Schwann (Prof. Theodore), Death of, 290; proposed Monument to, 449
Science in New South Wales, 44
Science in Education, Sir Stafford Northcote on, 206
Science, The New Code and the Teaching of, 536
Science and Art Department, Report of, 557
"Science and Culture and other Essays," Prof. Huxley, LL.D., F.R.S., Geo. J. Romanes, F.R.S., 333
Science Teaching, Prof. Goldwin Smith on, 373
Scientific Education in Liverpool, 270
SCIENTIFIC WORTHIES—Adolf Erick Nordenskjöld (*with Portrait*), 309
Scientific Lectures in Chinese at Peking, 449
Scorpio, Apus and Limulus, Studies on, Prof. E. Ray, Lankester, F.R.S., 479
"Scottish Naturalist," 617
Scudder (Sam. H.), "Butterflies: their Structure, Changes, and Life Histories, with Special Reference to American Forms." Being an Application of the "Doctrine of Descent" to the Study of Butterflies, 5
Sea, Ingenious Apparatus for Discovering the Depth of the, 471
Sea-froth, Dr. J. H. Gladstone, F.R.S., 33; Capt. S. P. Oliver, 268
Sea-shore Alluvion—Dungeness or Denge-ness, J. B. Redman, 583
Seasonal Order in Colours of Flowers, Dr. J. C. Costerus, 481
Secchi (Padre), Proposed Monument to, 87
Secondary Batteries, the Charging of, 232; Experiments with Faure's, 299
Secondary Cell, on an Experimental Form of, Prof. A. S. Herschel, 363, 527
Seeds, Action of Liquids and Gases on the Vitality of, Prof. Italo Giglioli, 328
Selenium, the Action of Light on, 376
Sella (Signor), Ascent of the Matterhorn, 537
Selenography, First Steps to a New, in which it will be Recognised that the Moon was once an Inhabited World, John Jones, 288
Serviss (G. P.), Markings on Jupiter, 436
Sewage, Purification of, 410
Sharp (Samuel), Obituary Notice of, 319
Shells, Tanganyika, Edgar A. Smith, 218
Ships' Logs, Application of Electricity to, 584
Siam, Education in, 325
Siberia, the Gilyaks of, 209
Siberia, Joseph Martin's Exploration of, 376
Siberia, throngh, Henry Lansdell, 582
Siemens' Electrical Railway, 42
Siemens (Dr. C. W., F.R.S.), Conservation of Solar Energy, 440, 504, 603
Sievers (Herr J. J.), Death of, 469
Silks of India, The Wild, W. Odell, 563
Silurian Formation, New Find of, on the Western Coast of Norway, 18
Silurian Fossils in the North-west Highlands, W. H. Huddleston 582; Rev. T. G. Bonney, 603; Chas. W. Peach, 603

Silver-Land, Cameos from the, or the Experiences of a Young Naturalist in the Argentine Republic, E. W. White, 480
Singh (Nain), Death of, 472. 539
Sion and Sierre, Earthquakes at, 161
Skull, Artificial Deformation of the Human, in the Malay Archipelago, Dr. A. B. Meyer, 132
Skuthorpe (J. R.), and the Relics of Dr. Ludwig Leichhardt, 112
Sky: the Autumn, Rev. T. W. Webb, 9, 36; Telescopic Definition in a Hazy, A. S. Atkinson, 483
Slate, an Incised, Park Harrison on, 18
Smith (W. G.), Heads and Hats, 55
Smith (Worthington G.), Herbaceous Stem on a Palæolithic Implement, 173; Palæolithic Floors, 460
Smith (Edwin F.) and Charles F. Wheeler, Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan—Indigenous, Naturalised, and Adventive, 196
Smith (Edgar A.), Tanganyika Shells, 218
Smith (Prof. Goldwin), on Science Teaching, 373
Smith (Sydney), Death of, 536
Smoke-abating Appliances, Exhibition of, 111
Smoke-Abatement Exhibition, 121, 219
Smokeless London, Edmund McClure, 173
Snakes, Notes about, Arthur Stradling, 377
Society of Arts Patent Bill, 30
Society of Chemical Industry, 469
Society of Telegraph Engineers and Electricians, 192
Solar Parallax from Observations of Mars, 278; Galle's Method for, 472
Solar Physics, Prof. Stokes's Lectures on, G. G. Stokes, 30; Capt. Abney's Lectures on, 162, 187, 252
Solar, Gas-Flame, and Electric Light Spectra, J. Rand Capron, 152
"Solar" Locomotive on the French Northern Railway, 161
Solar Halo, J. T. Brownell, 290; W. F. Evans, 386
Solar Eclipse of May 17, Total, 375, 450, 472, 594; Eclipse Notes, by J. Norman Lockyer, F.R.S., 573; M. Bischoffsheim's Expedition to Egypt, 418
Solar Observations, Sir William Thomson, F.R.S., 316
Solar Energy, Conservation of, Dr. C. W. Siemens, F.R.S., 440, 504, 603; E. Douglas Archibald, 504; Prof. Chas. Morris, 601; Dr. T. Sterry Hunt, 602
Solar Spot, Equatorial, Wentworth Erck, 481
Solar Spectrum in a Hail-Storm, C. H. Romanes, 507
Soldiers who have died on the Battle-field, Attitudes retained by, 230
Soldier's Bed, New Design for a, 537
Solomon Islands, New Birds from the, 282
Song of the Lizard, Francis P. Pascoe, 32
Sound, Action of Free Molecules on Radiant Heat and its Conversion thereby into, J. Tyndall, F.R.S., 232; Coloured, Karl Pearson, 339
Sounds and their Relations, Alex. Melville Bell, 503
Sound-producing Ants, H. F. Blanford, 32; J. Fotheringham, 55; D. M. Lewis, 266
South Australia, Weather in, Mrs. Merrifield, 483
South Jutland, Earthquake in, 396
Southern Cross, Dante and the, Samuel Wilks, 173; J. J. Walker, 173, 217; N. Perini, 197
Spain, on the Whale Fishery of the Basque Provinces of, Clements R. Markham, F.R.S., 365
Sparrows in South Australia, 18
Specific Heat and Thermal Conductivity, H. G. Madan, 507
Spectrum Analysis: Spectrum of the Electric Light, J. Hopkins Walters, 103; Solar, Gas-flame, and Electric Light Spectra, J. Rand Capron, 152; Photographic Spectrum of the Great Nebula in Orion, William Huggins, F.R.S., 489; Solar Spectrum in a Hailstorm, C. H. Romanes, 507; on the Spectrum of Carbon, by Professors Liveing and Dewar, 545
Spottiswoode (Dr. W., Pres.R.S.), Address at Royal Society, 115, 138; Matter and Magneto-Electric Action, 539; and J. F. Moulton, F.R.S., on the Movement of Gas in "Vacuum Discharges," 594
Stamkart (Dr. F. J.), Death of, 395
Stanford's London Atlas of Universal Geography, 383
Stars: Binary, 421; Star γ Virginius, 19; Binary, η Cassiopeiæ, 186; Double, 43; Variable, 114, 186, 209, 278, 471, 538; U Geminorum, 450; Ceraski's U Cephei, 493; New Red in Cygnus, J. Birmingham, 198; New Red, Prof. Edward S. Holden, 410; "Easy Star Lessons," Richard A. Procter, 358; Earliest Daylight Observations of Stars, 421
Steckborn on Lake Constance, Discovery of Lacustrine Relics, 470
Stecker (Dr.), Exploration of Lake Tana, 209
Steeten on the Lahn, Prehistoric Remains Discovered at 421
Steno, Prof. Thos. McKenny Hughes, F.R.S., on, 484
Steudel's Nomenclator, 223
Stevenson (Chas. Alex.), Velocity of Wind, 102; Vivisection, 483
Stevenson (Thomas), on the relative Resistances of Land and Water to Wind Currents, 607
Stewart (Prof. Balfour, F.R.S.), Heights of the Rivers Nile and Thames, 268
Stieler's Hand Atlas, 232
Stillmann (Dr. J. B. D.), "The Horse in Motion," 591
Stockbridge, Hants, Storm Petrel found near, 18
Stokes (Prof. G. G., F.R.S.), Prof. Stokes's Lectures on Solar Physics, 30
Stone (J. Harris), Natural Ant Trap, 151
Storage of Electricity, Edmund P. Toy, 289
Storage of Energy, Prof. W. E. Ayrton, F.R.S., 495
Storm, Magnetic, G. M. Whipple, 583, 604
Storm-Petrel found near Stockbridge, Hants, 18
Stradling (Arthur), on the Clenching of Hands from Emotional and other Causes in the two Sexes, 364; Notes about Snakes, 377
Strahan (A.), Channel Tunnel, 463
Strange Phenomenon, 484; James Moir, 410; Donald Cameron, 437
Strecker's (Adolph), Short Text-Book of Organic Chemistry by Dr. Johannes Wislicenus, H. Watts, F.R.S., 148
Stress and Strain, Influence of, on the Action of the Physical Forces, Herbert Tomlinson, 401
Struggle of Parts in the Organism, Duke of Argyll, F.R.S., 6; Dr. William B. Carpenter, F.R.S., 6, 52; Geo. J. Romanes, F.R.S., 29
Submarine Ships, Invention of, 325
Suicide; an Essay on Comparative Moral Statistics, Henry Morselli, M.D., George J. Romanes, F.R.S., 193
Sullowsky (M.), Dispatch from, 249
Sulphate of Copper, on the Electrolysis of, G. Gore, LL.D., F.R.S., 473
Sulphur, Sainte-Claire Deville's Studies in, 231
Sulphuretted Hydrogen, Occurrence of, at Aetolikon, 420
Sumatra, Dr. B. Hagen's Exploration of, 89; Fossil Flora of, Dr. Oswald Heer, 200
Sun, Land of the Midnight, Paul B. du Chaillu, 59
Sun, the, C. A. Young, LL.D., 262
Sun's Heat, Variations in the, E. Douglas Archibald, 316
Sun-Spots, Outburst of, July 25, 1881, J. B. N. Hennessey, 241; W. H. M. Christie, F.R.S., 337; Rev. S. J. Perry, F.R.S., 337; Problematical Sun-Spots, 349; Table of the Appearance of Rare Lepidoptera in this Country in connection with the, A. H. Swinton, 584
Sutherland, Geological and Mineralogical Map of, M. Foster Heddle, 526
Sutton (Henry), New Electrical Storage Battery, 198
Swan's Incandescent Light, Photographic Experiment with, H. Baden Pritchard, 54
Swinton (A. H.), Table of the Appearance of Rare Lepidoptera in this Country in connection with the Sun-Spots, 584
Swiss Seismological Commission, 251
Swiss Lake Dwellings, 519
Switzerland, Earthquake in, 137, 208; Weather in, Albert Riggenbach, 364
Sydney, N.S.W., Linnean Society, 355
Symbiosis of Algæ and Animals, 377
Symons (W.), Growth of Trees, 218
Syrski (Dr. Simon), Death of, 395
Systematic Mineralogy, Text-Book of, Hilary Bauerman, L. Fletcher, 49
Sze-chuan, E. H. Parker's Notes on, 89

Tait (Prof. P. G.), Pressure Errors of the *Challenger* Thermometers, 90, 127
Tamworth, New South Wales, Discovery of Copper and Iron at, 346
Tana, Lake, Dr. Stecker's Exploration of, 209
Tanganyika, Lake, E. C. Hore's Exploration of, 112, 232; Tanganyika Shells, C. A. White, 101; Edgar A. Smith, 218
Tay and the Forth Bridges, 246
Taylor (Dr.), Curator of the Ipswich Museum, Presentation to, 137

Taylor (Chas. J.), the Recent Weather, 365
"Tea Industry in India; a Review of Finance and Labour, and a Guide for Capitalists and Assistants," S. Baildon, 551
Technical Instruction, Royal Commission on, 42, 137, 161
Technical Education, 477
Teeth, Cause of the Decay of, A. Weil, 136
Tele-dynamics and the Accumulation of Energy—their Application to the Channel Tunnel, E. Walker, 152
Telegraph: in China, 88, 179, 325; in Japan, 450
Telephone in Russian Turkestan, 277
Telescopes, Celestial Objects for Common, Rev. T. W. Webb, 98
Telescopic Definition in a Hazy Sky, Dr. G. W. Royston-Pigott, F.R.S., 77; A. S. Atkinson, 483
Temnopleuridæ, Morphology of the, Prof. P. M. Duncan, F.R.S., 257
Temperature of the Southern Hemisphere investigated by Dr. Hann, 395
Temperatures, Winter, Phenological Observations on Early Flowers, J. Edmund Clark, 552
Temple Observatory, Rugby, 472
Thames and Nile, Heights of the Rivers, Prof. Balfour Stewart, F.R.S., 268
Thermal Conductivity, Specific Heat and, H. G. Madan, 507
Thermometers, Pressure Errors of the *Challenger*, Prof. Tait, 90, 127
Thomas (H. S.), "The Rod in India," 215
Thompson (Sir Henry), Food and Feeding, 478
Thompson (Prof. Silvanus P.), Electrical Resistance of Carbon under Pressure, 482; "Elementary Lessons in Electricity and Magnetism," 550
Thomson (Sir Chas. Wyville), Obituary Notice of, 467
Thomson (Joseph), Exploration of Africa, &c., 299, 302
Thomson (J. J.), on Vortex Rings, 354
Thomson (Sir William, F.R.S.), Solar Observations, 316
Thomson (William), Introduction to Determinants, with numerous examples, 216
Thorpe (Prof. T. E., F.R.S.), Dust Explosions in Collieries, 488
Thudicum's Dr. J. L. W.), Annals of Chemical Medicine, 263
Tides: Ancient Tidal Action and Planes of Marine Denudation, Prof. Edward Hull, F.R.S., 177; Tidal Evolutions and Geology, Dr. Samuel Haughton, F.R.S., 265; Velocities in Tidal Rivers, 280; Taylor and Francis' Tide-Table for 1882, 249; Geological Importance of the Tides, Dr. G. H. Darwin, F.R.S., 213; Hypothetical High Tides, Prof. J. S. Newberry, 357; A. Hale, 385; C. Callaway, 385, 436; S. V. Wood, 408; J. Vincent Elsden, 408; an Elementary Treatise on the Tides, based upon that of the Late Sir J. W. Lubbock, Bart., F.R.S., Rev. J. Pearson, 360
Tiflis, Snow in, 250
Timbo, Exploration of, 349
Time, a Glimpse through the Corridors of, Prof. Robert S. Ball, LL.D., F.R.S., 79, 103; Prof. T. H. Huxley, F.R.S., 241
Time, Synchronisation of, for the United States, 276
Tokio, Geographical Society of, 232; Calendar of the University, 519; Memoirs of the Science Department, 614
Tomlinson (Herbert), the Influence of Stress and Strain on the Action of Physical Forces, 401; Electrical Resistance of Carbon under Pressure, 459
Tongatabu, Earthquake in, 450
Tonnage Question, 585
Tonometer, König's Great, 346
Topley (W.), Geological Survey of Italy, 86
Topographical Botany, H. C. Watson's, 248
Topography of the Planet Mars, 493
Tornadoes, Whirlwinds, Waterspouts, and Hailstorms, 155, 291
Total Solar Eclipse of May, 375, 450, 472, 587
Tourmaline and Beryl, Specimens of, at the Florence Institute, 373
Toy (Edmund P.), Storage of Electricity, 289
Traditions, Primitive, as to the Pleiades, Edward B. Tylor, F.R.S., 150
Tramway, Electric, 13
Tramways, Compressed Air upon, W. D. Scott Moncrieff, 266
Transactions and Proceedings of the New Zealand Institute for 1880, 305
Transit of Mercury, November 8, 19
Transit of Venus in 1882, 242, 493
Transylvania, Fall of Meteorites in, 420
Trap, Natural Ant, J. Harris Stone, 151
Trepinje, Earthquake at, 537
Trees, the Growth of, W. Symons, 218
Tribe (Alfred) and Dr. J. H. Gladstone, F.R.S., Chemistry of the Planté and Faure Accumulators, 221, 461
Trimen (Henry), the Lepidoptera of Ceylon, 32, 338
Trimen's Journal of Botany, 571
Trinidad, Monos Island, 57
Trinity College, Dublin, Observatory of, 616
Trondhjem, Remarkable Phenomenon observed at, 450
Tropical Plants, Select Extra, Readily Eligible for Industrial Culture or Naturalisation, with some Indications of their Native Countries and some of their Uses, Ferd. Baron von Mueller, F.R.S., 480
Trout, Acclimatisation of, in New Zealand, 18
Tuckett (F. F.), Heads and Hats, 55
Tunnel, proposed, through the Col de Somport, 63
Tunnel, Channel, A. Strahan, 463
Turkestan, Destruction of Vineyards in, 450
Tylor (Edward B., F.R.S.), "Die heilige Sage der Polynesier-Kosmogonie und Theogonie," Adolf Bastian, 28; Primitive Traditions as to the Pleiades, 150; Origins of English History, Chas. Elton, 501
Tyndall (John, F.R.S.), Essays on the Floating Matter of the Air in Relation to Putrefaction and Infection," 6; Action of Free Molecules on Radiant Heat, and its Conversion thereby into Sound, 232

Ulven (Western Coast of Norway), New Find of Silurian formation at, 18
Umbrella Sticks and the Pimento Tree, 299
Unicorn, the, a Mythological Investigation, Robert Brown, Prof. A. H. Sayce, 525
United States Naval Observatory, Observations of Double-Stars made at, Prof. Asaph Hall, 122
United States, Synchronisation of time for, 276; Census, 324
University College, Course of Practical Exercises in Physiology, Dr. J. Burdon Sanderson, F.R.S., 408
University Intelligence, 47, 71, 94, 119, 142, 166, 191, 257, 329, 353, 378, 401, 426, 451, 474, 499, 522, 543, 594, 617
Uranium, the Atomic Weight of, 567

Valencia, the Geology of, 566
Vapour-tension of Liquid Mixtures, 231
Variable Stars, 114, 186, 209, 278, 471, 538; U Geminorum, 450; Ceraski's U Cephei, 493; of the Algol Type, 186; Variable Cygni (Birmingham) 1881, 484
Vega, the Voyage of the, A. E. Nordenskjöld, 179, 200
Vegetable Food of the New Zealanders in Prehistoric Times, on the, 318
Vegetation, Palæozoic, Evolution of the, J. S. Gardner, 8
Velocity of Light, Lord Rayleigh, F.R.S., 52
Velocity of Wind, Chas. Alex. Stevenson, 102
Velocities in Tidal Rivers, 280
Venice: Geographical Congress at, 19, 20; Royal Italian Scientific Institution at, Prizes offered by, 185
Ventnor, the Climate of, 33
Ventosa (V.), Integrating Anemometer, 79
Venus, Transit of, in 1882, 137, 242, 493; Expeditions, Arrangements, 565
Verhandlungen der k.k. geologischen Reichsanstalt, 211
Vevey, Fall of a Meteoric Stone at, 88
Victoria Philosophical Institute, 144, 283, 380, 403, 452, 523, 548, 620
Vienna: Imperial Academy of Sciences, 23, 48, 96, 168, 235, 308, 500, 524, 548; Imperial Institute of Geology, 144, 260, 308, 404, 524, 572; Exhibition of Electricity at, 518
"Vignettes from Nature," Grant Allen's, Alfred R. Wallace, 381; Grant Allen, 459; Dr. W. B. Carpenter, F.R.S., 435, 480, 554; W. Budden, 529
Vineyards, Destruction of, in Turkestan, 450
Viper, New Species of, Discovered in Egypt, 302
Virchow (Prof.), Banquet in Honour of, at Berlin, 62, 87
Vivisection Act, Prof. Ferrier and the, 42
Vivisection, 429; Miss Cobbe and H. H. Johnston, 459, 483, 506; Dr. Anna Kingsford, 482; Chas. Alex. Stevenson, 483; Writer of Article on "Vivisection, 506; Arthur Nicols, 506; B.Sc., Student of Medicine, 552
Volcanoes of Japan, Prof. Milne on, 420
Vortex Rings, J. J. Thomson, 354

Wagner (Prof.), on the Medusæ, &c., of the White Sea, 300
Walker (E.), Tele-dynamics and the Accumulation of Energy—their Application to the Channel Tunnel, 152

Walker (J. J.), Dante and the Southern Cross, 173, 217
Walker (Thos.), Aristology ; or, the Art of Dining, 478
Wallace (Alfred R.), "Head-hunters of Borneo ; a Narrative of Travel up the Mahakkam and down the Barito. Also journeyings in Sumatra," by Carl Bock, 3 ; Grant Allen's "Vignettes from Nature," 381 ; "the Story of our Museum, showing how we Formed it, and what it Taught us," Rev. Henry Housman, 407
Walters (J. Hopkins), Spectrum of the Electric Light, 103
Watches which do not require Winding, Invention of, 18
Water, Colour of, 276 ; Moths attracted by Falling, J. Starkie Gardner, 436 ; Water in Australia, F. T. Mott, 507 ; Scarcity of in France and Germany, 593
Waterspouts, Tornadoes, Whirlwinds, and Hailstorms, 155, 291
Watts (H. F.R.S.), a Treatise on Chemistry, by H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S., 50 ; "Adolphe Strecker's Short Text-book of Organic Chemistry," Dr. Johannes Wislicanus, 148
Wead (Chas. K.), on Combining Colour Disks, 266
Weather, the, 285 ; Richard M. Barrington, 79 ; R. McLachlan, F.R.S., 241 ; Chas. J. Taylor, 365 ; (in Switzerland) Albert Riggenbach, 364 ; in South Australia, Mrs. Merrifield, 483 ; Daily Weather Charts in the North Atlantic, 605
Webb (Rev. T. W.), the Autumn Sky, 9, 36 ; "Celestial Objects for Common Telescopes," 98 ; the Great Nebula in Andromeda, 341
Wedgwood (Julia), a Pet Baboon, 217
Weith (Dr. Wilhelm), Death of, 185
Wetterham (D.), Arctic Research, 102
Whale Fishery of the Basque Provinces of Spain, on the, Clements R. Markham, F.R.S., 365
Whale, Basque, in the Mediterranean, Prof. Henry Hillyer Giglioli, 505
Wheeler (Chas. F.), Edwin F. Smith, Catalogue of the Phaenogamous and Vascular Cryptogamous Plants of Michigan, Indigenous, Naturalised, and Adventive, 196
Whipple (G. M.), Earth-Currents, 316 ; Magnetic Storm, 583, 604
Whirlwinds, Tornadoes, Waterspouts, and Hailstorms, 155, 291
White (C. A.), Tanganyika Shells, 101
White (E. W.), "Cameos from the Silver Land ; or, the Experiences of a Young Naturalist in the Argentine Republic," 480
White Sea, Fauna and Flora of the, 328
Whitehead (Dr. J. L.), Climate of the Undercliff, Isle of Wight, 33
Wiesner (Dr. Julius), "Elemente der Anatomie und Physiologie der Pflanzen, 503 ; "Das Bewegungsvermögen der Pflanzen : eine Kritische Studie über das gleichnamige Werk von Chas. Darwin nebst neuen Untersuchungen," Francis Darwin, 578, 597
Wilks (Samuel), Dante and the Southern Cross, 173
Williams (W. Mattieu), Movements of Jupiter's Atmosphere, 338
Williamson (Prof. A. W., F.R.S.), an Error in the commonly-accepted Theory of Chemistry, 21
Williamson (Prof. Wm. C., F.R.S.), *Helophyton Williamsonis*, 124, 173
Willoughby (Edward F.), Heads and Hats, 55
Wilson (Sir Erasmus, F.R.S.), Egypt of the Past, 74
Wind, Velocity of, Chas. Alex. Stevenson, 102
Wind Measurements, 486 ; C. H. Romanes, 505 ; Richard B. Prosser, 505
Wind Currents, on the Relative Resistances of Land and Water to, Thos. Stevenson, 607
Wings of Pterodactyles, Prof. O. C. Marsh, 531
Winter Refuges, our : Ventnor, 33 ; the South of England, 11, 154
Woeikof (Dr. A.), System of Meteorological Observations in the China Seas, 410 ; Glaciers and Glacial Periods in their Relations to Climate, 424
Women, Success of, in the Honours Examinations of the University of London, 16
Wood (S. V.), Hypothetical High Tides, 408
Woodward (Dr. Henry, F.R.S.), Obituary Notice of Sir Antonio Brady, 174
Woorara, 323
Wright (Dr. E. Perceval), Researches on Animals containing Chlorophyll, 361
Wroblewski (Dr. S.), on the Application of Photometry in the Study of the Phenomena of Diffusion in Liquids, 45
Wragge (Clement L.), Meteorological Observations on Ben Nevis, 491
Wundt (Wilhelm), "Philosophische Studien herausgegeben," 336

Yellow River and the Pei-ho, H. B. Guppy, 584
Young (C. A., LL.D.), the Sun, 262

Zaragoza (Don Justo), on Ancient Canal Schemes between the Atlantic and Pacific in Central America, 113
Zeitschrift für wissenschaftliche Zoologie, 23, 305, 401
Zinc, Molecular Structure of, Influence of Heat on the, 374
Zodiac, Origin of the Signs of the, "The Unicorn : a Mythological Investigation," Robert Brown ; "Astral Origin of the Emblems and Hebrew Alphabet," J. H. Broome, Prof. A. H. Sayce, 525
Zoological Atlas (including Comparative Anatomy), with Practical Directions and Explanatory Text for the Use of Students. Invertebrata, D. M'Alpine, 122
Zoological Gardens, Additions to, 18, 43, 64, 89, 114, 138, 161, 186, 208, 231, 251, 277, 302, 326, 348, 375, 396, 421, 450, 471, 493, 519, 538, 566, 593, 616
Zoological Record 1880, 240
Zoological Society, 95, 143, 234, 258, 307, 402, 474, 499, 547, 594, 619 ; Jumbo, 386, 393, 487 ; Zoological Society's Living Collection, Illustrations of New or Rare Animals in the, 295, 391, 608
"Zoologie, Abriss der, fur Studirende, Arzte und Lehrer," Dr. A. Brass, 337

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

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

THURSDAY, NOVEMBER 3, 1881

A RECENT "FIND" IN BRITISH PALÆONTOLOGY

THE world is but rarely startled nowadays by the discovery of whole groups of new organisms from the rocks of Britain; it is only from the Far West that such surprises come. Two or three generations of active collectors have ransacked our strata so thoroughly that only now and then by some happy chance is a new vein of research opened, the finder of which may be congratulated rather on his good luck than on his special acuteness in observation. Such a vein has recently been struck by the Geological Survey among the Lower Carboniferous rocks of the south of Scotland. Some account of the more important features of this "find" may be of interest to the general reader.

Travellers who enter Scotland from the south, remark that after leaving the plains of the Tweed on the east side, or those of the Solway on the west, they find themselves in a range of hills or uplands, not lofty and picturesque indeed, but with sufficient height and individuality of feature to form a notable barrier between the valleys of the border on the one hand and the Scottish Lowlands on the other. This belt of pastoral high grounds, so bright with the glamour of poetry and romance, has a special interest to the geologist. He can trace it back to its origin about the close of the Silurian period, when it first began to rise out of the sea, and served, by its upheaval, to define one or more of the great inland basins in which the Old Red Sandstone was deposited. From that ancient time down to the present the ridge seems to have formed a barrier between the basins on its northern and southern margin. No doubt it has been enormously worn down in the general denudation of the country, deep valleys have been trenched through it; much of it has now and again been submerged and covered by masses of sedimentary material. Nevertheless it has preserved its existence. Lying along a line of terrestrial weakness, its strata, originally horizontal sheets of mud and sand, piled over each other to a depth of many thousand feet, have been crumpled and corrugated to a vast extent. The movements by which these contortions were produced have doubtless recurred at many intervals, so that we may conceive them to have in some measure, if not entirely, compensated by occasional elevation for the lowering of the level of the ridge by continuous denudation.

During the early part of the Carboniferous period these southern Silurian uplands of Scotland formed a barrier between the lagoons of the Lowlands and the more open waters to the south which spread over the north and centre of England. That the ridge was not continuous, or at least that there was now some water-way across it or round its end, between the basins on either side, is indicated by the similarity of their fossils. Yet that it formed on the whole a tolerably effective barrier is indicated partly by the marked difference between the corresponding strata on its northern and southern flanks, and partly by the singular series of organic remains to which attention is here called.

For some years past the Geological Survey of Scotland has been engaged in the detailed investigation of the Carboniferous rocks between the Silurian uplands and the English border. The whole region has now been mapped; the maps are partly published, and partly in the hands of the engraver for speedy publication. The rocks have been collected, and their chemical and microscopic analysis is in progress. Their fossils have been gathered from every available stratum, and have already been in large measure named and described. So that materials now exist for a tolerably complete review and comparison of the stratigraphy, petrography, and palæontology of the Carboniferous rocks of the Scottish Border. In the course of the work one particular zone of shale on the banks of the River Esk has been found to possess extraordinary palæontological value. From this stratum where exposed for a few square yards by the edge of the river a larger number of new organisms has been exhumed by the Survey than has been obtained from the entire Carboniferous system of Scotland for years past. As a whole the remains are in an excellent state of preservation. Indeed in some instances they have been so admirably wrapped up in their matrix of fine clay as to retain structures which have never before been recognised in a fossil state.

The more important treasures from the shales of Eskdale and Liddesdale are fishes, crustaceans, and arachnids. The fishes were at once placed in the hands of Dr. R. H. Traquair, whose devotion to fossil ichthyology has made him our *facile princeps* in this department of palæontology. The first part of his report on them, devoted to the Ganoidei, has been completed and is published by the Royal Society of Edinburgh (*Trans. Roy. Soc. Edin.* xxx. (1881), p. 15). He points out the extraordinary interest of the collection, both as opening up an almost entirely new fish-fauna, and as revealing remarkable structural peculiarities in many of the new forms. Out of twenty-eight species of ganoids no fewer than twenty at least are new. Of the sixteen genera in which these species are comprised five are now for the first time added to science (*Phanerosteon*, *Holurus*, *Canobius*, *Cheirodopsis*, and *Tarrasius*), of which one (*Tarrasius*) is altogether so peculiar that no place can be found for it in any known family. To the family of Palæoniscidæ fifteen new species and three new genera are added. The most abundant species is a form of *Rhadinichthys*, which occurs also on the north side of the Silurian barrier. Another fish of common occurrence in the latter region is *Eurynotus crenatus*, of which only a single scale has been found in the Eskdale and Liddesdale region. A third species common to the two sides of the barrier is probably *Wardichthys cyclosoma*. But with these and possibly one or two other exceptions, all the fishes in the southern area are as yet peculiar to it, while at the same time the common forms of the Lothians are conspicuous by their absence in Eskdale and Liddesdale. These facts suggest interesting problems in Carboniferous geography and in ancient zoological distribution.

Without entering here into structural details, we may refer to the peculiarities of one or two of the new forms described by Dr. Traquair. He proposes the term *Phanerosteon* for a genus of Palæoniscid fishes, possessing a fusiform body, apparently for the most part devoid of scales, with a peculiarly rounded off dorsal fin, and destitute of fin-fulcra. If the nakedness of the body be due not to the non-preservation of scales, but, as seems almost certain, to the original absence of them, we are here presented with a Palæoniscoid fish showing a condition of squamation almost identical with that of *Polyodon*. Only one species, but a number of specimens of it have been obtained. The new genus *Holurus*, though placed by its author among the Palæoniscidæ, offers in its non-bifurcated caudal and rounded long-based pectoral fin a contradiction to his definition of this family; but the cranial osteology is in the main so decidedly Palæoniscid that he prefers to regard the genus as standing most fittingly where he has put it. Two species are described. Still more aberrant from the typical Palæoniscidæ is the genus *Canobius*, which to the general configuration of the family unites a disposition of the suspensorial and opercular apparatus almost identical with that of the same parts in the Platysomid *Eurynotus*. Four species are described. But the most remarkable of all this singular group of fishes is included by Dr. Traquair in a new family, to which, from the more characteristic of two specimens having been found at the foot of the Tarras Water, he has given the name of Tarrasiidæ. *Tarrasius*, the typical and only known genus possesses rhombic, minute, shagreen-like scales, persistent notochord, well ossified neural and hæmal arches and spines, with the slender interspinous bones penetrating between the extremities of the vertebral spines as in teleostean fishes, and a long dorsal fin composed of closely-set jointed rays. Only two specimens, conjectured to belong to the same species, have as yet been obtained. Their state of preservation is such as to leave in doubt some important parts of the structure of this curious fish. It is to be hoped that future exploration in the same prolific locality may furnish Dr. Traquair with additional evidence on the subject, and enable him to complete his work.

Associated with the skeletons of the fishes are the remains of some new phyllopod and decapod crustaceans, which have been worked out by Mr. B. N. Peach, the Acting Palæontologist of the Scottish Geological Survey, who has described them in a memoir also communicated to the Royal Society of Edinburgh (*Trans. Roy. Soc. Edin.* vol. xxx. (1881) Part 1). The Phyllopods consist of two new species of *Ceratiocaris*, which differ from the Silurian species of this genus in having the body relatively much larger than the carapace. The numerous specimens are in a good state of preservation, one individual having been found with its intestinal canal distended with food. Of Macrurous Decapods several new species occur that differ in no essential respect from their living representatives. They belong to the genera *Anthrapalæmon*, *Palæocrangon*, and *Palæocaris*, upwards of forty specimens of one species of *Anthrapalæmon* having been obtained. Mr. Peach has worked out their structure with great skill. Among his observations is the occurrence of abundant minute calcareous calculi on the tests of these crustacea, precisely like those of the common shrimp.

One of the most singular features in our recent additions to the palæontology of the Lower Carboniferous rocks of the Scottish Border is the abundance in which the remains of scorpions have been discovered. The existence of these arachnids (*Eoscorpius*) in strata of this age in Scotland was made known some years ago by Dr. H. Woodward. But we are now in possession not of mere single and imperfect fragments, but of numerous and often admirably-preserved specimens which have enabled Mr. Peach to work out the structure of the insects in great detail. In anticipation of the early publication of his descriptions the following notes may be given here. He finds that these Palæozoic forms differ in no essential respect from the living scorpion so far as regards external organs. He has recognised in them every structure of the recent form, down even to hairs and hooks on the feet. The sting alone has not been certainly observed, but that it existed may be inferred from the presence of the poison gland which Mr. Peach has detected in the fossil state. The chief difference between the living scorpion and its ancient progenitors lies in the fact that in the fossil forms the mesial eyes are much larger in proportion to the lateral ones, and also to the size of the whole animal. The two mesial eyes are placed on an eminence near the anterior margin of the carapace formed by two converging tubes, and so arranged that the creature could look with them upwards, outwards, and forwards. There are at least four lateral eyes on each side. The mandibles, palpi, and four pairs of walking legs are beauti-

fully distinct on many specimens. The combs are much like those of the modern scorpion, but with a very remarkable sculpturing which at once recalls that so characteristic of the Eurypterids. The genital orifice, combs, and eight breathing stigmata occupy positions similar to those of the same organs in the modern scorpion. As regards theories of descent these fossils afford no more help in tracing the pedigree of the scorpion than is furnished by the living form, for it is obvious that the scorpion has remained with hardly any change since Carboniferous times. There can be little doubt that it is the most ancient type of Arachnid, whence the others have been derived.

Since the first specimens of scorpion were found by the Geological Survey among the Lower Carboniferous beds of the Border further research has brought many more to light from other and distant parts of the country. No fewer than five species belonging to a single genus (*Eoscorpius*) have been recognised by Mr. Peach, some of which must have contained individuals eight or ten inches in length. Most of these specimens, and also the crustacea and fishes above referred to, have been obtained by the Survey fossil-collector, A. Macconochie.

One further interesting fact deserves mention here. When the Geological Survey first began its work in Scotland, and was engaged in mapping the east of Berwickshire and Haddingtonshire, a remarkable and hitherto unique specimen was found there which was described by Salter under the name of *Cycadites Caledonicus*, as the most ancient cycad yet known. Among the specimens recently collected by A. Macconochie from the Border ground are several apparently of this same form which are so well preserved as to show that they are not plants at all. They occur together with species of *Eurypterus*, and are almost certainly a yet undescribed comb-like organ belonging to that creature. This fact, coupled with the singular eurypterid-like sculpture on the combs of the fossil scorpions, lends support to the suggestion which has been made that the eurypterids are ancestral aquatic arachnids.

ARCH. GEIKIE

THE HEAD-HUNTERS OF BORNEO

The Head-hunters of Borneo: a Narrative of Travel up the Mahakkam and down the Barito; also Journeyings in Sumatra. By Carl Bock (late Commissioner of the Dutch Government). With thirty Coloured Plates, Map, and other Illustrations. (London: Sampson Low, Marston, Searle, and Rivington, 1881.)

THIS large and lavishly-illustrated volume derives its chief value from the fact that the author is a clever artist, and that all the handsome coloured plates which form the main feature of the book are evidently careful drawings made on the spot, not imaginary designs concocted from more or less imperfect sketches or descriptions. The houses, villages, and forest scenes are all true to nature, and the same may be said of the numerous portraits of the Dyaks and illustrations of their domestic life and customs. The figures are indeed wonderfully life-like and the drawing accurate, the only fault being a very slight tendency to Europeanise the features—a kind of personal equation due to Mr. Bock's artistic studies having been made from European models. This is visible in the small and well-formed mouths of the two women in Plate 16, and in the perfectly straight and well-developed nose of the "Chief of the Forest People" in Plate 24. When, however, he has taken special pains and has had ample time to finish his drawing, as in "Hetdung, my favourite Dyak Boy" (Plate 23), he avoids this fault, and gives us a portrait as perfect and as characteristic as a good photograph.

Mr. Bock went out to the East to collect birds in Sumatra for the late Marquis of Tweeddale, and spent about nine months in that island. He was then employed by the Dutch Government to make an excursion through the interior of Borneo, to report on some of the Dyak tribes and collect specimens of natural history for the museums of Holland. This journey, which occupied in its preparation and execution about six months, was partly over ground new to European travellers; first to the country of the Poonau Dyaks in about 1° 40′ N. lat., 116° 30′ E. long., and then up a western tributary of the Mahakkam or Koti River, and overland for a short distance to the head waters of the Teweh, a branch of the Barito or Banjermassin River. This watershed is in about 0° 5′ S. lat. and 115° 35′ E. long., and appears to consist of an undulating country with a few detached hills. It is however marked by a curious geological phenomenon very rarely met with in the tropics, a large area covered with huge angular rocks, of every shape and size and tossed about in the greatest confusion. It is called by the natives *Jalan batu*, or the Stony way, and our author's description of it will bear quotation:—

"Covering an area of several square miles, and cropping up as it were in the centre of a vast forest, this Field of Stones is well calculated to arouse the superstitious dread of a savage people. Here scattered in wonderful confusion like the remains of a ruined castle: there standing erect and orderly as if carved by chisel and levelled by plumb-line and square: some in ponderous masses as large as a house, fifty or sixty feet in height and of still greater width and thickness: others heaped like so many petrified cocoa-nuts, or like a pile of forty-pounder cannon-balls: here bare and gaunt like the pillars of Stonehenge: there moss-covered and decked with ferns or gorgeous flowers: in all directions for miles and miles the stones lie scattered. Some of them have assumed fantastic shapes, in which the imagination can easily picture a travesty of the human form, or of other familiar objects: others again are marked with quaint devices, where wind and rain have put finishing touches to natural cracks and crevices, and made them assume the appearance of deliberately carved inscriptions, like those seen on ancient weather-beaten tombstones—or rather, like the curious 'picture-writings' found on scattered stones and rocks in British Guiana and other parts of South America. . . . For miles our route lay through this wilderness of sterility and fertility combined—sometimes creeping between two parallel walls of stone, thrown so closely together that there was scarcely room to walk sideways; sometimes making a considerable *détour* to avoid a more than usually rough spot. In some places the earth was covered with small loose stones, most difficult and painful to walk over; in others, the ground seemed to be of solid rock, and great care was necessary in walking to prevent one's feet being fixed in one of the innumerable crevices, which were the more dangerous from being partially covered by vegetation. Many of the large stones were so lightly balanced on a small foundation that it seemed as if the exercise of a moderate force would be sufficient to overturn them."

Mr. Bock was at first inclined to attribute this phenomenal region to volcanic agency; but, considering that no earthquakes or volcanic phenomena occur throughout Borneo, and that these rocks are all "a rubbly limestone," he concludes that they owe their origin to "the denuding force of the torrential tropical rains, which have gradually bared the limestone deposit." This however is a very lame conclusion, and in no way accounts for the extraordinary way in which the rocks have been fractured and heaped over each other. The only sufficient explanation is to be found in the action of subterranean waters dissolving away the limestone rock and thus forming extensive caverns, the roofs of which have at length fallen in over a large area, and thus produced the unmistakable appearances of violent upheaval and fracture. This phenomenon is however very rare on so extensive a scale, and, so far as we can recollect, this Bornean "field of stones" is almost unique. The nature of the surrounding country is not described, but the locality appears to be a low and nearly level watershed between the lateral tributaries of two great river systems, so that there might be a subterranean drainage in two directions. In many other parts of Borneo there are indications of long-continued denudation, and it may be that the very absence of volcanic phenomena, and the consequent stability of the surface for long periods, has rendered possible the amount of uninterrupted subterranean denudation required to produce this mimic representation of great volcanic convulsions.

Mr. Bock gives us a pretty full account of the Dyak tribes of Southern Borneo and all that he could learn about them, and the general impression of his descriptions, aided by his life-like portraits and domestic scenes, is, that there is a wonderful similarity between all the chief tribes of this great island both in physical and mental characteristics, though there are many specialities in habits. In the south we find a decided indication of Pacific influence in the general practice of tattooing, in the custom of *pomali* or "taboo," and perhaps even in the practice of cannibalism by one tribe—the Tring Dyaks. In the south, too, the use of the blow-tube seems to be almost universal, whereas it is comparatively rare in the north; but in their general character and habits, customs, ideas, and superstitions, there is a practical identity which renders much of Mr. Bock's volume a repetition of what has been more fully and accurately described by St. John, Grant, and other writers.

We may however note a few of the more novel or interesting facts recorded. Mr. Bock never saw an orang-utan, so that this animal is evidently far less abundant in the southern than in the north-western parts of the island. He describes the effects of a great drought in 1878—a year before his visit—which destroyed the forest-trees over large areas and caused the destruction of birds and game, and the failure of crops, to such an extent as to cause a famine, and this on the equator in an area of dense forest where rains are usually of almost constant occurrence. Almost the only amusing episode in the book is the account of an earnest attempt to discover the much-talked-of "tailed men" of Borneo. Tjiropon, an old and faithful servant of the Sultan of Koti, declared, in the Sultan's presence, that he himself had seen some of these people in the Passir country. He called them "Orang-bontoet," or tailed men, and added the usual statement, that the tail was from two to four inches long, and that the people cut holes in the floor to receive it, so that they could sit down comfortably! Mr. Bock thought this so absurd that he disbelieved the whole story, but the Sultan of Koti was greatly impressed by it, and it was decided to despatch Tjiropon on an embassy to the Sultan of Passir with a letter requesting him to send by the bearer two of the "Orang-bontoet." After a long absence he returned, and met the party at Banjermassin as agreed; but he was very crestfallen, and would say nothing except that he had delivered the letter, and had not been able to procure any tailed men. Thereupon the Resident of Banjermassin, at Mr. Bock's request, himself sent a party to Passir with a letter to the Sultan, requesting him to say if there really were any tailed men in his country, and what had happened to the former messenger. After twenty-five days' absence the party returned, with a message from the Sultan of Passir explaining the whole matter. It appears that the Sultan's personal attendants are known by the term "Orang-boentoet di Sultan di Passir"—literally "the tail-people of the Sultan of Passir." The Sultan declared he had never heard of any other "orang-bontoet." He was very angry at two of his suite being so unceremoniously asked for, and ordered the messenger to depart instantly on pain of being flogged—a threatened indignity which sufficiently accounted for poor Tjiropon's silence. When again spoken to, however, he exclaimed,—"Before Allah! I *have* seen the *Orang-bontoet* long ago, and have spoken to them, but I could not see them this time."

Among the few natural-history facts noted, are, the conspicuousness of the wild bees' nests "at variance with the almost universal habit among all animals to conceal their nests as much as possible." But these nests evidently come under the category of objects which exhibit warning colours, being sufficiently protected by the stings of their inhabitants. The remarkable tenacity of life of the *Loris tardigradus* is well illustrated in the following passage:—

"One day I wounded one, and knowing its tenacity of life I strangled the little animal, then cut it open and pierced its heart. An hour elapsed before I waited to skin it, and when I took down the body I found it still alive, its lovely eyes wide open. When, hoping to finally despatch it, I pierced its brain with a needle, it began to shriek, and still some minutes elapsed before it was actually gone."

An equal tenacity of life is found in the allied Galeopithecus, which could be killed neither by breaking the spine nor piercing the brain, and it is not improbable that the continued survival of these very ancient types in the midst of higher forms may be in part due to this extreme power of endurance.

The journal of the Sumatra expedition contains little of importance, and all that is new or valuable in the volume might have been well compressed into a couple of magazine articles or papers for the Geographical Society. The illustrations however furnish the real *raison d'être* of the book; and besides the portraits of natives already referred to, attention may be called to the plate "Crossing the River Benangan," which gives the very best and most accurate idea of an equatorial forest that the present writer has ever met with. ALFRED R. WALLACE

BUTTERFLIES

Butterflies: their Structure, Changes, and Life-Histories, with Special Reference to American Forms. Being an Application of the "Doctrine of Descent" to the Study of Butterflies. With an Appendix of Practical Instructions. By Samuel H. Scudder. (New York: Henry Holt and Company, 1881.)

MR. SCUDDER'S great reputation as an entomologist will cause many readers to turn to this beautifully got up volume with eager curiosity. They will expect to find a tolerably full account of all those interesting and complex phenomena of metamorphosis, variation, dimorphism and polymorphism, protective colouration, mimicry, and distribution, for the elucidation of which no class of organisms offers such abundant and striking materials; while they might not unreasonably anticipate that the bearing of the whole series of these phenomena on the "Doctrine of Descent" would be clearly indicated and the necessary conclusions to be drawn from them strongly insisted upon. The first separate work ever published on the general history of butterflies, as distinguished from their classification or specific description, would naturally excite some such expectations as these; but those who have entertained such ideas will be disappointed, and may perhaps be inclined to give the book less credit than it really deserves. We will therefore briefly indicate its contents and point out a few of its merits and deficiencies.

The first four chapters—"The Egg," "The Caterpillar," "The Chrysalis," and "The Butterfly"—respectively, give a very good general account of the form and structure of the insect during the stages of its existence, and they are illustrated by a large number of very excellent woodcuts, many of which seem to be original. Then follow descriptions of the internal organs, and their transformations during development, and a good chapter on habits, illustrated almost exclusively from North American species. We now come to the more important and interesting part of the volume, and find chapters on "Seasonal Changes and Histories," "The Colouring of Butterflies," "Diversity of the Sexes in Colouring and Structure," "The Origin and Development of Ornamentation," "Ancestry and Classification," and "Geographical Distribution," the titles of which cover a wide range, and seem to include all the chief points required for a full exposition of the subject. The treatment however is by no means satisfactory, since it is a rare thing to find any fact even alluded to beyond the range of North American species; and though the valuable observations of Edwards and Riley are frequently referred to, the important researches of Weismann and Fritz Müller are hardly mentioned. Far more important however is the almost total silence on the whole question of protective and warning colouration in larva and perfect insects and the wonderful phenomena of mimicry, which play so large a part in determining both the forms and colours of insects all over the world, and which are so marvellously developed in butterflies. The absence of all these considerations renders the chapter on "The Origin and Development of Ornamentation" most unsatisfactory, since it is almost wholly devoted to suggestions as to the probable lines which have been followed in the development of the ornamentation, while we are left without any clue to the reasons for such special and wonderfully diversified results, or the laws by which they have been produced. Equally meagre is the chapter on "Geographical Distribution," which is treated solely from the point of view of the North American collector.

A more important fault than these deficiencies, in a work presumably intended for popular reading and to excite young American entomologists to a more complete study of their subject, is the very peculiar system of nomenclature adopted by the author, which, by the needless difficulties it will cause, must tend to disgust beginners with the whole study of natural history. The writer who has done more than any other person to facilitate the study of North American butterflies is Mr. William H. Edwards, who, besides a great work on "The Butterflies of North America," illustrated by fine coloured plates, has published, so recently as 1877, a complete "Catalogue" of the species. He is in fact *the* authority on North American butterflies, to the conscientious study of which he has devoted his life. When any such standard systematic work exists in a country, it seems to us the obvious duty of all who write popular books to follow its classification and nomenclature, not as endorsing their correctness, but simply to facilitate reference to works which every student *must* constantly refer to. Instead of doing so Mr. Scudder follows a quite different order in his systematic list of species, adopts a complex system of families, sub-families, tribes, and genera, mostly with unfamiliar names; and uses a generic nomenclature so totally unlike that of the above-named standard work, that out of a list of fifty-eight genera referred to in his volume only ten have the same names as those adopted by Mr. Edwards. As an example of the difficulty and confusion this must cause to a beginner we may mention that the North American species of the old genus Papilio are here given under five distinct generic names; Lycæna under the same number, and Argynnis under four. The family Papilionides, which Mr. Scudder retains, no longer contains the genus Papilio, after which it is named, because he transfers this name to our old friend the Camberwell Beauty, which he styles *Papilio Antiopa*. The old Satyridæ, or Meadow Browns, are now named Creades, and they are placed at the head of all the butterflies instead of near the end, as in the works of Edwards and of all the old writers. This must be all the more puzzling, because throughout the body of the work these names are everywhere given without the least indication that they are not in universal use. Thus at pages 100–102 we have *Basilarchia Archippus* many times mentioned, with a reference to Riley. But that author always uses the old name *Limenitis disippus*, and in the copious index to his Missouri Entomological Report, just issued, the name Basilarchia is not to be found, neither does it appear, even as a synonym, in Mr. Edwards' "Catalogue"! No one will object to differences of opinion on questions of nomenclature, when kept to their proper place in strictly scientific treatises; but every one who has at heart the extension of a taste for natural history has a right to protest against such totally unnecessary difficulties being thrown in the path of beginners.

We regret having to speak so strongly in animadversion of a book which contains much interesting matter and much valuable information, which is written in a pleasant

style and is illustrated in a very attractive manner. But we feel that an opportunity has been missed of producing a volume which should open up one of the most marvellous pages in the book of nature, in a manner to interest a wide class of readers and attract many new votaries to the study of these most beautiful and in many respects most instructive members of the great class of insects.

OUR BOOK SHELF

The Quarterly Journal of Microscopical Science. (London: Churchill.)

THE twenty-first volume of the second series of the above journal—published during the four quarters of this year—lies in its complete form before us, and it seems to merit more than a passing record at our hands. The volume contains over 650 pages of text, and, besides woodcuts, thirty-four plates, many coloured, and the majority of double size; but it is not the quantity of the material, gratifying though it be to see that the British school is not wanting in this respect, so much as the quality of the contributions that we would call attention to. In the importance of its Memoirs this journal, now in its majority, may fully claim to rank on the level of the highest of those comparable to it published in Germany, and its editor and his assistants are to be congratulated on seeing that all the subjects coming under their province are so fairly dealt with. It is not proposed to treat here of the individual memoirs from a critical point of view—no one individual could write such a criticism—but as a general *résumé* of the work done. Slightly classified, vegetable histology and physiology is enriched by the papers on *Welwitschia mirabilis* by F. Orpen Bower; on the development of starch grains, by F. W. Schimper; on the water glands in the leaf of *Saxifraga crustata*, by W. Gardiner. As contributions to zoology may be mentioned the memoir by G. Busk on Polyzoa; by H. B. Brady on Reticularian Rhizopods; a most important paper on Limulus an Arachnid, by the editor; to embryology the researches of Lankester on Limnocodium, Scott on Lampreys, Wilson on Actinotrocha; to anatomy the memoirs, on the head cavities and nerves of Elasmobranchs, by Dr. Marshall; on the nasal mucous membrane, by Dr. Klein; on the Branchiate Echinoderms, by Herbert Carpenter; on the organ of Jacobson, by Dr. Klein; on the lymphatic system of the skin and mucous membrane, by Dr. Klein; on the Wolffian duct and body in the chick, by Adam Sedgwick; on the cranial nerves of Scyllium, by A. Milnes Marshall; and on the structure and significance of some aberrant forms of Lamellibranchiate gills, by Dr. K. Mitsuri. Nor must the papers by Mrs. Ernest Hart on the micrometric numeration of the blood corpuscles; by J. F. Dowdeswell on some appearances of the blood corpuscles; nor those by Dr. Cunningham on microscopic organisms in the intestinal canal, and Prof. Lister on the relations of micro-organisms to disease, be overlooked. The value of this volume will thus be apparent to the reader who knows of the subjects of which the above is a condensed list. One thing alone, to our mind, the volume needs, viz. a really efficient index to its valuable contents. The two pages and a half of index to these 650 pages of matter form an index only in name. Would it not be well to have an index volume published to the twenty-one volumes of this series, and then with volume xxii. commence a yearly index which would be both a help and a service to the student?

Essays on the Floating-Matter of the Air in Relation to Putrefaction and Infection. By John Tyndall, F.R.S., LL.D. (London: Longmans and Co., 1881.)

TO reprint these essays in an easily-accessible form was a happy thought of the author's. It is of vast importance to the public at large that they should at least know what views are being held by a large majority of working and thinking men on the subjects of putrefaction and infection. Quite apart from the question of how germs originate is the question of what evils arise from their presence; and although, with most of those who have investigated the matter, we regard it as well proven that, except from a pre-existing germ, no new germ arises, yet we would be prepared almost to overlook this part of the matter in our anxiety to see proper notions diffused as to the effects produced by these "floating matters of the air." The benefits that mankind has gained by the researches of the biologist, chemist, and physicist into this subject are already beyond calculation; nor is there yet any apparent limit to them. From the pages of this small volume some ideas may be gleaned of what the modern treatment of surgical cases has gained by a knowledge of this subject; nor do we think the day far distant when medicine may reach to the rank of surgery through an insight into the germ causation of febrile disease. The history of the silkworm disease in Italy and France bears witness to the enormous value, even if measured in a commercial sense, of the labours of Pasteur, Quatrefages, and others in working out from this point of view the parasitic diseases that caused at one time the almost total destruction of the silk industry in Europe; and the history of Pasteur's researches on fermentation, even when told in a few words, as in the fourth chapter of this volume, does it not tell of discoveries full of benefit to one portion at least of mankind? Prof. Tyndall well writes: "The antiseptic system of surgery is based on the recognition of living contagia as the agents of putrefaction." Keep these away, destroy them either by an excess of cold or heat, and the putrefaction is prevented. But this is true not of surgery only; it makes itself felt in the routine of every-day life. An account was laid before the Academy of Sciences of Paris, in May of this year, of an examination of the feeding-bottles in use at a *crèche* in Paris. The milk for the children put into these contracted a nauseous odour. Of thirty-one examined, twenty-eight contained in the caoutchouc tubes or nipples germs (microscopical microbes), and even in some cases there were masses, more or less abundant, of fungoid vegetations. The milk found remaining in some was acid, with numerous bacteria; and this in spite of what was thought to be cleanliness. No wonder Prof. Tyndall writes of such material—such matter out of place—as dirt. We cannot all contrive to live in the grand, pure air to be found in such places as the Bel Alp; but all could help towards making the air of their dwellings freer from the contagion of dirt; and if right and accurate notions were held on such matters by all interested in them, prevention would soon be seen to be much better than cure. This little volume will be found exceedingly interesting reading, and its contents will furnish the reader with abundant material for thought, which perhaps may, in floating through his brain, take root there and bring forth a crop of good fruit.

E. P. W.

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. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

The Struggle of Parts in the Organism

MR. ROMANES, in his letter published in your number of Oct. 27 (vol. xxiv. p. 604) draws a distinction between the "Argument from Design as elaborated by the Natural Theologians of the past generation," and another argument from design which he

attributes to me, and which he describes as a "metaphysical" teleology—the idea of "an ultimate design pervading all nature, and blending into one harmonious Cosmos the combination and co-ordination of physical causes."

The first of these arguments from design he says he has a right to contest in your columns and to represent as "subverted" by Mr. Darwin: whilst as regards the second of these arguments from design, he admits the truth of my position that "no possible amount of discovery concerning the physical causes of phenomena can affect it."

I am not able to accept this distinction, or to withdraw on the strength of it my protest against the original communication of Mr. Romanes. The distinction is, in my opinion, purely imaginary and fallacious. The fundamental proposition of all arguments from design is simply this: that the exquisite adaptations to special ends which are conspicuous in organic nature are, and can only be, the work of physical forces when these are under the combination and direction and control of Mind.

But the whole force of this general proposition, and the whole power of it to produce conviction, depends on its applicability to particular cases of adaptation. There may be, and there are in nature, a few cases of apparent adaptations and of orderly arrangements of a very simple kind which do not necessarily suggest Mental Purpose. They may be the effect of what we call accident, or of the action of elementary laws under no guidance or direction. Inorganic phenomena furnish many examples of such arrangements. Even among organic things there may be a few examples of them. But in the special and elaborate adaptations of organic structures to their particular work and function, the human mind recognises the operation of mental faculties having a fundamental analogy with its own. Mind is a known agency, producing well-known effects. These effects can be recognised with as much certainty as the effects of any material force acting by itself. The Argument from Design is founded on this recognition. The writers of the last generation were perfectly right in resting the general Argument from Design on the separate instances of adaptation in which the mark of Mind is most signal and conspicuous. I hold, as they held, that each particular instance of adaptation which cannot be due to chance, and which cannot be due to the uncombined action of elementary forces, is "a separate piece of evidence pointing to operations of special design."

Mr. Darwin's theory of Natural Selection no more touches this argument than his hand could touch the fixed stars.

When Sir Charles Bell wrote his beautiful and classical Treatise on the Hand, he knew that the hand of every individual man has been "developed" in the womb. He knew that in the course of that development it passed through many successive stages. He knew that the vital processes concerned in this development were organic processes forming part of "natural law." But it never occurred to him to imagine that the "law" under which such intricate and wonderful adaptations were reached was a "law" in which Design had no part, or over which Mental Purpose had no control. He saw in physical causation the instrument of Mental Purpose, and not its rival or its enemy. He knew, moreover, the close relations between the hand of man and the less perfect, but the equally adapted structures of the same limb in the lower animals. He knew, farther, that the theory of Evolution had been started, and that just as individuals were born and grew, so it was suggested that all Animal forms had been born of each other, and that the Human Hand was the result of a long gestation in the womb of Time. He alludes to these theories and sets them aside—not as being untrue, but as being immaterial to his argument. And he was right.

Mr. Romanes is much mistaken if he supposes that the present generation is satisfied with the purely materialistic explanations of adapted structures which are erroneously supposed to be the final result of Mr. Darwin's theory. So thoroughly dissatisfied, on the contrary, with these explanations is the mind of the present generation, that it is breaking out in revolt against them along all the line. The old school of Theism is as alive as ever, and is as ready as ever to appropriate every new fact into the structure of its well-worn defences. And outside this school—among men who reject Christianity altogether, and who sit loose from every known theology—a conviction has arisen that somehow—by whatever name it may be called—Mind is indeed "immanent" in nature, working everywhere with an awful and an abiding Presence.

This view has been supported of late in Germany in a powerful argument by an author whose philosophy may seem grotesque, but who certainly has at his command all the resources of scientific knowledge, and who accepts and incorporates every fact which has been established in the whole field of biological investigation.

I wish Mr. Darwin's disciples would imitate a little of the dignified reticence of their master. He walks with a patient and a stately step along the paths of conscientious observation. No fact is too minute—no generalisation is too bold. But for the most part the whole is kept well within the limits, actual or supposed, of physical causation, and the rash dogmatism on higher questions of Philosophy and Theology which are common among his more fanatical disciples, are "conspicuous by their absence" in his writings.

ARGYLL

IT will be instructive to many, I doubt not, as to myself, to receive from Mr. Romanes an explanation of the precise sense which he attaches to the phrase "a general law whose operation is presumably competent to produce" any set of phenomena.

No one is more desirous than I am to see science freed from all theological complications; and it seems to me that every one who speaks of laws as "governing," "controlling," "regulating," or "producing" phenomena, is really mixing up ideas belonging to two entirely distinct categories.

That in the *purely scientific* sense, a "law of Nature" is nothing more than a general expression of a certain set of uniformities which the intellect of man discerns in the surrounding universe—that such a law holds good just so far as it has been verified, and not necessarily any further—that it accounts for nothing, and explains nothing—and that the power of prediction which it is supposed to give, depends entirely on an *assumption* of its universality, which may or may not be justified by facts—was the teaching of the great masters (Herschel, Whewell, and Baden-Powell), who aimed to form correct habits of thought among what half a century ago was the "rising generation" of scientific men. And as all subsequent writers on the logic of science, from J. S. Mill to W. Stanley Jevons, have taken the same view, I venture to think that it rests with Mr. Romanes to show that there is anything in the *law* of Natural Selection (which is simply the generalised expression of the *fact* of "the survival of the fittest"), that places it in a different category from every other.

The whole series of expressions to which I have taken exception may be regarded either as a "survival" of the theological conceptions by which science was formerly dominated, or as the result of a very common confusion between a "law" of science and a "law" of a state. For a "law" can only "govern," "control," "regulate," "produce," or exert any kind of *coercive* agency, when there is a power to give it effect; the "law," in that sense, being simply the expression of the will of such governing power, divine or human, as the case may be.

But as science (and in this I am quite at one with Mr. Romanes) knows nothing of such "metaphysical" conceptions, I cannot but think that it would be much better that scientific language should be cleared from expressions that have no meaning at all, if it be not one based upon them.

If I have not made my meaning sufficiently clear, I may refer any one who wishes to see this matter more fully discussed to my paper on "Nature and Law," in the *Modern Review* for October, 1880.

WILLIAM B. CARPENTER

56, Regent's Park Road, N.W., October 29

P.S.—I regret that my reference to what Mr. Simon (in his address on Public Medicine at the International Medical Congress) designated as "the very remarkable series of facts" adduced by Dr. Creighton in support of his view of the communicability of bovine tuberculosis to man through the medium of milk, should have been so worded as to make it appear that Dr. Creighton accepts the doctrine of Klebs as to the "micrococcus" origin of tubercle, his dissent from which he had explicitly recorded. As Mr. Simon spoke of Klebs' doctrine as having been "solidly settled and widely extended" by the recent researches of Schüller, and as Dr. Creighton's difficulty of conceiving "a neutral (?) living organism" to be "charged with the power of conveying complex details of form and structure from one body to another," affords no *dis*proof of it, there seemed to me no occasion, in writing for the general public, to take any special notice of a point which Mr. Simon, in addressing a professional audience, had thought it better to pass without mention.—W. B. C.

An Alleged Diminution in the Size of Men's Heads

ALLOW me to draw the attention of your readers to a statement which is certainly strange, if true. An opinion is prevalent in the hat trade that the size of men's heads has undergone a decrease within the last thirty or forty years. The following statement has been given to me by a hatter whose name has attained a pre-eminence of a duration of more than one generation. "Five-and-thirty years ago," he says, "when I was a young man, we used to purchase hats for retail trade in the following ratio :—

Sizes	21	21½	22	22½	23	23½	inches.
Relative number ...	0	1	2	4	3	1	

At the present time," he adds, "I am selling hats in this ratio :—

Sizes	21	21½	22	22½	23	23½	inches.
Relative number ...	3	4	3	1	1	0	

A manufacturer writes : "I should say that heads generally are two sizes less than at the time you refer to. A head of more than twenty-four inches' circumference is now quite a rarity, whilst we make thousands of hats for heads with a circumference of about twenty-one inches." I have received similar statements from other members of the trade, both wholesale and retail, and therefore feel that no further apology is required for bringing them under your notice. Accepting the statement *quantum valeat*, I have endeavoured to ascertain whether I could find any explanation or confirmation thereof. I have not succeeded, and therefore venture to ask information or opinions through your columns. The statement comes to me not only from men of experience in the trade, but from men of intelligence and observation exercised beyond the limits of the shop or the factory. It is, I am informed, extensively believed among hatters; it may, nevertheless, be merely a general impression. The diminution, it is said, is observed mostly among grooms and men of that class in the social scale. If this be really the case the change should be noticeable also among soldiers. The diminution is possibly more apparent than real, and may be traceable to alteration in the style of hair-cutting, or of wearing the hat. It has been suggested to me that men of the present generation have from birth smaller heads, dependent upon an alteration in the dimensions of the female pelvis, in consequence of modern fashion in dress. Of this opinion, however, I obtain no confirmation from eminent obstetricians of whom I have made inquiries. The statement then, as it stands, is wanting in explanation, and calls for further investigation. I may here quote the reply sent me by Prof. Flower to my question as to his opinion on the statement made by the hatters "that men's heads were smaller than they were twenty years ago" :—

"Before drawing any important conclusion from such a statement it would be necessary to know much about the authority upon which it is made. Who, for instance, are the hatters that make it Do all hatters concur in the same statement? Is it a mere general impression, or is it founded upon actual arithmetical data? Does it refer to any particular class of men, and does it refer to the same class of men? If it should be true, may it not arise from some change of fashion (if only founded upon the size of the hat, and not of the head) other even than the one you suggest, of hair being worn shorter—such as hats being worn more on the top of the head than formerly (in old-fashioned prints one sees the hat well down over the ears, which is certainly not the case now), or perhaps hats of the kind specified being now worn by a different (perhaps lower) class of the community, or by younger people? All these questions must be considered, and perhaps other sources of error eliminated which may not occur at first, before the statement can be accepted. If the evidence of the statement appears to bear investigation it would be well worth while following it up, as, if true, it would be one of the most remarkable facts with which I am acquainted, that in the space of twenty years a material diminution in the average size of the heads of the same population has taken place —a fact so contrary to all theory and to all experience."

For my own part I confess to some degree of scepticism as to the FACT, and should be glad of an explanation of this, probably only apparent, diminution in the size of men's heads.

Little Park, Enfield, October 26 W. B. KESTEVEN

The Evolution of the Palæozoic Vegetation

I AM pleased to have elicited the opinion of so distinguished an authority as Prof. Williamson upon Saporta and Marion's work, and his criticisms, even where antagonistic, will also, I am sure, be received by them with pleasure. Prof. Williamson holds views regarding the interpretation of some of the plant remains which are at variance with those held by most French geologists; but were the correctness of all his views conceded, I do not think Saporta and Marion's theory of the evolution of plants would thereby fall to the ground. A vast array of fact, which is not controverted, has been brought forward in a very able manner, and a connected and well-considered theory as to the nature of the modifications that have led through Cryptogams to Phanerogams is for the first time presented in a concise and lucid manner; and I think few will agree with the professor in deprecating such work because knowledge of the older floras is still incomplete. J. S. GARDNER

The Teaching of Practical Biology

IN the interesting introductory address of Prof. T. Jeffery Parker at Otago there is an omission which I am sure my friend would be the very first to wish to have rectified. In speaking of that remarkable development of the teaching of practical work in biological laboratories which will no doubt have a very considerable influence on the pursuit of this branch of science, Mr. Parker makes reference to the considerable services which have been rendered by Professors Huxley and Ray Lankester; but he forgot to say that one who, unfortunately, is no longer among us, provided for systematic teaching in practical work some time before Prof. Huxley was enabled to bring his wishes to fulfilment. The characteristics of this line of study were made known to the general zoological world in 1870, when Prof. Rolleston published his "Forms of Animal Life, being Outlines of Zoological Classification *based upon Anatomical Investigation* and illustrated by Descriptions of Specimens and of Figures." Prof. Rolleston's system was well enough shown in his preface to that work, where there occurs the following sentence, which I beg leave to quote as germane to this question :—"The distinctive character of the book consists in its attempting so to combine the concrete facts of zootomy with the outlines of systematic classification as to enable the student to put them for himself into their natural relations of foundation and superstructure."

October 29 F. JEFFREY BELL

The Igneous Rocks of Iceland

LAST year a friend and I rode round the north and west sides of Iceland, and from my observations then I cannot doubt that the conclusions to which Dr. J. Geikie has arrived concerning the south-west of the island apply equally to the more northerly parts. The glacier-scorings on the older lava were especially marked in a district unexplored except by a few Icelanders, and known as the Storisande or Big Sand. This desert lies to the north of Ball's Jokul and Lánge Jokul, and between Arnevatn and the River Blanda. As we crossed the undulating surface of the old lava, pale and ruddy in colour, the contrast was very striking where the black basalt seemed to rise from the plain in jagged cliffs up to the ice-field which caps these ranges. Where the sand was blown off this pale lava there were the lines of glaciation clearly engraved. The trend of the desert as a whole was towards the north, and the lines of glaciation ran north and south. In the Husavik district we saw, besides these two lavas, the lava of the present century, including that of 1875.

A. J. HUBBARD

1, Ladbroke Terrace, Notting Hill, W., October 31

Replacing Flint Flakes

WITH reference to the replacing of flint flakes on Palæolithic implements it may be of interest to your correspondent, Mr. W. G. Smith (NATURE, vol. xxiv. p. 582), to learn that I have succeeded in building up a core out of Neolithic flakes. When searching the sandhills at Dundrum, Co. Down, last August, with my friend Mr. J. S. Hyland, I noticed a number of flakes of a similar colour lying on the slightly raised shingly beach on which the sandhills stand, at a point where the sand had apparently been recently blown away. Seeing from an imperfection in the stone that several fragments had formed part of the same flint, I collected all the pieces I could find, some of which were at a yard or two's distance from the rest. Without much trouble I was able the same evening to put them together, and have so fixed twenty-two flakes into position, forming about three-fourths

of the original pebble. The operator had first broken the pebble into two halves, and then chipped two-thirds of one half away in flakes, of which I found thirteen; the remainder of that half he threw down as useless. Of the other half I have nine flakes, and one is missing; the unbroken remainder is also gone. Perhaps the workman threw it away to a distance in disgust, as he does not seem to have got a single satisfactory flake out of the whole flint. The appearance of the half which I have almost complete is extremely like the illustration of the core made up out of a modern flint-knapper's flakes in Evans' "Stone Implements," except that the crowns of the flakes are triangular instead of quadrangular. There are the same small interstices between the crowns of the flakes, showing that the blow splinters off on each side of the bulb of percussion a small fragment, as well as the flake itself. This explains why the average concavity on the core is slightly less than the average convexity of the flake at the top of the bulb of percussion.

F. ARCHER

Crosby, Liverpool

Climate of Atacama

SOME practical evidence as to climate has come forward at the shareholders' meetings of the northern Railways of Chile, the Coquimbo, Tongoy, and Carrizal and Cerro Blanco. In each of these districts torrential rains have occurred, which are all reported as unexampled. Long residents state that rain was formerly little known, and such was my observation in connection with the district. One reason why the weather is deserving of attention is that no change has taken place in the water-surface or vegetation. A similar change to rain in the Suez and Cairo district is attributed to the Suez Canal, but it is a matter worthy of consideration whether we are not really entering on a cycle of change. So far as Atacama is concerned, if at any former period there were rains, the conditions of habitation must have been different from those which have been so long considered to apply to the rainless district.

HYDE CLARKE

PHYLLOXERA CONGRESS.—Dr. E. R. F. wishes to know where he can obtain a full report of the recent Phylloxera Congress at Bordeaux.

SCIENTIFIC INSTRUMENTS (J. S. MARSTON).—We cannot undertake to commend any particular instrument maker; you should get the lists of the leading makers, whose addresses you will find in our advertising columns.

HOLLOWAY COLLEGE.—So far as we understand this is not a charitable institution: Miss S. should write to the authorities at the College, Staines.

EFFECTS OF COLOURED GLASS (E. M.).—It is owing to the law you refer to.

THE AUTUMN SKY

I.

MANY and varied must ever be the regrets that attend the departure of summer days and summer pleasures; and their remembrance casts a lingering sadness even over the bright and beautiful hours that often alleviate the approach of sterner and gloomier seasons. Such impressions however are not shared alike by all. Few perhaps altogether escape their influence; but in some classes they are softened or even obliterated by the development of interests and pleasures of a very different description. Such is especially the case with the astronomical observer. The shortening of the twilight hours is to him as the withdrawing of a veil that obscured the minuter, yet not least interesting, features of the glorious scenes that he loves to explore; and he views with fresh pleasure the deepening tone of the background of unfathomable space, as the atmospheric illumination fades steadily away. We cannot indeed in our latitudes rival the transparent purity of the south, that gives such a magnificent depth to the aspect of the firmament, and throws out in such radiant brilliancy the host of heaven; yet even our autumnal skies are so great an advance upon the misty softness of the summer's night that the observer cannot but rejoice in their return.

These remarks are very obvious, not to say somewhat late in their application, when the sun has already advanced so far upon his downward way: yet they may not be entirely inappropriate when we are about to draw attention to some of the present characteristics of the sky. Much now in every direction invites the inquiring gaze, and an early hour challenges the opening of the observatory, or the arrangement of the telescope. Eyepieces should be cleaned, adjustments rectified. Instruments of all kinds and sizes may be called into profitable and pleasant requisition—let the possessors only make the best of what they have. If we do not see more than we anticipate, though that may sometimes happen among the uncertainties of the English climate, yet we shall surely see enough to amaze us at the greatness of the Creator.

From its pre-eminent brightness, the planet Jupiter will naturally be the first object of attention. Belts we shall expect to find traversing his great broad disk, for they are very seldom absent; but there also we shall encounter a more unusual object, the ruddy patch, which has been sometimes described as vermilion, possibly from "personal equation," but which to most eyes exhibits a cinnamon or brick-red hue. There it has been, with scarcely any appreciable change, for the last three years[1]—a degree of permanence equalled, and even surpassed, by some dark spots in ancient days, but singularly contrasted with the general mutability of the markings of the disk. What is that spot? and where is it situated with regard to the real surface of the planet? Is it mere superficial colouring? but if so, of what material? Or is it an opening in the great mass of clouds—or what we call such—that is thought to envelope this colossal globe? But if so, how strange that its outline should have remained so steadily permanent. And in that case, as it is difficult to suppose it at the same level with those dark grey bands which have been ascribed to a similar absence of vapour, shall we place it above or below them? We might infer the former, if it is the case, as has been said, that it is more easily traced up to the limb than the dark belts; but the observation is delicate, and the effacing of the grey bands in that situation is not matter of universal consent. We might possibly conceive, on other grounds, admitting that the dark belts do indicate a deep clearing of vapour, that ruddy tints are caused by something at a higher level, because these are occasionally suffused over the whole equatorial zone and its markings, so as sometimes even to affect the general colour of the planet to the naked eye. The interposition of trees has prevented the writer hitherto from observation this year, but the accompanying sketch, taken 1879, November 12, with my 9½-inch

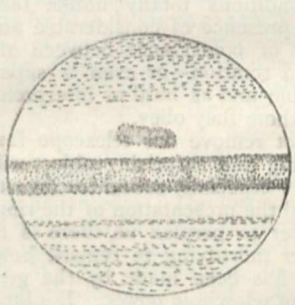


FIG. 1.

"With" mirror, may perhaps be of some interest in comparison with the observations of the present season.

The image, it will be noted, is telescopic, *i.e.* inverted.

[1] Traces of it may be detected in the Earl of Rosse's observations in 1873; but it seems to have been unnoticed in the interval.

The red spot was suspected to consist of two confluent masses, as well as to be somewhat inclined to the neighbouring belt; but the former idea, at least, not being confirmed by other observers, was probably owing to the inferior atmospheric conditions, which did not admit of a power much above 100. The central girdle consisted as usual of three divisions: the N. broadest and darkest, and of a cinnamon hue; the equatorial zone pale grey, with very feeble transverse interruptions, an indistinct continuation of the "portholes" so conspicuous some years previous; the S. band grey also, but deeper in tone. The N. hemisphere, beyond a bright region, had many faint grey stripes: towards the opposite pole was a feeble brownish shading; so that the colouring of the disk as a whole was, in heraldic language, "counterchanged." On other occasions very singular tints have been noted by eminent observers—yellow, full blue, and crimson; and the subject well deserves study, even though, as seems likely, that study should lead to little of a satisfactory nature.

Then there are other markings to be investigated on that great disk, both luminous and dusky, and that in another aspect, with a view to the determination of rotation; for, strange to say, it is found that some small dark specks travel more rapidly than other bright ones, and that the red spot moves slowest of all. And thus it is that the uncertainty in the axial velocity of that vast globe, first noticed by Cassini more than two centuries ago, is almost as far from being removed as ever; and, on the whole, one is tempted to question whether, after all, we have a single accurate idea, excepting that of mutability, concerning that enormous surface; and whether, if we could be transported there, we should not be surprised at the baselessness of all our conjectures. Certainly it may be said as to Jupiter, and not as to Jupiter only, that the recent advances in optical power and observing skill have only served to make more evident the thickness of the veil that obscures these objects in mystery. Analogy leads us a little way safely enough, but only to desert us before long. However, we must patiently watch and wonder.

Other matters, too, might be noted before we take our leave of that brilliant disk, so easy of investigation, so difficult to interpret. Why are the shadows cast on it by the satellites sometimes so black, at others so dim, or so abnormally small? Why, when a satellite passes behind the limb, is it sometimes neatly bisected by it, at others visible behind or through it, either from optical projection, as stars have been seen in front of the moon, or from the partial transparency of the edge of the globe? And then the satellites—they, too, have their anomalies in differences of apparent magnitude and brightness, due perhaps to variable obscurations of surface, but, if so, indicating conditions totally unlike that of our own satellite—the presence of considerable atmospheres, the possible want of coincidence between their periods of revolution and rotation—or even a superficial constitution as mutable and as hard of interpretation as that of the primary whom they obey.

We shall not remove our telescope far before a still more interesting and surprising object will present itself in Saturn, now especially suited for investigation, both as to altitude and the presentation of the ring. If there was much in Jupiter to perplex us, there is far more here; and it is rather mortifying to remark how little advance in knowledge has been made by the great increase, in recent years, of telescopic power. But little is ascertained now, beyond what was detected by the perfect vision of Dawes with his 6½-inch Merz object-glass, or the beautiful definition of the 15-inch achromatic, by the same maker, at Harvard College. A study, in fact, of the memoir by Bond and his associates, in the *Annals* of that college, vol. ii. part 1, published in 1857, would be the best preparation for an intelligent scrutiny of this planet. But not much beyond a general impression can be expected from ordinary telescopes. It will require considerable power, as well as light and sharpness, to detect Encke's subdivision of the outer ring (which, however, I caught in 1880 with my 9½-inch mirror), to trace any possible subdivisions of the inner ring, to ascertain whether, as Trouvelot thinks, the gauze veil is becoming less transparent in its outer portion, or to investigate those strange and puzzling outlines of the shadow of the ball on the rings, which, noted in part by others, have been recorded in detail in the Harvard memoir. A copy is here given of one, but not perhaps the most remarkable, of their diagrams.

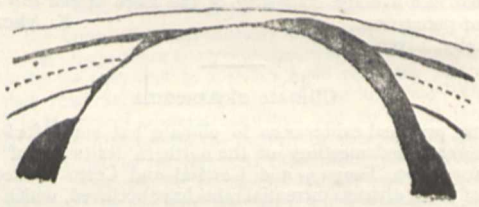


FIG. 2.

Such a contour could be only accounted for, if at all, by an amount of unequal thickness in the ring, which ought to be, but is not in the smallest degree, visible in the edgeways presentation. The success of Prof. Hall in detecting a bright spot of considerable permanency upon the ball encourages attention in that direction—especially as there are several previous records of such phenomena. To hunt for the smaller satellites with any but superior instruments would of course be waste of time, but it may be remarked that Enceladus has been seen by Ward with exceptionally keen sight and a 4·3 inch Wray object-glass, by Franks with 5 inch ditto, by Pratt with an 8·15 inch "With" mirror, and by myself with 9·33 inch. Mimas, the innermost, has been detected with a 7-inch achromatic by Wray. Meyer at Geneva has found it of late nearly as bright as Enceladus, and thinks it may be variable.

The morning skies at present are graced by Venus, not however a remarkable object in her gibbous phase; and Mars, who is coming rapidly round by his opposition to the evening. The smallness of his diameter, about 15″, is a great impediment, especially in the English sky, to the hope of success with his minor details, though it may be borne in mind that in the air of Milan, and with an admirably defining Merz object-glass of 7½ inches, Schiaparelli has made many delicate observations on a scarcely larger diameter, and with exceptionally fine air has carried them down, strange as it may appear, to a diameter of only 6″.

The only other of the larger planets now visible is Neptune, easily picked up by means of an ephemeris, and distinguishable from a fixed star, even in a small telescope, by its dull and steady light. It demands, however, a large aperture for the bringing out and sharp definition of its pallid disk; in the latter respect the great achromatics at Rome (9·3 inch) and Bothkamp (11·5 inch) were unsuccessful, but I have seen it neatly terminated with Huggins's 15-inch object-glass. Its satellite, though glimpsed by Ward with a 4·3-inch achromatic, is far too difficult for ordinary vision or common apertures; I have seen it however plainly with the 15-inch just mentioned.

Vesta, though possibly visible with the naked eye, is a mere brilliant point of less than 1″ in the telescope.

Some notes on the autumnal constellations will be brought forward in a subsequent paper.

T. W. WEBB

(To be continued.)

METEOROLOGY OF BEN NEVIS

THE cairn on the top of Ben Nevis marks, as is well known, the highest spot in the British Islands, and when the question of high-level meteorological observations came to be seriously entertained some years ago, attention was drawn to this position as the best afforded in these islands for a first-class meteorological observatory which would form one of the more important members in the network of the high-level stations of the Continent. The advantages of the situation are enhanced by the consideration that the mountain rises directly from the level of the sea to a height of 4406 feet, and that its summit stands from 2000 to 3000 feet clear above the mountain ridge to westward which lies between it and the Atlantic. The mountain thus raises its head in the very midst of the west-south-westerly winds from the Atlantic, which exercise so preponderating an influence on the meteorology of Europe. Among the results from observations made at this elevated situation the more important to be looked for are those which relate to the greater movements of the atmosphere, particularly the upper currents in their relations to the cyclones and anti-cyclones of Europe, the data for the investigation of some of the laws regulating these movements being obtained by a comparison on the one hand of observations made on Ben Nevis with those made at the other high-level stations of Europe, and on the other with those made at lower levels, and published in the different Daily Weather Reports.

When therefore the Scottish Meteorological Society (last spring) accepted the handsome offer of Mr. Clement L. Wragge to ascend Ben Nevis every morning in time to make observations on the top at 9 a.m., every care and precaution was taken as regards the quality of the instruments procured, and in the arrangements made for their exposure and protection, so as to make the observations first-class, as far as this could be secured without constant residence on the top or the erection of continuously recording instruments. Further, as it is contemplated to build an observatory on the top, the arrangements regarding the instruments and their positions were carried out, so that all that will be required to complete the observatory is simply the erection of a suitable residence for the observers.

That Mr. Wragge possessed not only enthusiasm, but also strength of will, skill, and readiness of resource, was soon manifested. He met the Council of the Society in Edinburgh on May 26 and 27, was in Fort William on the following day, and on Tuesday, the 31st, fixed and secured the instruments in proper position on the top of the Ben, including a massively-built cairn for the reception of the barometer. On June 1, at 9 a.m., the observations were regularly begun, and have since been continued without the break of a single day up to the disastrous storm of October 14. This continuity, so extremely desirable in such a series of observations, was guaranteed by Mr. Wragge securing at the outset the services of a well-qualified assistant, whom he trained to the work, as well as a second assistant, whom he also trained, to meet any emergency that might arise.

The instruments are these :—A barometer inclosed in a cairn, 6½ feet high and 17 feet in circumference, which incloses a strong box fastened with lock and key, with a second door protecting the box from heavy rains and the gusts of wind which blow up the narrow gullies of the tremendous precipices, 1800 feet high, only a few paces off, and sweep over the instruments with terrific fury. A Stevenson's screen, with maximum, minimum, dry and wet-bulb thermometers, the bulbs of which are 4 feet above the mountain stone; the box opens to north, and also contains the ozone tests. The other instruments are a terrestrial minimum radiation thermometer, a solar maximum radiation thermometer, 4 feet high, and a rain-gauge, 8 inches in diameter, and its rim 1 foot high. Fig. 1 shows Stevenson's thermometer screen in elevation, erected on four stout posts, having angle-sloping stanchions, by which the box was securely and immovably fixed.

This arrangement continued till the end of July, when, as the tourist season was then setting in, a more effectual protection of the thermometers was necessary, so as to prevent the possible occurrence of any crowding of tourists immediately around the thermometers, or any other interference which might vitiate the readings made daily at so heavy an expenditure of time and trouble. In order to afford the required protection, Mr. Stevenson designed a strong wire cage, measuring five feet each way, the wire-netting being supported by strong iron rods continued downwards beyond the cage, and bent below at right angles. The horizontal projecting rods below are weighted with heavy blocks of stone, so as to secure complete stability to the structure. In the interior of the cage the Stevenson screen, with the thermometers and ozone tests, is placed, and firmly secured with supports.

Fig. 2 is a sketch of the station, kindly prepared by Mr. Wragge, which will explain, better than any verbal description could do, the arrangements which have been carried out with regard to the instruments, and also the remarkable character of the plateau at the top of Ben Nevis. A is the barometer cairn ; B, the wire cage, with the thermometer screen seen inside ; C, the solar maximum radiation thermometer, a black-bulb in vacuo, the terrestrial radiation thermometer being placed on one of the stones adjacent; D, the rain-gauge; and E, the hut, covered

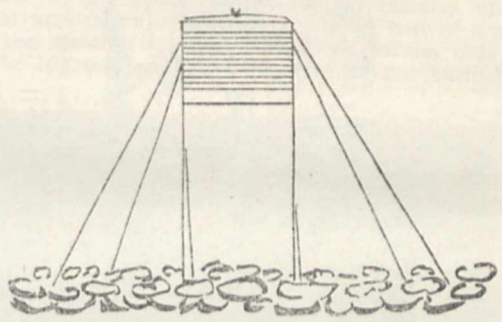


FIG. 1.—Stevenson's thermometer screen as fixed on Ben Nevis shown in elevation.

with tarpaulin and built of the surrounding stones for shelter to the observer. The cairn of the Ordnance Survey is distant twenty-five paces north-westwards from the barometer cairn.

Under instructions from the Council of the Scottish Meteorological Society I inspected the station on the top of the Ben on July 28, and on the following day the station at Fort William, where observations are carefully and intelligently made by Mrs. Wragge as nearly as possible at the same instant of time that observations are made at the top and at the different points on the outward and homeward journeys. We left Fort William about half-past five on Thursday morning, the party consisting of Mr. Wragge, Dr. Sanderson, the Society's honorary treasurer, Mr. R. C. Sanderson, and myself, as well as Mr. Wragge's Newfoundland dog, Renzo, that daily accompanies him in his ascents. The instruments are read at Fort William before starting, and the first observation on the journey is made at a peat bog, which was reached at 6.12 a.m., Mr. Wragge dismounting and reading his aneroid and sling thermometer, and noting the wind, clouds, and other observations of the weather. The lake was reached at 7.23 a.m., where the third set of observations were made, including the temperature of the water of the lake, which was 48°·3, being 3°·0 higher than that of the air. Here our ponies were left, and Mr. Wragge pushed on, in order to reach the top in time for the regular 9 a.m. observation, while we followed more at leisure.

FIG. 2.—The Summit of Ben Nevis.

The fourth set of observations were made at the spring, which is about 800 feet from the top, the temperature of the spring being 37°·4. Observations are again made at these same points on the homeward journey, which, together with the three at the top at 9, 9.30, and 10 a.m., make a daily series of ten observations, independently of those made at the same times by Mrs. Wragge at Fort William, and at other times in the afternoon and evening. In addition, extra observations are also made, such as when entering or emerging from the cloud-fog, when the wind suddenly changes in direction or force, &c., these being made from their important bearings on general atmospheric circulation. These observations, which are taken with scrupulous regularity, evince on the part of Mr. Wragge the most undaunted devotion to his work, particularly in consideration of the extreme discomfort they often entail, since to make them he must dismount not unfrequently in a piercingly cold storm of wind and rain.

The following are the observations made on July 28, at 9 a.m., by Mr. Wragge, and also those made at the same time by Mrs. Wragge at Fort William :—

	Ben Nevis.	Fort William.
	inches.	inches.
Barometer at 32°	25·434 ...	29·931
Aneroid	25·355 ...	—
	°	°
Max. Thermometer ...	36·8 ...	54·0
Min. ,, ...	32·5 ...	49·2
Dry-bulb ,, ...	35·0 ...	53·5
Wet-bulb ,, ...	35·0 ...	50·3
Solar max. ,, ...	94·0 ...	—
Terres. min. ,, ...	32·2 ...	—
	inch.	inch.
Rainfall	0·260 ...	0·069
Wind, direction	South-westerly	South-westerly
,, force (0–12) ...	3 to 4 ...	4
Cloud-fog (0-10)	10 ...	9

We reached the summit shortly before eleven, the last 1000 feet of the ascent having been through a dense cloud-fog, which clung persistently to the mountain the whole time we were on it. We found the protecting wire cage in its position, having been placed there on the previous day, but the Stevenson screen was still in the position it had occupied since the observations began, and as is shown in Fig. 1. A reading of the instruments having been made, the workmen proceeded to remove the thermometer-box to its new position inside the wire cage, as represented in Fig. 2, and the party withdrew to the hut, which, though containing only one apartment, 8 feet by 4 feet, and its walls far from wind-tight, afforded a most welcome shelter from the bitterly cold masses of mingled fog, Scotch mist, and sleety drizzle which drifted across the mountain. A fire was quickly lighted in the middle of the hut with splinters of wood and balls of tow steeped in paraffin, the excessive dampness of everything rendering the use of paraffin indispensable. The inspection which followed showed that the full equipment of instruments were in excellent order and in excellent positions, and that the observations were made with a precision and a fidelity which left nothing to be desired.

At the time of our visit everything was drenched with wet. On opening the thermometer-box the whole inside presented the appearance of having been just lifted out of water, a drop hanging from the bulbs of the dry and other thermometers. Mr. Wragge informed us that during the fifty-one days preceding our visit the dry-bulb thermometer was found on opening the box to be without the drop hanging from it only on six occasions.

A noteworthy feature of the meteorology of Ben Nevis is the winds. Repeated instances were seen, during the ascent and descent, of a thin filmy fragment of mist suddenly appearing over one of the glens, which on being watched was observed slowly to ascend, lengthening and becoming denser as it rose, frequently assuming in time an appearance resembling the smoke rising from a burning mountain. On one occasion the whole of that

part of Glen Nevis seen from our position was clear of cloud and mist, but in a brief space of time, not exceeding five seconds, a dense mist suddenly filled the whole breadth of the glen, the upper limit of the cloud-fog being only a little lower than the level of our position. These facts point to ascensional movements in the atmosphere over Ben Nevis, which in all probability are caused by the temperature of the surface of the mountain being higher than that of the enveloping atmosphere at the same heights. These ascensional movements are disturbing influences on the winds prevailing on the Ben, but especially at the top, the result being that it is frequently difficult, if not impossible, to say what the true direction of the wind is, as it is found to blow from all points of the compass within the space of a few minutes.

In the accompanying sketch (Fig. 2) Mr. Wragge has given a faithful representation of the surface of the plateau of the summit. This plateau consists of about ninety acres, the difference of level between any two points of which does not exceed ten feet. It is throughout strewn to a depth of about four feet, with blocks of felstone lavas and volcanic agglomerates, nearly all tilted up to such a degree that the only mode of progression is over the sharp edges of the stones. These blocks are different from the rock of the mountain itself, the nearest rock resembling them being found in Glencoe, twelve miles distant. No soil is anywhere visible, the heavy rains doubtless having long ago washed it all down hill; indeed, except in small detached patches, the mountain is wholly bare of soil for the last 1500 feet of the ascent.

That the striking bareness of Ben Nevis is due to the excessive rains having washed away the soil, and not to the climate, is shown by the remarkably well-grown specimens of *Cerastium alpinum*, *C. trigynium*, *Saxifraga stellaris*, and *Alchemilla alpina*, which were found at heights closely approaching 4000 feet in situations which protected the soil from being carried away by the rains. In a small patch only 240 feet from the summit, I gathered a small grown specimen of *Saxifraga stellaris* in flower, and in the same patch there was growing a Carex, which however showed no flower. Excepting the above flowers and *Sagina saxatilis*, *Carex rigida*, *Luzula spicata*, and a single specimen of *Sibbaldia procumbens*, I did not notice any other flowering plants which a botanist would take the trouble to put into his vasculum. The scanty flora of Ben Nevis as regards the rarer species is thus in striking contrast to the rich floras of Ben Lawers and many others of our Scottish mountains, a circumstance which m perhaps possess some geological significance.

ALEXANDER BUCHAN

THE ELECTRIC TRAMWAY

ONE of the most interesting sights in counection with the Exhibition at Paris is the electrical tramway; it is a practical evidence of the great future in store for electricity as a motive power. From an article in *La Nature* we give some of the leading features of this recent application of electricity. In the case of a tramway the question is a complicated one, for the rails cannot be isolated, and they therefore cannot be used as

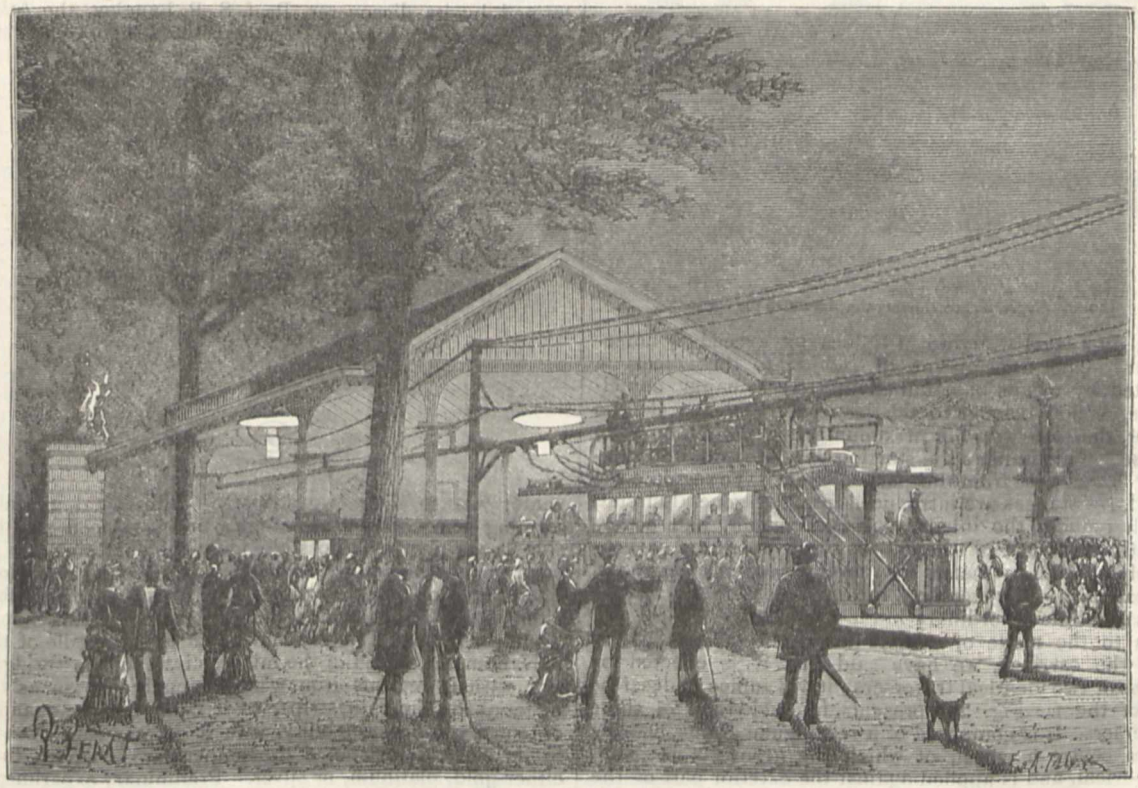


FIG. 1.—Siemens' Electric Tramway; Departure Station at the Place de la Concorde.

conductors. How then, in these conditions, is the motor of the carriage connected with the fixed generator placed in the Exhibition at the Palais de l'Industrie? This is the problem which MM. Boistel and Sappey, the engineers of Messrs. Siemens, have completely solved, after several fruitless attempts, which almost always precede successes of this kind. In the preliminary experiments made at the workshop in the Rue Picot, they made use, as conductors, of a brass tube electrically connected with the carriage by a traverser, the function of which we

shall explain; the wheels and rails will serve as the return wire. This system worked well at the *workshop*. In practice a special difficulty was encountered. The dirt sticking to the rails and felloes of the wheels formed a sort of crust so insulating as to prevent adequate communication with the earth. The increase of resistance produced by this interposition of finely conducting bodies was often sufficient to arrest the vehicle. The remedy was happily beside the evil, and a second conductor was established parallel with the first, in communication with the second pole of the generator, on which runs a second traverser, identical with the former. These two cars follow on their respective tubes the movements of the vehicle, and ensure a good and constant communication between the electrical generator and the motor. Fig. 1 represents the carriage and the station at the Place de la Concorde. At the height of the knife-board are seen the two conducting tubes supported at certain distances by posts, and in the intervals by iron wires, like the floor of a suspension bridge. The carriage is exactly the same as the ordinary tramway car. The motor is placed underneath the feet of the inside passengers; it is a Siemens dynamo-electric machine, with horizontal inductors similar to that which produces the current in the Palais de l'Industrie. The distance traversed is about 500 metres, and is accomplished in one minute. The work expended reaches 8 horse-power in the curved

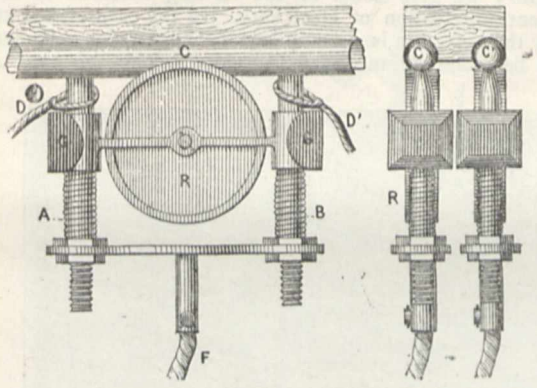


FIG. 2.—Traversers conducting the current to the carriage.

part; on a level straight run it does not exceed 3½ horse-power. The transmission of motion to the wheels is effected by means of a fall-chain. By a happy coincidence, which belongs to the very nature of the electric motor, the *static effort* is maximum when the motor is in repose. This renders the starting very easy, and no difficulty is met with from this point of view. To regulate the speed, resistances are introduced into the general circuit, which reduces the intensity of the current, and consequently the work of the motor; this operation is very simply effected by means of a lever placed at each end of the carriage. For stopping, the current is broken, and at the same time an ordinary brake is applied.

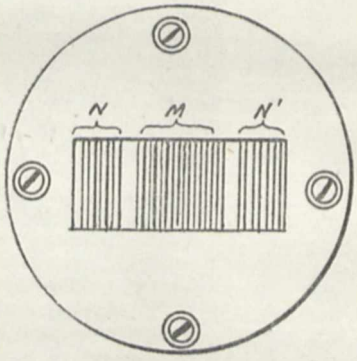
As to the mode of communication of the conductors with the carriage, we have said that it is effected by means of two identical traversers; it will suffice to describe one of them. Fig. 2 represents in detail one of these traversers. It is composed of a rectangular frame, bearing in its centre a wheel, of which the groove R is semi-cylindrical, and is applied against the exterior part of the conductor C, formed of a brass tube 22 millimetres in diameter and slit on its lower part along all its length to a breadth of about 1 millimetre. In this tube slides a cylindrical core of 12 centimetres in length, on which are fixed, at its extremities, two vertical shafts, A, B, which support the wheel or roller. Two springs supported on these vertical shafts press the wheel against the tube, and maintain an elastic contact between the tube and the wheel. The carriage may then be moved; the wheel runs against the tube, the core glides in the interior, without the communication ceasing to be, if not perfect, at least quite sufficient for the purpose. Only at times a few sparks are seen at the moment when the carriage passes the coupling of the tubes; these sparks are due to small instantaneous ruptures of the current which do not affect the regular working of the system. The experiment shows that the wear and tear scarcely affects the tube, and bears almost entirely on the core placed in the tube; but nothing is easier than to replace a core. The current reaches the machine by the copper conductor F. The traction of the carriage is effected by the cords D or D', according to the direction.

The electric railway of the Palais de l'Industrie presents the first practical solution of an electric traction in the case of a tramway. Of course it is easy to see how this application of electricity is capable of the greatest development, and that by modification of details the principle might be applied to railways.

THE BOLOMETER

AN instrument a thousand times more sensitive to radiant heat than the thermopile, and capable of indicating a change of temperature as minute as 1-100,000th of a single Centigrade degree, deserves the attention of the physicist. When to these qualifications it can be added that the new instrument is far more prompt in its action, and more reliable than the thermopile for the *quantitative* measure of radiation, then, indeed, no apology is needed for a detailed description. The instrument is termed by its discoverer, Prof. S. P. Langley, the *bolometer*, or *actinic balance*. The earliest design of the in-

FIG. 1.

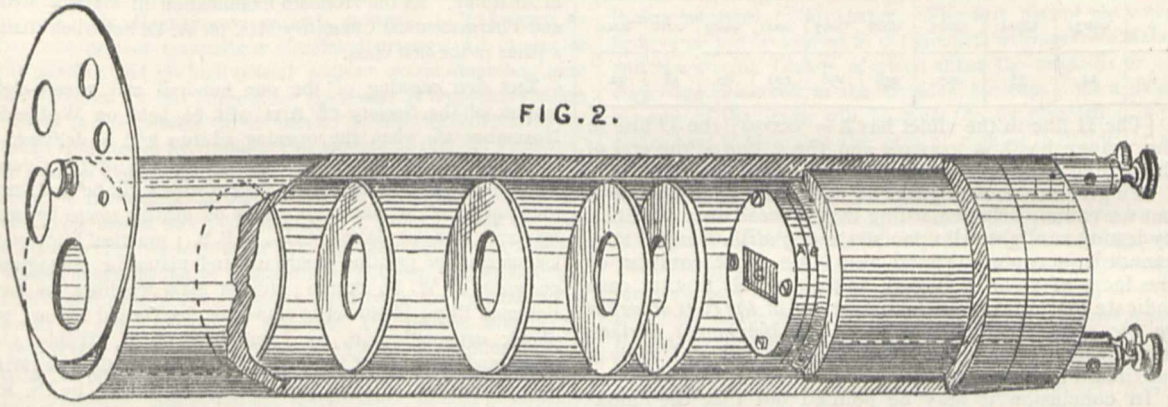


ventor was to have two strips of thin metal, virtually forming arms of a Wheatstone's bridge, placed side by side in as nearly as possible identical conditions as to environment, one only of them being exposed to radiation. Such radiation would slightly warm the strip and therefore alter its electric resistance, and the amount of this change would be indicated by the movement of the needle of the galvanometer placed in the middle circuit of the "bridge." For various reasons iron was eventually chosen as the material for the thin strips, as it combines the qualities of tenacity and laminability, with a greater sensitiveness in its electric resistance to temperature changes than either gold, platinum, or silver. Preliminary experiments made with a simple strip of iron in comparison with several delicate thermopiles showed the advantage of the new method of investigation. A large Elliott thermopile of sixty-three pairs, a very sensitive thermopile of sixteen small pairs, and a delicate linear thermopile of seven pairs of elements were selected. The iron strip taken was 7 millims. long, ·177 millims. broad, and 0·004 millims

thick. Its resistance was 0·9 ohm. The three former instruments were one after the other connected with a short-coil mirror galvanometer of sufficient delicacy. The same galvanometer was used in the bridge, the three resistances used with the strip being respectively ·9, ·4, and ·4 ohm, and the total current employed being a little over half a weber. The result showed the sensitiveness of the three instruments and of the strip to heating by radiation to be respectively as 1, 4·1, 16·3, and 226·3.

The actual bolometer embodies the principle of the preliminary experiment with various additional refinements. Sheets of *steel* (palladium and platinum can also be used) are rolled out until of a thickness of from ·01 to ·002 of a millimetre is attained. Out of these sheets small gratings are cut or punched, having the individual bars about 1 millimetre wide and 1 centimetre long. Two systems of strips are arranged so that the current from a suitable battery divides itself, half passing through each, the interposed galvanometer showing no deflexion when the two currents are of equal strength. Fig. 1 shows the general arrangements of the gratings of strips. A rectangular opening is cut in a disk of ebonite of 3 centimetres

FIG. 2.



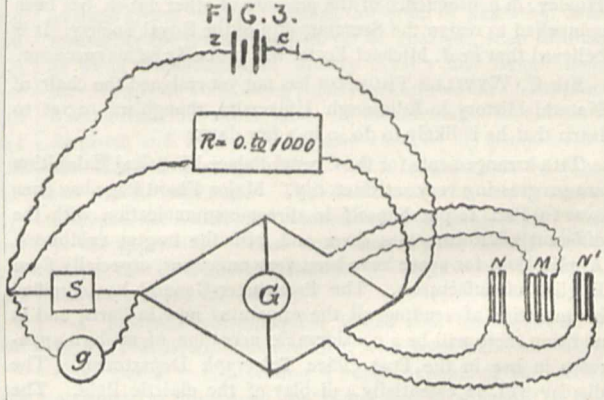
diameter. A second disk of the same size is clamped behind it, and between the two the gratings or systems of strips are fixed. That system which is to be exposed to radiation is placed in the centre of the rectangular opening at M. It consists of fifteen strips, eight of them being in front, and seven at a little distance behind. The second system is divided into two halves, N and N′, on each side of M, each half consisting of seven similar strips, four in front, three behind. Every joint is soldered, and the resistance of the fourteen strips in N N′ is made up equal to that of the fifteen strips in M by the interposition of a short wire in the circuit. M is placed in one arm of the bridge, and N N′ in the other, as indicated in the diagram of Fig. 3.

To protect the bolometer from air-currents, sudden changes of temperature, and from danger in handling, it is inclosed in a cylinder of ebonite lined with sheet copper. This is represented in Fig. 2, where the tube is drawn partly in section to display the interior. At the anterior end of the tube is a revolving diaphragm with suitable apertures. Within, a number of cardboard diaphragms or stops are placed, being retained in position by rings of ebonite tube between them. Behind these is the grating G of the bolometer fixed between the two disks of ebonite A and B. At the back there is a layer of solid non-conducting material, through which the conducting-wires pass to the two terminals. In the posterior end of the case are contained the resistance-wires by which to bring the two systems to equality; this being advisable because, if they are unequal at the beginning of the experiment, though they can be balanced by taking proportionally unequal resistances in the other arms of the bridge, according to the well-known law, any general rise of temperature will produce a *greater increment* of resistance in the system whose resistance is at first greater, producing a continuous "drift" in the galvanometer needle. Fig. 3 shows the connections of the bolometer and the bridge. A battery of one or more Daniell's cells, Z, C, provides a current the strength of which is controlled at will by changing the resistances in a box of coils, R, arranged as a shunt to the bridge-circuit. The working current is measured by a shunted galvanometer, *g*, and

the two systems of strips M and N N′ of the bolometer are connected to their respective places in the bridge by four insulated wires twisted together and covered with flannel. A modification of the usual formula enables the change of resistance of M to be calculated from the currents observed in the galvanometer G.

The results of the new instrument are somewhat startling. A sunbeam one square centimetre in section will, according to Prof. Langley, warm one gramme of water 1° C. in one minute. It would therefore raise a sheet of water 1-500th of a millimetre thick, and 1-10th

FIG. 3.



of a square centimetre in area, $83\frac{1}{3}$° C. in one second, supposing all the heat to be retained. And as platinum has a specific heat of only ·032, the same sunbeam falling on a strip of platinum of these dimensions should, on a similar supposition, raise it in one second to 2603° C., a temperature sufficient to *melt* it! This result is, however, prevented by the re-radiation which the strip almost instantaneously exerts.

An examination of the heating effect of rays from different portions of the spectrum of solar radiations was made, but under conditions different from those of the measurements made by Müller, Herschel, and Tynda

These experimenters worked with spectra obtained by prisms of quartz, rock-salt, and other refractive substances. Prof. Langley used the far purer spectrum obtained by reflection from the surface of one of Rutherford's diffraction-gratings ruled on speculum-metal. This showed the result that *the heat-maximum* (of solar rays) *in a normal spectrum is not in the infra-red rays, but is at least as far up the visible spectrum as the orange near the D-line.* This result is so important that we append the figures. In the upper line are the wave-lengths of rays in millimetres; in the lower the corresponding reduced galvanometer deflections.

λ	·00035	·0004	·0005	·0006	·0007	·0008	·0009	·0010	·0011
δ	12	55	207	256	198	129	80	58	41

[The H line in the violet has λ = ·00039; the D line in the orange has λ = ·00059; and the A line at the end of the visible red has λ = ·00076.]

We give the above figures as stated by Prof. Langley; but we cannot help remarking that if these were obtained by letting sunlight fall upon strips of *polished metal* they cannot be accepted offhand as a true representation of the facts of solar radiation, as they merely in that case indicate the position of the maximum of *the rays absorbed by the metal surface employed.* A blackened surface would without doubt tell a very different tale and show a maximum for other rays.

In conclusion it may be pointed out that the fundamental principle of the bolometer is identical with that of Siemens' electrical pyrometer, where also changes of temperature are measured by changes in the electric resistance of a conductor. But though the principle be identical the application is quite novel; and we must congratulate Prof. Langley on the skill and ingenuity with which he has applied an unpromising principle to the construction of this most interesting and most promising instrument of research. S. P. T.

NOTES

THE announcement will be received with regret that Prof. Huxley, in consequence of the pressure of other duties, has been compelled to resign the Secretaryship of the Royal Society. It is believed that Prof. Michael Foster will probably be his successor.

SIR C. WYVILLE THOMSON has not yet resigned the chair of Natural History in Edinburgh University, though we regret to learn that he is likely to do so in a few days.

THE arrangements for the Crystal Palace Electrical Exhibition are progressing very satisfactorily. Major Flood Page has gone over to Paris to put himself in direct communication with the different administrations there and with the largest exhibitors. Applications for space have been very numerous, especially from English manufacturers. The Postmaster-General has signified his intention of sending all the apparatus now in Paris, and in addition there will be a considerable accession of modern apparatus in use in the Post Office Telegraph Department. The display will be essentially a display of the electric light. The whole of the building will be divided off and illuminated by the different inventors and manufacturers of lamps. The new Edison light will be shown in operation in the Concert Hall, and very great interest is evinced in the public display of this light. The effect produced by it in Paris was quite startling, and it is generally believed that Mr. Edison has solved the problem that he set himself, viz. to produce a light to supersede gas in our houses.

THE success of women in the late Honours Examinations of the University of London in Arts, Science, and Medicine was very remarkable. In the conjoint Honours Examination in Mathematics for candidates for the 1st B.A. and 1st B.Sc. Examinations Miss Charlotte A. Scott obtained the first place in the first class, with marks qualifying for an exhibition. In the 1st B.A. Honours Examination in English subjects Miss M. L. G. Petrie obtained a precisely similar position, whilst two other ladies, Misses C. A. J. Cluer and H. E. Clay, were also placed in the first class. In the 1st B.A. Honours Examination in German, Misses A. Page and H. H. Brown were placed in the first class, the former qualifying for a prize. Miss F. H. Prideaux actually carried off the supreme honours in Human Anatomy at the Honours Examination of the 1st M.B., being placed first in the first class, and being awarded the Gold Medal in Anatomy. In the Honours Examination in Materia Medica and Pharmaceutical Chemistry Mrs. M. A. D. Scharlieb attained a place in the first class.

THE first meeting of the one hundred and twenty-eighth session of the Society of Arts will be held on Wednesday, November 16, when the opening address will be delivered by Sir Frederick J. Bramwell, F.R.S., chairman of the Council. The following are among the papers which will be read during the session:—The American system of heating towns by steam, by Capt. Douglas Galton, C.B., F.R.S.; practical hints on the manufacture of gelatine emulsions and plates for photographic purposes, by W. K. Burton; stained glass windows, by Lewis Foreman Day; photometric standards, by Harold Dixon; telephonic communication, by Lieut.-Col. C. E. Webber; the causes and remedies of bad trade, by Walter R. Browne, M.A.; the native tribes of the Hudson's Bay Territories, by Dr. Rae, F.R.S.; the manufacture of ordnance, by Col. Maitland; some practical aspects of recent investigations in nitrification, by R. Warington; the production and use of gas for purposes of heating and motive power, by J. Emerson Dowson; gas for lighthouses, by John Wigham (illustrated by an exhibition of some of the gas flames and apparatus used in lighthouses); the relation of botanical science to ornamental art, by F. Edward Hulme, F.L.S., F.S.A.; the storage of electricity, by Prof. Silvanus Thompson, D.Sc.; the high-pressure steam-engine, by Loftus Perkins; the industrial resources of Ireland, by J. Philips Bevan; a new chemical compound, and its application to the preservation of food, by Prof. Barff, M.A.; the distribution of time by a system of pneumatic clocks, by J. A. Berly; tonnage measurement, by Admiral Sir R. Spencer Robinson, K.C.B., F.R.S.; tools and cutting edges, by D. A. Aird; the teaching of forestry, by Col. G. F. Pearson; the art of turning, by P. W. Hasluck. The usual short course of Juvenile Lectures, given during the Christmas holidays, will be by Mr. W. H. Preece, F.R.S., the subject being "Recent Wonders of Electricity." The following are the subjects of the courses of the Cantor lectures for the session just about to commence:—First course, on some of the industrial uses of the calcium compounds, by Thomas Bolas, F.C.S.; second course, on recent advances in photography, by Capt. Abney, R.E., F.R.S.; third course, on hydraulic machinery, by Prof. John Perry; fourth course, on book illustration, old and new, by J. Comyns Carr. In connection with Capt. Abney's lectures, it is intended to arrange for an exhibition of photographic apparatus, processes, &c. These lectures originated in 1863, with a bequest to the Society of Arts by the late Dr. Cantor. Since that date three or more courses have been given every session, each course dealing with some application of science or art to industry or manufactures.

WE understand that Mr. Donald McAlister, Fellow and Lecturer of St. John's College, Cambridge, has undertaken to prepare for Messrs. Macmillan and Co. an English edition of Prof. Ernst Ziegler's "Text-Book of General and Special Pathological Anatomy," which is on all hands regarded as the standard authority on its subject. The book will range with Dr. M. Foster's "Text-Book of Physiology," Gegenbaur's "Comparative Anatomy," and other works published by the same firm.

THE eminent Italian geodesist, General Marquis J. Ricci, of Genoa, died at Novara on September 27, at the age of seventy years. The geodetic methods of Gauss, Bessel, and Baeyer were introduced into the geodetic work of Italy in great part through General Ricci, who was one of the original members and for long president of the Italian Commission for measuring the European degree.

IT is stated that Mr. Robert Hart, C.B., Inspector-General of Chinese Customs, is getting a series of elementary science works translated into Chinese. Many foreign books have already been translated into that language, but they have been intended either for the higher officials or for the students at the free Government schools. Mr. Hart however intends, it is said, to endeavour to have the present translations circulated amongst all classes of the people; and his high official position would doubtless give him facilities for this purpose not possessed by any other foreign servant of the Chinese Government. It was, we believe, owing to the enlightened exertions of this gentleman that the *Tungwen*, or Foreign College of Peking, was extended so as to embrace a scientific curriculum, as well as to train interpreters in foreign languages, which was its original aim. From a recent calendar it appears that this institution now has nine foreign professors, besides numerous native tutors, and is attended by 102 students. One department of the College is devoted to the preparation of books for the diffusion of scientific and general knowledge. This is said to have been kept in view as a prominent object from the beginning. Among the scientific subjects taught we find chemistry, natural history, mathematics, animal physiology, and astronomy. Students who display conspicuous merit are entitled to the first step of the nine degrees of official rank. They are then appointed to the discharge of official functions in connection with some leading department of the Government, but they are required to continue their studies at the College as "resident graduates." A complete course lasts for eight years, the first three of which are given exclusively to foreign languages, and the remainder to the acquisition of scientific and general knowledge. Most of the students, moreover, as they are intended for a special service, receive a stipend varying with the length of their study, but which never exceeds about 3*l.* a month. This is certainly a good sign of the value attached by the rulers of China to Western knowledge; but everything does not present the same roseate hue in that country. We read that the line of telegraph erected from Soochow to Shanghai is being opposed by the agriculturists, who are placing all manner of obstacles in the way of the workmen employed. They pull up and destroy the poles, thinking that they act against the Fheng-shui, or geomantic influence, and are likely to lead to spiritual complications. Troops are stated to have been despatched to protect the line. Doubtless in time these deeply-rooted prejudices, which stand so much in the way of real internal improvements in China, will pass away; at present it must be acknowledged with regret that they are as living and active as ever. We notice that telephonic communication is about to be extensively employed in the large foreign settlement at Shanghai.

LOVERS of Japanese porcelain will be glad to hear, on the authority of the Consul-General of the United States in Japan, that the modern productions will in time, if indeed they do not already, far surpass the older manufactures of Satsuma, Owari, Imari, and Kutani wares. The chief want of Japanese porcelain is regular symmetry in the pieces, and uniformity in a set or number of pieces. The absence of these is due, he says, to the fact, that machines or forms for moulding are not used, and the ovens are so defective that the heat is not evenly distributed. The native manufacturers are now manifesting much interest in the improvement of their wares. At one place the clay pits are said to have been worked for two thousand years or more, and the deposits seem scarcely more than scraped. Cobalt, used in colouring, is found in the same hills. The total value of the earthenware and porcelain exported from Japan to foreign countries during last year was valued at nearly one hundred thousand pounds sterling.

WITH the *Bilderschriften des Ostindischen Archipels und der Südsee*, Dr. A. B. Meyer begins the first part of a serial publication, which promises to be of great value to anthropologists. The distinguished curator of the Dresden Zoological Museum has undertaken, with the assistance of the Department of the Arts and Sciences, to issue a series of fac-similes, photographic or otherwise, of the most important objects in the extensive collection entrusted to his charge. This first part of the comprehensive project is devoted to the pictorial writings from Malaysia and the Pacific Islands, of which either the originals or exact copies are preserved in the Dresden Museum. As a detailed account of the series will be given on its completion, it will suffice here to state that the present number contains six folio photographic plates of the curious and hitherto undeciphered hieroglyphics or pictorial writings from North Celébes, the Pelew Islands and Easter Island. These are accompanied by eight folio pages of letterpress full of extremely interesting matter. For although no direct attempts are made at interpreting the texts, all previous essays of any value are collected, as well as such local myths or legends as may be likely to suggest a key to the interpretation of the writings. These are partly on wooden tablets, partly on prepared bast, partly also on the lintels and doorposts of the native houses that have been brought bodily to Europe. That they are all true writings, and not merely so much conventional ornamental work, a careful study of these plates will convince the most sceptical. Both the illustrations and the letterpress are produced in the sumptuous style characteristic of such publications in Germany.

THE Committee on Photometric Studies appointed by the Board of Trade, have issued their report. Among other things they recommend that, for the determination of the illuminating power of coal gas, the use of the sperm candle should be discontinued, and that, for the future, Mr. Harcourt's air-gas flame, as defined in the appendix to the report, should be employed instead, as a means of affording with constancy the light of one average sperm candle. And in the event of any other mode of measuring the illuminating power of coal gas, such for instance as some modification of Messrs. Keates and Sugg's lamp or Mr. Methven's lamp being resorted to on account of its practical convenience, this other mode of measurement should be standardised, and from time to time checked, by comparison with Mr. Harcourt's air-gas flame, which should alone be taken as the official standard. The details of the experiments and evidence, on which the recommendations are based, are given in an appendix. These experiments were mostly conducted under the Committee's direction by Mr. Harold B. Dixon, the secretary to the Committee.

A JAMAICA correspondent writes that Mr. Maxwell Hall, M.A., F.R.A.S., has succeeded, with some aid from the Local Government, in establishing a regular system of meteorological observations throughout the island, and a summary of these is published monthly in the *Jamaica Gazette*. A daily telegram is also sent round the island, giving results of readings at the chief stations, and any premonitory hints that may be considered necessary in view of telegraphic information from the United States signal stations at Key West and Cuba. Thus both shipping and agricultural interests are well prepared for any storms or hurricanes that may be expected. "Mr. Maxwell Hall's work," our correspondent writes, "though not yet fully recognised by the Government, is carried on in a most commendable spirit, and there is no doubt that when the benefits of regular and trustworthy meteorological observations are apparent,

and Mr. Maxwell Hall's numerous contributions to astronomical science are more fully appreciated, we shall have in Jamaica a properly equipped meteorological department, doing valuable work in this region, in which the distribution of hurricanes, and sometimes earthquakes, have so important a bearing on human life and the general prosperity of the island." A Weather Observatory, we learn from the *Jamaica Gleaner*, has been established by Mr. Hall at the Government Cinchona Plantations, at the residence of Mr. Morris, director of the Botanical Department, who has undertaken voluntarily to give it personal and daily attention. This observatory is at a height of 4900 feet.

SPARROWS have multiplied to such an alarming extent in South Australia that a Commission appointed by the Government have sent in a report recommending means to be taken for their destruction, and rewards to be given for heads or eggs.

MR. J. H. WILLMORE, of Queenwood College, near Stockbridge, Hants, writes under date November 1: "A 'Storm-Petrel was found not far from here on Sunday week. The little bird was lying on its back on the top of a hedge, and had evidently been dead some days. On opening it one side of its body was found to be black, as if it had died from a blow. I imagine the very rough weather had driven it inland, and it had come into contact with one of the trees close by. These birds are, I believe, very rarely found so far inland, and, so far as I can learn, this is the first instance in this neighbourhood."

MR. PARK HARRISON has published, through Quaritch, an interesting account of an incised slate and various other objects discovered in an old structure at Towyn, Merionethshire. The slate is covered with many curious figures, evidently cut by the hand of man; and these Mr. Harrison endeavours to interpret. There are numerous illustrations, including an autotype reproduction of the slate itself and another with only the figures clearly brought out.

SINCE 1869 the Otago (New Zealand) Acclimatisation Society has, we learn from the *Colonies and India*, liberated 157,041 young trout, and has sent 135,110 trout ova to various parts of Otago. Since 1874 it has liberated 34,900 salmon fry, and in 1879 and 1880 it liberated 790 perch and 60 tench. Young American "White-fish" (*Coregonus albus*), let loose in the lakes in the Rotorua district about two years ago, have been recently met with by the natives; but as soon as it was discovered what the fish were they were returned to the water. The natives are delighted at the discovery. The Auckland Society has, through want of support, been compelled to sell by auction its stock of animals and plants.

THE Brighton Health Congress and a "Domestic and Scientific Exhibition" will be held in the Pavilion Dome and Museum in the second week of next month. The president of the Congress is the Earl of Chichester, and the president of the Exhibition is Dr. B. W. Richardson.

M. LOEWY, sub-director of the National Observatory of Paris, has been appointed by the Government to report on the state of French provincial observatories, which have recently received a credit of 4000*l.* from the French Parliament. These establishments are five in number:—(1) Marseilles, directed by M. Stephan, with MM. Borelly and Coggia and two computers, has a credit of 1250*l.* The principal work is observation of nebulæ by Stephan, revision of Rumker's catalogue, discovery of comets and small planets, study of intra-Mercurial planets by Borelly, determinations by the Gauss method of absolute magnetic declination, &c. (2) Toulouse Observatory, directed by Baillaud, with a budget of 880*l.* and a municipal subvention of 200*l.* for printing the observations. A magnetic pavilion has been built with compass constructed by Brümer. The principal work is the observation of sun-spots, cataloguing variable stars, and observation of August meteors; not less than 1300 were tabulated on the last occasion of their appearance. (3) Bordeaux, directed by Rayet, with a credit of 1200*l.* The regular work has not yet begun, but observations have been made on comets and the red spot on Jupiter. (4) Lyons, directed by André, the credit given by the Government being 800*l.*; the amount of subvention paid by the city is not stated. The principal feature of this observatory is its connection with three meteorological stations situated in the vicinity—one at Tête d'Or, the second at Mont Verdun, and the third at Ampius. The regular astronomical work has not yet been begun. (5) Algiers, directed by M. Trepied, has a credit of 1500*l.* from the Government. The principal work has been the observation of Jupiter's satellites.

A VETERAN watchmaker at Vouvry, Switzerland, claims to have invented a process by which watches will run for years without winding up. A sealed box containing two watches intrusted to the municipal authorities on January 19, 1879, has just been opened, and the watches were found going.

THE Council of the Institute of Civil Engineers have issued their usual lists of subjects for papers in connection with the various premiums which they award. A copy can be obtained at the Institute, 25, Great George Street, Westminster.

M. HANS H. REUSCH describes in the Danish *Naturen* (No. 9, 1881), a new find of Silurian formation on the western coast of Norway, at Ulven, two miles south of Bergen. The fjeld consists here of conglomerate, sandstone, and clay slate, with concretions of limestone which contain remains of Silurian corals, casts of graptolites, and trilobites. The formation is equivalent to that of Central Norway.

SEVERAL further experiments have taken place at the Paris Opera in electric lighting. The success has been very great for the incandescent light in the hall, and for the Brush system on the staircase. For the first time gas has been wholly suppressed in several parts of the house.

IN the *Times* of October 29 is a very interesting account of the present condition of the St. Gothard Tunnel, from a correspondent who went through it.

IN *Bulletin* vol. vi. No. 2 of the United States Geological and Geographical Survey, Mr. S. H. Scudder gives an analysis of the insect remains found in the rich Tertiary Lake Basin at Florissart, Colorado, in anticipation of his forthcoming memoir on the subject.

MR. LATIMER CLARK has printed, in the form of a pamphlet a list of the rare and curious books relating to Electricity and Magnetism which he exhibits at the Paris Exhibition.

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. G. Aldridge; a Ring-tailed Coati (*Nasua rufa*) from South America, presented by Mr. Francis B. Norcliffe; a Tarantula Spider (*Mygale*, sp. inc.), a Millipede (*Julus*, sp. inc.) from Pernambuco, presented by Mr. Charles C. Craven; a Smooth-headed Capuchin (*Cebus monachus* ♂) from South America, a Richardson's Skua (*Stercorarius crepidatus*), British, four Tuatera Lizards (*Sphenodon punctatus*) from New Zealand, deposited; a Hooded Crow (*Corvus cornix*), a Common Rook (*Corvus frugilegus*), two Grey Plovers (*Squatarola helvetica*), a Ruff (*Machetes pugnax*), a Bar-tailed Godwit (*Limosa lapponica*), British, a Green-cheeked Amazon (*Chrysotis viridigenalis*) from Columbia, a Finsch's Amazon (*Chrysotis finschi*) from Mexico, purchased; four —— Finches (*Coryphospingus cristatus* ♂ ♂ ♀ ♀) from Bolivia, on approval.

OUR ASTRONOMICAL COLUMN

THE BINARY STAR γ VIRGINIS.—Dr. Doberck has recently determined the elements of this star from all the measures available up to the spring of the present year. He gives two orbits, the second of which represents the measures about the periastron-passage somewhat better than the first, but otherwise has no material advantage over it. Dr. Doberck points out that the part of the orbit most interesting to examine was described between the years 1839 and 1847, when the angle of position, after being very oblique, passed quickly through zero, without very much alteration of distance. He finds that the correction required by the angles observed by Dawes, who used a prism for the purpose of keeping the images of the stars apparently in the great circle passing through the zenith, did not much change; those of M. Otto Struve altered in a most pronounced manner; but he adds, "it is quite natural that the errors should be rather large in the case of these stars, which for most observers were at no great distance from the southern horizon, and which, in most telescopes, appear as large disks, at least when the state of the atmosphere is not exceptionally favourable." Dr. Doberck gives a separate comparison with the observations of the Pulkowa astronomer from 1840 to 1874 both as uncorrected and with the corrections in the "Observations de Poulkowa," vol. ix.; he finds that "the observed distances are improved by the corrections, except before 1843, when no corrections ought to be applied," and this is apparent from his investigations on the elements of other double-stars: the angles also are confirmatory, but would be better without the corrections as late as 1853. We subjoin Dr. Doberck's second orbit, and for the sake of comparison the orbit deduced by Thiele, after a very full discussion of the measures up to the year 1865, taken from his treatise published at Copenhagen in 1866.

	Doberck.	Thiele.
Periastron passage	1836·450	... 1836·685
	° ′	° ′
Node	46 0	... 35 35
Periastron from node on orbit (λ)	273 55	... 283 44
Inclination	33 9	... 35 6
Eccentricity	0·89040	... 0·89575
Semi-axis major	3″·94	... 3″·97
Period of revolution	179·65 years	... 185·01 years.

We have added 180° to Dr. Doberck's element (λ), to accord with the angle as it was expressed by Dawes and most other observers until within a recent period, but there appears to be slight variation in the brightness of one of the components, as will be seen from an inspection of M. Otto Struve's observations in the Pulkowa volume referred to above.

THE TRANSIT OF MERCURY, NOVEMBER 8.—This is a phenomenon of which we must look for particulars from observers in Australia: it will be wholly invisible in Europe, the conjunction in R.A. taking place at 0h. 38m. a.m. Greenwich time. At the next transit on the morning of May 10, 1891, the egress only will be observable at Greenwich, the sun rising at 4h. 19m., and the last external contact occurring at 4h. 50m. The conditions are reversed in the following transit on November 10, 1894; the first external contact will take place at 3h. 55m. p.m., and the sun's upper limb will be in the horizon at 4h. 18m. This will be the last transit of Mercury in the present century.

COMET 1881 *f* (DENNING).—M. Schulhof of Paris has found elliptical elements for this comet: the period assigned is 7¾ years, but is yet uncertain. A near approach to the orbit of the planet Jupiter is shown by M. Schulhof's ellipse in heliocentric longitude 219°·7, at which point the distance is only 0·18 of the earth's mean distance from the sun.

GEOGRAPHICAL NOTES

MR. JAMES JACKSON, "Archiviste-Bibliothécaire" of the Paris Geographical Society, has published, in a volume of 340 pages, a "Liste Provisoire de Bibliographies Géographiques Spéciales." The list was undertaken at the instance of the Society, and was printed in some haste, we believe, for the recent Venice Congress. But when we remember that the list is only a bibliographical one, a list of lists, in fact, the accumulation of geographical literature is almost appalling. It bears evidence of extensive and careful research, though the author admits that it is by no means exhaustive. Mr. Jackson recently visited the United States to search the libraries there, and the result is a work invaluable to all students of geography. He has wisely devoted comparatively small space to Europe, because, as he states, the works relating to the countries of that continent are well known and easily accessible. Mr. Jackson gives not only bibliographies proper, but references to works on travel and geography, and to periodicals, journals, and transactions, which contain special lists. The divisions of the list are:—Europe, Asia, Africa, America, Oceania, Polar regions, Oceans and Hydrography, Peoples and Nations, Voyages, Travellers, and Geographers, and Generalities. By means of the arrangement under each division the methodical table of contents, the index to authors and periodical publications, the work is rendered easily consultable. It reflects the greatest credit on Mr. Jackson's industry, and on the enterprise of the Paris Society.

THE only new paper in the Geographical Society's *Proceedings* is Mr. William Beardall's on his exploration of the Rufiji River under the orders of the Sultan of Zanzibar, which lasted from December 8, 1880, till February 19, 1881, and, we believe, was undertaken mainly at the suggestion of Sir John Kirk. A sketch map of the river accompanies the paper, on which the portion above Mpembeno, almost to E. long. 37°, is given from Mr. Beardall's surveys. The geographical notes furnish some particulars respecting the Italian Antarctic Expedition, Mr. Joseph Thomson's recent exploration of the Rovuma district of East Africa, and the American Missionary Expedition to the Bihé plateau in West Africa. There are obituary notices of the Visconde Duprat, the Rev. F. W. Holland, Major S. Anderson, R.E., Sir Vincent Eyre, and Col. T. G. Glover, all of whom had rendered more or less important services to geography.

WRITING on a new map of the Dutch East Indies, about to be published at the Hague, the *Annales de l'extrême Orient* for October mentions that, besides its scientific value, this map is interesting from the adventures which have attended its production. The four stones which together form the lithograph were engraved for the most part in Java, the orography and the names alone remaining to be done in Europe. They were carefully packed and despatched to Holland by one of the Dutch mail steamers, but the latter unfortunately was wrecked, and the stones sank to the bottom of the sea. After much trouble the huge cases containing them were raised, and ultimately arrived at their destination. The new map is on a scale of 1 to 500,000, and is in three colours: the mountains in bistre, the seas, lakes, &c., blue, and the remainder in black. The leaves measure 218 centimetres by 78.

IN an "occasional note" on Monday, the *Pall Mall Gazette* predicts a miscellaneous Arctic meeting for the opening of the Geographical Society's session on November 14. If this should prove correct, it is to be hoped that Capt. Gray may be induced to give some verbal information on his discovery that the Polar-pack was this summer six degrees nearer the shores of Europe than in 1879. Though the note in question is, no doubt, to some extent inspired, we believe the evening's programme is by no means finally decided upon. The subject on which the president, Lord Aberdare, in his address would most naturally dilate, would be his recent visit to Venice, in which case we may hope for an intelligent and intelligible account of the proceedings of the Geographical Congress. Hitherto we have heard of little but some effusive speeches and the showering of diplomas and medals on the foreign societies and individuals who took the trouble to send articles to the Exhibition.

WITH reference to the report that Mr. Gordon-Bennett is about to visit Dundee in order to purchase a whaler to be sent in search of the *Jeannette*, it is probable that this new expedition is the one which Lieut. Hovgaard, of the *Vega*, has volunteered to lead.

CAPT. MEYER, of the German schooner *Phœnix*, at Callao, from San José de Guatemala, reports having discovered a new island. According to advices received by the West India Mail it is in lat. 7° 48′ S., long. 83° 48′ W., lying about 188 miles from Punta Aguja, which is the nearest land. The island appeared of volcanic origin, not being over fifty feet above the sea in its highest part. It is a mile long, and about the same width, and Her Majesty's ship *Kingfisher* and the United States vessel *Alaska* have been despatched to examine it. The Chilian transport *Chile* has also been ordered to pay it a visit during a trip she is now making to the North.

MR. JOSEPH THOMSON has returned to Zanzibar from a three months' exploration of the Loende tributary of the Rovuma

River. Not a trace of coal was found along the whole course of the river, though it was reported by the natives to be seen in abundance protruding on the river banks. The whole country is thickly covered with wood. Mr. Thomson contemplates setting out on his second expedition during the present month. He intends to visit the little-known region between the sea and Mount Kilimanjaro, extending from Melinda on the north to Pangani on the south. Mr. Thomson hopes to make important discoveries in geology and botany.

A PRETTY full account of the proceedings of the recent International Geographical Congress at Venice will be found in the new *Bollettino* (for August) of the Italian Geographical Society, which reports in full the papers on the question of oscillations on the coast of Italy. It contains besides a map showing the various arcs of meridian and parallels that have been measured all over the world, and a map of Europe showing the present state of the various trigonometrical surveys in that continent. Russia, Turkey, and Greece are almost blank, and the Scandinavian peninsula is far behind; the other countries are shown covered with triangles.

LUNAR DISTURBANCE OF GRAVITY[1]

IN November, 1878, Sir William Thomson suggested to Mr. G. H. Darwin that he should investigate, experimentally, the lunar disturbance of gravity and the question of the tidal yielding of the solid earth. This Committee of the British Association was subsequently reappointed, and the authors' names were added to the list of its members. In May, 1879, the authors visited Sir William Thomson at Glasgow, and there saw an instrument which, although roughly put together, he believed to contain the principle by which success might perhaps be attained. The instrument was erected in the physical laboratory of the University of Glasgow. The following are the rough details:—

A solid lead cylinder, weighing perhaps a pound or two, was suspended by a fine brass wire, about five feet in length, from the centre of the lintel or cross-beam of the solid stone gallows which is erected there for the purpose of pendulum experiments. A spike projected a little way out of the bottom of the cylindrical weight; a single silk fibre, several inches in length, was cemented to this spike, and the other end of the fibre was cemented to the edge of an ordinary galvanometer-mirror. A second silk fibre, of equal length, was cemented to the edge of the mirror, at a point near to the attachment of the former fibre. The other end of this second fibre was then attached to a support, which was connected with the base of the stone gallows. The support was so placed that it stood very near to the spike at the bottom of the pendulum, and the mirror thus hung by the bifilar suspension of two silks, which stood exceedingly near to one another in their upper parts.

It is obvious that a small displacement of the pendulum, in a direction perpendicular to the two silks, will cause the mirror to turn about a vertical axis.

A lamp and slit were arranged, as in a galvanometer, for exhibiting the movement of the mirror by means of the beam of light reflected from the mirror. It was found to be in incessant movement, of so irregular a character that it was hardly possible to localise the mean position of the spot of light on the screen, within five or six inches. On returning to the instrument after several hours, the observer frequently found that the light had wandered to quite a different part of the room, and it was sometimes necessary to search through nearly a semicircle before finding it again. The cause of this extreme irregularity of the movement of the pendulum was obscure; and as Sir William Thomson was of opinion that the instrument was well worthy of careful study, the authors determined to undertake a series of experiments at the Cavendish Laboratory at Cambridge.

Accordingly throughout 1880 they proceeded to make experiments with an instrument which involved the principle above explained. Several modifications of some importance were introduced. The pendulum was hung in fluid, in order to quickly destroy the oscillations generated by local tremors, and, being suspended by two wires, it was only free to oscillate in one direction, namely, the meridian. There was also introduced an apparatus, which we have not space to explain, by which a known very small horizontal thrust might be applied to the pendulum. By means of this the actual displacements of the pendulum were determinable from the observed displacements of the spot of light on the screen.

The image on the screen was found to be in a state of continual agitation of an irregular character, so that it was not possible to take a reading with very great accuracy. But as the pendulum was hung in fluid, the agitation was not nearly so great as it had been in the instrument at Glasgow.

The observers also found that the pendulum was subject to a diurnal oscillation, and that it stood furthest north towards 6 p.m., and furthest south towards 6 a.m. Superposed on this motion was a gradual change of the mean diurnal position, for during two months the pendulum moved northwards.

The instrument was found to exhibit the flexure of the stone piers of the gallows, even when the force employed was only a slight pressure with one finger. Water poured on the ground round the basement of the stone gallows tilted the whole structure over, and very small changes of temperature in the stone piers were found to give distinct effects. It was concluded that 1 foot of displacement in the spot of light on the scale corresponded with 1″ of change in the direction of the plumb-line with reference to the base of the gallows.

From these experiments the authors concluded that the instrument was susceptible of all the delicacy requisite, but that the mode of suspension was unsatisfactory.

Accordingly in 1881 they proceeded to erect a new instrument in which the support for the pendulum was a copper tube, which itself formed the envelope for containing the fluid in which the pendulum was suspended. The whole apparatus was immersed in a large mass of water, and the observations were taken from outside of the room by means of a telescope. The unsteadiness of the image was diminished, probably on account of the precautions taken against inequalities of temperature in various parts of the instrument, and because the pendulum was hung in a very confined space. The accuracy with which readings could be taken was thus increased.

Similar diurnal oscillations of the pendulum were again observed, and a similar slow change in the mean diurnal position. The authors therefore concluded that these changes are a real phenomenon, and do not depend upon changes of temperature in the instrument itself.

They also noted that there are periods lasting for several days in which the pendulum is in a state of continual agitation, so that the readings taken at a few seconds apart do not agree *inter se*, and that there are other periods of abnormal quiescence. These periods do not seem intimately connected with the external meteorological conditions, at least as far as the experiments have been hitherto carried.

The pendulum was found to be practically insensible to the effect of local tremors, such as are produced by hitting the stone support or stamping on the ground in the immediate neighbourhood of the instrument. But it was extraordinarily sensitive to steady forces. If a force be applied at a point on the floor a dimple is produced in consequence of the elastic yielding of the soil, and any object on the floor is slightly tilted towards the point where the force is applied. Now when a person stood in the room at sixteen feet away from the instrument, and again at seventeen feet, the difference was rendered distinctly evident between the amounts of inclination towards the point of pressure of the stone basement supporting the pendulum in the two cases.

Although no great pains had been taken to render the instrument as sensitive as possible, it was found that an alteration of the plumb-line through 1-100th of a second of arc was distinctly measurable.

The second part of the paper contains an account of the work of some of the previous observers on the same subject.

M. Zöllner's instrument, the "horizontal pendulum," is described. It does not appear that any extensive series of observations have been made with it.

An account of M. d'Abbadie's work is next given. He made his observations by means of reflections from a pool of mercury, and the site of his experiments was at Abbadia, near Hendaye, in the south of France. He found that there were periods of agitation and of quiescence in the mercury, apparently without reference to any perceptible external causes. There were also gradual changes of level extending over several months, and the

[1] Report of the Committee, consisting of Mr. G. H. Darwin, Prof. Sir William Thomson, Prof. Tait, Prof. Grant, Dr. Siemens, Prof. Purser, Prof. G. Forbes, and Mr. Horace Darwin, appointed for the Measurement of the Lunar Disturbance of Gravity. Account of experiments by G. H. Darwin and H. Darwin, read at the British Association, York, September 1881.

experience of several years showed that there was something like an annual inequality of level. There were sometimes changes through 2″ or 3″ which took place in a few hours.

At Geneva M. Plantamour has been making observations concerning variations of the plumb-line, by means of delicate levels, and has arrived at results in general accordance with those of M. d'Abbadie.

The experiments of the authors present a general confirmation of these conclusions, and show that the earth's surface is in a state of continual movement.

With reference to this continual oscillation the authors adduce an experiment which was commenced about three and a half years ago by Mr. Horace Darwin at Down, in Kent. The experiment was undertaken in connection with Mr. Darwin's investigation of the geological activity of earthworms. There are two stout metal rods, one of iron and the other of copper. The ends were sharpened, and they were hammered down vertically about eight feet deep into the soil, and they are in contact with one another, or nearly so. The ends were then cut off about three inches above the ground.

A stone was obtained like a small grindstone, with a circular hole in the middle. This stone was laid on the ground with the two metal rods appearing through the hole. An arrangement with a micrometer screw enables the observer to take contact measurements of the position of the upper surface of the stone with regard to the rods. The stone has, on the whole, always continued to fall, but the general descent can only be gathered from observations taken at many months apart, for it is found to be in a state of continual vertical oscillation.

The measurements are so delicate that the raising of the stone produced by one or two cans full of water poured on the ground can easily be perceived. The effect of frost and the wet season combined is strongly marked, for on January 23, 1881, the stone was 4·12 mm. higher than it had been on September 7, 1880. The prolonged drought of the present summer has had a great effect, for between May 8 and June 29 the stone sank through 5·79 mm.

The changes produced in the height of the stone are, of course, entirely due to superficial causes; but the amounts of the oscillations are certainly surprising, and although the basements of astronomical instruments may be very deep, they cannot entirely escape from similar oscillations.

The last part of the paper contains a discussion of the present aspects of the question, and a criticism of the various forms of instrument which have been used hitherto for the detection of small variations in the position of the plumb-line.

The authors suggest that greater precautions should be taken in the protection of the piers of transit instruments from changes of temperature, and in the drainage of the soil round the basements of the piers; they also draw attention to the disturbing effect of the weight of the observer's body. They express a hope that systematic observations of changes of level may be undertaken at a number of observatories by some instrument analogous to that with which they are working. They are still prosecuting their experiments, and they are in hopes of being able to reduce their instrument to a convenient form, so that it may not be difficult to transport or to erect.

In conclusion they state that they have no hope of being able to observe the lunar attraction in the present site of observation, but they think it possible that they may devise a portable instrument which shall be amply sensitive enough for such a purpose, if the bottom of a deep mine should be found to give a sufficiently invariable support for the instrument.

AN ERROR IN THE COMMONLY ACCEPTED THEORY OF CHEMISTRY

AT a public meeting of the University College Chemical and Physical Society Prof. A. W. Williamson, F.R.S., gave an address on "An Error in the Commonly Accepted Theory of Chemistry."

He began by saying that he had been frequently struck by the fact that two theories believed at one time to be conflicting had often been shown by the progress of study to be both true. As an instance in point he took the rival theories, one of which represented molecules as constituted after the pattern of three or four types, while the other viewed them as containing complex groups called radicles.

There was at one time opposition between those who made use of atomic weights and those who employed equivalent weights; the most important step that has of late been taken is the introduction of the notion of equivalence into the atomic theory; an inspection of the series HCl, H_2O, H_3N, H_4C showed that the atom of chlorine has a different value to that of oxygen, nitrogen, or carbon; thus ammonia may be viewed as being formed by replacing three atoms of chlorine in three molecules of hydric chloride by one atom of nitrogen. Thus nitrogen was said to be trivalent or a triad, and other elements, such as phosphorus, boron, &c., were found to resemble it in this respect; oxygen was called a dyad, and it was found that sulphur, calcium, &c., might also be classed as divalent; in short every element might be placed in one or other of the groups, monad, dyad, triad, &c. That an element can belong to one only of these groups was the view still held by one distinguished chemist, who, for instance, said that nitrogen was trivalent only, and that in sal-ammoniac it was not pentavalent, but that the body in question was a molecular compound of two chemical compounds, ammonia and hydric chloride.

He (Prof. Williamson) thought this was little else than a return to Berzelius' mode of representing compounds, though it was open to an objection from which the theory of the Swedish chemist was free; for Berzelius said that the force which united the two molecules that made up the compound molecule was identical with that which held together the atoms of the constituent molecules, the force being in each case electrical; whereas Prof. Kekulé assumes the forces in the two cases to differ, the one being molecular, and the other chemical.

Now as long as we knew neither of these forces, he (Prof. Williamson) thought it hazardous to assert that there was a difference between them. A study of the evolution of heat in chemical processes threw some light on the subject; Berthelot and Thomsen had shown that when you placed a number of substances within the influence of one another, that reaction or decomposition took place which could evolve the most heat, and we must take into account not merely the heat given out by what we considered the purely chemical process, but also that due to the passage of the product from one state of aggregation to another—from the liquid to the solid state when a precipitate was formed.

Thus the chemical process was determined by the heat due to the chemical reaction plus that due to change of physical condition; and this indicated an identity between chemical and physical force. We might learn the same lesson from Deville's truly remarkable researches on dissociation or strictly reversible decompositions. Thus calcic carbonate was decomposed by heat into lime and carbonic acid, but no sooner was the temperature sufficiently lowered than the two recombined; so, when water was heated, the molecules were separated and formed steam, but on lowering the temperature they recombined to produce water. Ice, water, and steam had in many respects different properties—differences in specific gravity, specific heat, refractive power, &c., quite analogous to those which were found between different chemical compounds.

We had therefore no grounds for assuming a difference between chemical and physical force; Kekulé's theory that an atom can have one, and only one, atomic value was no longer tenable, for it involved the assumption of molecular compounds. The theory commonly in vogue was that atoms vary in their value within certain narrow limits; that nitrogen, for instance, was either trivalent or pentavalent. It had even been asserted that the combining power of an atom was independent of the nature of the elements with which it combined; in the words of a very distinguished chemist, "No matter what the character of the uniting atoms may be, the combing power of the attracting element is always satisfied by the same number of these atoms." This view appeared to him (Prof. Williamson) to have been due to a habit of mind naturally prevailing in many studies, but which, he thought, we had found reason in our scientific work to abandon—he meant the absolute as opposed to the relative.

Prof. Williamson then went on to say that he knew of no limitation to atomic value; he did not say there were no limitations, but he did know that many elements have atomic values greater than those commonly assumed.

We found that the character of the atoms materially affected the result; thus gold could not combine with more than three atoms of chlorine alone, but it could take up an additional atom of chlorine if supplied with an atom of sodium at the same time. In this way we got the common double chloride of gold and sodium, $NaAuCl_4$, in which the gold is pentavalent.

We were not to consider the sodium as being here combined

with gold as such, it is combined with the whole group $AuCl_4$, a radicle that is doubtless far more chlorous than chlorine itself.

If any were inclined to doubt the truth of this view, they should write the formula $ClNH_4$ under $NaAuCl_4$, when they would perceive that the radicle $AuCl_4$ corresponded to NH_4, ammonium, the basylous properties of which no one doubted nowadays.

In ammonium we have the basylous energies of four hydrogen atoms concentrated by the inert nitrogen, and the result was a powerfully basylous radicle; in $AuCl_4$ we have the chlorous energies of four chlorine atoms giving a powerfully chlorous radicle.

Among other examples of the kind the Professor cited:

K_2AsF_7 with nonovalent atom.
K_2PtCl_6, K_2SiF_6 } with octovalent atoms.
$OI(OH)_5$, $KSbF_6$ } with heptavalent atoms.
K_2FeF_4, K_2MgBr_4, K_2CuCl_4 } with hexavalent atoms.
$KMgCl_3$ with tetravalent atoms.

And he concluded his address by drawing attention to the conditions that affect the atomic value of an element, which he said were, firstly, the nature of the combining atoms: there was a limit to the number of atoms of one kind that can combine with a given element, but if the element combined at the same time with one or more atoms of a different character, this limit might be passed; and secondly, the temperature, a sufficient rise of temperature being always accompanied by a diminution of atomic value. He thought it of great importance that these points should be considered by those who had artificially limited their horizon. The properties of many of the atoms in complex substances having been in great measure concealed from view by the practice of giving specific names, such as the word "molecular," he thought it would be much better to say at once that we are ignorant of the constitution of these bodies than to resort to such names.

JURASSIC BIRDS AND THEIR ALLIES[1]

ABOUT twenty years ago two fossil animals of great interest were found in the lithographic slates of Bavaria. One was the skeleton of *Archæopteryx*, now in the British Museum, and the other was the *Compsognathus* preserved in the Royal Museum at Munich. A single feather, to which the name *Archæopteryx* was first applied by Von Meyer, had previously been discovered at the same locality. More recently another skeleton has been brought to light in the same beds, and is now in the Museum of Berlin. These three specimens of *Archæopteryx* are the only remains of this genus known, while of *Compsognathus* the original skeleton is, up to the present time, the only representative.

When these two animals were first discovered they were both considered to be reptiles by Wagner, who described *Compsognathus*, and this view has been held by various authors down to the present time. The best authorities, however, now agree with Owen that *Archæopteryx* is a bird, and that *Compsognathus*, as Gegenbaur and Huxley have shown, is a Dinosaurian reptile.

Having been engaged for several years in the investigation of American Mesozoic birds, it became important for me to study the European forms, and I have recently examined with some care the three known specimens of *Archæopteryx*. I have also studied in the Continental museums various fossil reptiles, including *Compsognathus*, which promised to throw light on the early forms of birds.

During my investigation of *Archæopteryx* I observed several characters of importance not previously determined, and I have thought it might be appropriate to present them here. The more important of these characters are as follows:—

1. The presence of true teeth, in position, in the skull.
2. Vertebræ biconcave.
3. A well-ossified broad sternum.
4. Three digits only in the manus, all with claws.
5. Pelvic bones separate.
6. The distal end of fibula in front of tibia.
7. Metatarsals separate, or imperfectly united.

These characters, taken in connection with the free metacarpals and long tail, previously described, show clearly that we have in *Archæopteryx* a most remarkable form, which, if a bird, as I believe, is certainly the most reptilian of birds.

If now we examine these various characters in detail, their importance will be apparent.

The teeth actually in position in the skull appear to be in the the premaxillary, as they are below or in front of the nasal aperture. The form of the teeth, both crown and root, is very similar to the teeth of *Hesperornis*. The fact that some teeth are scattered about near the jaw would suggest that they were implanted in a groove. No teeth are known from the lower jaw, but they were probably present.

The presacral vertebræ are all, or nearly all, biconcave, resembling those of *Ichthyornis* in general form, but without the large lateral foramina. There appear to be twenty-one presacral vertebræ, and the same, or nearly the same, number of caudals. The sacral vertebræ are fewer in number than in any known bird, those united together not exceeding five, and probably less.

The scapular arch strongly resembles that of modern birds. The articulation of the scapula and caracoid, and the latter with the sternum is characteristic; and the furculum is distinctly avian. The sternum is a single broad plate, well ossified. It probably supported a keel, but this is not exposed in the known specimens.

In the wing itself the main interest centres in the manus and its free metacarpals. In form and position these three bones are just what may be seen in some young birds of to-day. This is an important point, as it has been claimed that the hand of *Archæopteryx* is not at all avian, but reptilian. The bones of the reptile are indeed there, but they have already received the stamp of the bird.

One of the most interesting points determined during my investigation of *Archæopteryx* was the separate condition of the pelvic bones. In all other known adult birds, recent and extinct, the three pelvic elements—ilium, ischium, and pubis, are firmly anchylosed. In young birds these bones are separate, and in all known Dinosaurian reptiles they are also distinct.

In birds the fibula is usually incomplete below, but it may be co-ossified with the side of the tibia. In the typical Dinosaurs, *Iguanodon*, for example, the fibula at its distal end stands in front of the tibia, and this is exactly its position in *Archæopteryx*, an interesting point not before seen in birds.

The metatarsal bones of *Archæopteryx* show, on the outer face at least, deep grooves between the three elements, which imply that the latter are distinct, or unite late together. The free metacarpal and separate pelvic bones would also suggest distinct metatarsals, although they naturally would be placed closely together, so as to appear connate.

Among other points of interest in *Archæopteryx* may be mentioned the brain-cast, which shows that the brain, although comparatively small, was like that of a bird, and not that of a Dinosaurian reptile. It resembles in form the brain-cast of *Laopteryx*, an American Jurassic bird, which I have recently described. The brain of both these birds appears to have been of a somewhat higher grade than that of *Hesperornis*, but this may have been due to the fact that the latter was an aquatic form, while the Jurassic species were land birds.

As the *Dinosauria* are now generally considered the nearest allies to birds, it was interesting to find in those investigated many points of resemblance to the latter class. *Compsognathus*, for example, shows in its extremities a striking similarity to *Archæopteryx*. The three clawed digits of the manus correspond closely with those of that genus; although the bones are of different proportions. The hind feet also have essentially the same structure in both. The vertebræ, however, and the pelvic bones of *Compsognathus* differ materially from those of *Archæopteryx*, and the two forms are in reality widely separated. While examining the *Compsognathus* skeleton, I detected in the abdominal cavity the remains of a small reptile which had not been previously observed. The size and position of this inclosed skeleton would imply that it was a fœtus; but it may possibly have been the young of the same species, or an allied form, that had been swallowed. No similar instance is known among the Dinosaurs.

A point of resemblance of some importance between birds and Dinosuurs is the clavicle. All birds have those bones, but they have been considered wanting in Dinosaurs. Two speci-

[1] Read by Prof. O. C. Marsh before Section D, British Association, at York, September 2, 1881. Communicated by the Author.

mens of *Iguanodon* in the British Museum, however, show that these elements of the pectoral arch were present in that genus. Some other *Dinosauria* possess clavicles, but in several families of this sub-class, as I regard it, they appear to be wanting.

The nearest approach to birds now known would seem to be in the very small Dinosaurs from the American Jurassic. In some of these the separate bones of the skeleton cannot be distinguished with certainty from those of Jurassic birds, if the skull is wanting, and even in this part the resemblance is striking. Some of these diminutive Dinosaurs were perhaps arboreal in habit, and the difference between them and the birds that lived with them may have been at first mainly one of feathers, as I have shown in my Memoir on the *Odontornithes*, published during the past year.

It is an interesting fact that all the Jurassic birds known, both from Europe and America, are land birds, while all from the Cretaceous are aquatic forms. The four oldest known birds, moreover, differ more widely from each other than do any two recent birds. These facts show that we may hope for most important discoveries in the future, especially from the Triassic, which has as yet furnished no authentic trace of birds. For the primitive forms of this class we must evidently look to the Palæozoic.

SCIENTIFIC SERIALS

Journal of the Asiatic Society of Bengal, vol. l. part 2, No. 2 1881 (July 30), contains:—H. F. Blanford, F.R.S., on the relations of cloud and rainfall to temperature in India, and on the opposite variations of density in the higher and lower atmospheric strata, and description of a rain-gauge with evaporimeter for remote and secluded stations (plate 15).—J. Wood-Mason, on some insects belonging to the Rhopalocera from India and Burmah.—W. T. Blanford, F.R.S., on the Voles (Arvicola) of the Tibet Himalayas and Afghanistan (plates 1 and 2); and on *Myospalax fuscicapillus*, Blyth.

Gegenbaur's morphologisches Jahrbuch, vol. vii., part 2, 1881, contains—R. S. Bergh, on the organisation of the cilio-flagellate Infusoria; a phylogenetic study; plates 12–16. Contains diagnoses of the genera Ceratium, Dinophysis, Protoperidinium (nov. gen.), Peridinium, Protoceratium (nov. gen.), Diplosalis (nov. gen.), Glenodinium, Gymnodinium, Polykrikus, and Protocentrum, with descriptions of several species in each.—Dr. W. Pfitzner, on the minute structure of cell-nuclei.—Prof. Bischoff, on the third or lowermost frontal gyrus (Stirnwindung), and the inner upper lobulus-parietalis gyrus in the gorilla.

Zeitschrift für wissenschaftliche Zoologie, August, 1881 (vol. xxxvi. part 1), contains; Dr. H. Simroth, on locomotion and the organ of locomotion in *Cyclostoma elegans* and other indigenous land and freshwater mollusca (plate 1 and many woodcuts).—Dr. P. Stöhr, on the development of the skull in the Anura (plates 2 and 3).—Dr. A. Gruber, on division in the monothalamous rhizopods (plates 4 and 5).—F. Blockmann, on the development of *Neritina fluviatilis* (plates 6, 7, and 8).—Prof. W. Krause, on the human allantois (plate 9).

SOCIETIES AND ACADEMIES

MANCHESTER

Literary and Philosophical Society, October 4, 1881.—J. P. Joule, F.R.S., &c., in the chair.—On drops floating on the surface of water, by Prof. Osborne Reynolds, F.R.S. It is well known that under certain circumstances drops of water may be seen floating on the surface for some seconds before they disappear. Sometimes during a shower of rain these drops are seen on the surface of a pond, they are also often seen at the bows of a boat when travelling sufficiently fast to throw up a spray. Attempts have been made to explain this phenomenon, but I am not aware of any experiments to determine the circumstances under which these drops are suspended. Having been deeply engaged in the experimental study of the phenomena of the surface-tension of water and the effect of the scum formed by oil or other substances, it occurred to me that the comparative rarity of these floating drops would be explained if it could be shown that they required a pure surface, a surface free from scum of any kind. For, owing to the high surface-tension of pure water, its surface is rarely free from scum. The surface of stagnant water is practically never free except when the scum is driven off by wind. But almost any disturbance in the water, such as the motion of a point of a stick round and round in the water, or water splashed on the surface, will serve to drive back the scum for a certain distance. This may be shown by scattering some flowers of sulphur on the surface. This powder is insoluble and produces no scum, and hence it serves admirably to show the motion of the surface and whatever scum there may be upon it. If when the surface is so dusted a splash be made by a stick so as to throw drops on to the sulphured surface, at the first splash no floating drops are produced; but after two or three splashes in rapid succession it will be seen that the sulphured scum has been driven back by the falling water, leaving a patch of clear surface, and on this drops will float in large numbers and of all sizes. These drops are entirely confined to that portion of the surface which is clear. The drops, either by their initial motion or by the current of air, glide rapidly over the surface from the point at which they are formed. When, however, they reach the edge of the scum they disappear, apparently somewhat gradually. I have this summer made the experiment on several ponds and on various days, and I have never found any difference. Any scum, however transparent, prevented the drops, and they always floated in large numbers when the scum was driven back in the manner described, by the wind or any other way. This result points to the conclusion that whatever may be the cause of this suspension, it depends only on the surface of the water being pure, and not at all on the temperature or condition of the air.—On the mean intensity of light that has passed through absorbing media, by James Bottomley, D.Sc., F.C.S.—Note on the colour relations of nickel, cobalt, and copper, by James Bottomley, D.Sc., F.C.S.

VIENNA

Imperial Academy of Sciences, October 13.—V. Burg in the chair.—The following papers were read:—A. v. Liebenberg, experiments on the part of lime in germination.—E. Weiss, computation of the elements and ephemeris of Barnard's comet.—E. Brücke, on some consequences of the Young-Helmholtz theory.—T. W. Brühl, on the connection between the optic and thermic properties of liquid organic bodies.

PARIS

Academy of Sciences, October 17.—M. Wurtz in the chair.—The Secretary presented the instructions formulated by the International Conference for Observation of the Transit of Venus.—Crystalline sulphurated copper (*cuprèine*), formed at expense of old coins, apart from thermal springs, at Flines-les-Roches, Departement du Nord, by M. Daubrée.—Observations of the comet *b* 1881 (Tebbutt-Gould-Cruls) at Paris Observatory, by M. Bigourdan.—On a remarkable configuration of circles in space, by M. Stephanos.—On Fuchsian functions, by M. Poincaré.—On an experimental peculiarity relative to the equipotential law of Nobili's rings, by M. Guébhard. He has studied, under strong light, the trajectories of minute bubbles between electrodes in badly-conducting liquids; these are quite determinate and independent of gravity, and (friction and agitation of the liquid apart) seem to represent lines of force of the electric flow. With variously formed electrodes he has repeated Antolik's and Mach's experiments made with static discharge; and profiting by certain effects of polarisation, and counter-currents arising on quick reversal of the principal current, has obtained a fixed trace of the lines of flow.—Theory of a rapid vessel, by M. Pictet.—On the currents generated by atmospheric electricity and earth-currents, by M. Landerer. At Tortosa he stretched a wire between the roofs of two houses in a direction making a small angle with the magnetic meridian, and connected it with the water-pipes. The currents generated are variously due to condensation of aqueous vapour, to lightning-discharges, to action of wind, and to earth-currents. The first two and the fourth affect a telephone in the circuit, but not the third (these, however, as well as the second and fourth, deflect a galvanometer). The earth-currents are distinguished from atmospheric currents by their regularity and continuity during pretty long intervals. Variation of the earth-current is a sign of change of weather.—Action of sulphur on alkaline sulphides in very dilute solution, by M. Filhol. In such action on dilute solutions of monosulphide of sodium a polysulphide is formed, without notable production of hyposulphite, and it seems as though the original monosulphide has subsisted, spite of the dilution. But more probably it is decomposed and reconstituted.—On a new series of bases derived from morphine, by M. Grimaux.—On a new alkaloid of quinquinas, by M. Arnaud. The formula adopted for *cinchonamine* (this new alkaloid) is

$C_{19}H_{24}N_2O$. The author found it, simultaneously with cinchonine, in a very dense dark brown-red bark, of resinous fracture, from Santander; there being 0·8 to 1 per cent. of cinchonine, and 0·2 of the other. It differs from cinchonine in having two atoms more of hydrogen.—On the dissociation of carbamate of ammonium, by MM. Engel and Moitessier.—On the subcutaneous sacs and the lymphatic sinuses of the cephalic region in *Rana temporaria*, L., by M. Jourdain. He modifies the enumeration of sacs by Dugés, and indicates some relations hitherto overlooked. *Inter alia*, the lingual sinuses, forming cavities which communicate with the neighbouring reservoirs only by narrow orifices, form a nearly closed system, and M. Jourdain finds in this an explanation (different from that of Dugés) of the mechanism by which the tongue, become turgid, is protruded.—On a curious case of prefecundation observed in a Spionide, by M. Giard.—Contribution to a study of the Flagellata, by M. Kamstler. He has observed in *Cryptomenas ovata*, Ehrbg., transverse striation of the two flagellums serving for locomotion; also a group of long fine flagellums (hitherto unknown), which are also striated and serve for prehension of food; four layers in the body-wall, the outer one colourless, the others having chlorophyll (their structure is described); a spacious stomach with a sort of vestibule (but no œsophagean tube), intestine, and anus; small organisms therein, proving that Cryptomonas does not live on liquid food alone; a pore through which the contractile vesicle communicates with the exterior; an organ which is probably a male apparatus, &c. He also describes the oculiform point in *Phacus pleuronectes*, Dugard, which organ he developed by cultivation in intense light. He considers the structure to prove its visual function beyond a doubt.—On the cause of immunity of adults of the bovine species towards symptomatic or bacterian charbon in localities where this malady is prevalent, by MM. Arloing, Cornevin, and Thomas. Most of the young animals in an infected district are spontaneously inoculated with various quantities of the virus, and while those receiving much take the disease in fatal form, those receiving little have a mild attack, sufficient to insure future immunity. M. Bouley remarked on the bearing of hereditary influences, and M. Pasteur on the error of supposing that young animals had a greater aptitude to receive contagion.

October 24. M. Wurtz in the chair.—The following papers were read:—Detonation of acetylene, cyanogen, and endothermal combinations in general, by M. Berthelot. Gases formed with absorption of heat (acetylene, &c.), which do not detonate under simple heating, may be brought to explosion through sudden shock (*e.g.* through fulminate of mercury); this shock acts only on a certain layer of gaseous molecules, communicating enormous kinetic energy; the molecular edifice loses its relative stability and falls to pieces, and the initial energy is instantly increased by that corresponding to heat of decomposition of the gas. Hence a new shock produced on the next layer, which causes the same decomposition, and so on, to total destruction of the system.—On a general determination of the tension and volume of saturated vapours, by M. Clausius.—On an apparatus for determining, without pain to the patient, the position of a projectile of lead or other metal in the human body, by Prof. Bell. This is a modification of Hughes' induction-balance. One flat coil is superposed on another, so that the edge of the former is near the axis of the latter. One has thick wire, and is the primary circuit, the other has thin wire, and is the secondary. The two are dipped in paraffin and fixed in a wooden frame with handle. A vibratory current from a battery traverses the primary coil, and a telephone is put in circuit with the other. When the common part of the two coils comes near a metallic body silence gives place in the telephone to a sound which varies in intensity according to the nature and form of the body. It is found advantageous to insert in the two circuits two other coils similar to the first, but much smaller, and the common surface of which can be altered with a micrometric screw; also to insert an electrostatic capacity in the primary.—On the parasitic nature of disorders arising from impaludism, by M. Leverson. The efficiency of sulphate of quinine as an antidote is thus accounted for (various parasitic elements in the blood are described).—Note on the quality of waters of the Isère as regards the project of an irrigation-canal from the Rhone. Owing to the presence of salts of soda and magnesia in considerable quantity, the water of the Isère is absolutely unfit for irrigation.—On a configuration of fifteen circles, and on the linear congruences of circles in space, by M. Stephanos.—On the mathematical theory of the vibratory movement of bells, by M. Mathieu.—On the electrolysis of water, by M. Tommasi. A zinc-copper or zinc-carbon element, immersed in dilute sulphuric acid, does not decompose water, conformably to theory, if the two electrodes are of platinum. For this decomposition to take place, the positive electrode must be formed of a metal which, under influence of the voltaic current, can combine with the oxygen of the water.—On a proportion-compass (*boussole de proportion*) for measurement of resistances, by M. Carpentier. Suppose on the surface of a sphere, the vertical diameter of which is taken as polar axis, two similar circuits along two meridians at right angles to each other. Currents along these circuits affect a small magnetic needle hung at the centre of the sphere, which needle sets in the direction of the resultant of the two forces. This depends on the ratio of the intensities, and this ratio of the strength of one component to that of the other is precisely measured by the trigonometric tangent of the angle formed by the resultant with the other component. For measurement of resistances a current is made to divide between the circuits, and of course does so equally. Then the resistance to be measured is added to one circuit, and the current then divides inversely as the resistances. Two ways are indicated of eliminating the influence of terrestrial magnetism.—On the variation of the annual number of thunderstorms at Rio de Janeiro, by M. Cruls. In the period 1851–1876 (during which the annual number of thunderstorms is found to vary between eleven and forty-nine), he makes out a close correspondence between the curve of storms and that of solar spots. A curve for Toronto shows the same thing, though less distinctly. M. Faye expressed a feeling of reserve as to this correspondence. The period of spots could be reproduced in that of thunderstorms only if the spots sensibly affected the heat sent us by the sun; but no trace of an eleven-years' period has been found in annual temperatures. The conclusion is that solar spots and our thunderstorms are not in the relation of cause and effect. The correspondence indicated by M. Cruls is not sufficient to prove the necessity of finding a connection between the two phenomena.—On a new hydrate of carbon, by M. Morelle. He calls it *bergenite* instead of *bergenin*, the name given (1850) by its discoverer, M. Carreau, who did not study it very fully. It is got from Siberian saxifrage. M. Morelle arrives at the formula $C_{16}(C_4H_4O_4)_5$ (which corresponds to 75·75 per cent. of acetic acid). It is a pentatomic alcohol, ranking with pinite and quercite.—On the comparative toxicity of different metals, by M. Richet. Instead of injecting, he rendered the medium poisonous (*e.g.* the water for a fish). He named the *limit of toxicity* the quantity of poison per litre of water, allowing a fish to live more than forty-eight hours. Thus he shows that there is no precise relation between the atomic weight, or the chemical function of a body, and its toxical power.—Researches on the circulatory system of *Spatangus purpurense* by M. Kiehler.

CONTENTS

PAGE

A Recent "Find" in British Palæontology. By Prof. Archibald Geikie, F.R.S. 1
The Head-Hunters of Borneo. By Alfred R. Wallace . . . 3
Butterflies 5
Our Book Shelf:—
"The Quarterly Journal of Microscopical Science" 6
Tyndall's "Essays on the Floating-Matter of the Air in Relation to Putrefaction and Infection" 6
Letters to the Editor:—
The Struggle of Parts in the Organism.—The Duke of Argyll, F.R.S.; Dr. William B. Carpenter, C.B., F.R.S. 6
An Alleged Diminution in the Size of Men's Heads.—Dr. W. B. Kesteven 8
The Evolution of the Palæozoic Vegetation.—J. S. Gardner . . 8
The Teaching of Practical Biology.—F. Jeffrey Bell 8
The Igneous Rocks of Iceland.—A. J. Hubbard 8
Replacing Flint Flakes.—F. Archer 8
Climate of Atacama.—Hyde Clarke 9
The Autumn Sky, I. By Rev. T. W. Webb (*With Diagrams*) . . 9
Meteorology of Ben Nevis. By Alexander Buchan (*With Illustrations*) 11
The Electric Tramway (*With Illustrations*) 13
The Bolometer (*With Diagrams*) 14
Notes 16
Our Astronomical Column:—
The Binary Star γ Virginis 19
The Transit of Mercury, November 8 19
Comet 1881 *f* (Denning) 19
Geographical Notes 19
Lunar Disturbance of Gravity. By G. H. Darwin, F.R.S. . . 20
An Error in the Commonly Accepted Theory of Chemistry. By Prof. A. W. Williamson, F.R.S. 21
Jurassic Birds and their Allies. By Prof. O. C. Marsh . . . 22
Scientific Serials 23
Societies and Academies 23