culation is based on what seems a faulty method. The average of life, about fifty years, is taken, and the expectation of life (in reality a somewhat larger figure), twenty-five years, is added, making up seventy-five, the manifest assumption being that the full term of life of a species is equal to its *average* life plus the *expectation of life* at that age, a conception for which I know of no physiological justification. Eighty-six to eighty-seven years, the period given by the formula, probably represents with fair accuracy the average age at which people would pass from life by senile decay if their lives were not shortened by deleterious influences and conditions. ERNEST D. BELL.

"Primitive Constellations."

REFERRING to your reviewer's hostile notice of my work, "Primitive Constellations," I have seldom realised the strength of my general position until I have seen some attack on it. Against my main contention, *i.e.* the identity of various Greek and Babylonian constellations, he has nothing to say, except that I start with my "theory ready made." Really, he does me much honour. Am I the inventor of the "theory" that, *e.g.*, the signs of the Zodiac were derived from Babylonia? But, leaving nine-tenths of the book with merely a little abuse, he has much to say on the transliteration of Babylonian words, and expresses great scorn because, following Prof. Sayce, I deliberately write *sa*, and not *sha*, and so on. He says I "really ought to know there is no *h* in Assyrian." Indeed. I am at present away from books, but happen to have Sayce's "Assyrian Grammar" at hand. At p. 46 I read, "*a, ha* [cuneiform] . . . *h.* [cuneiform], *ah, hi, h.*" Again, I am perfectly aware of the force of "the determinative particle *ki*," and, in a book for general readers, have naturally chosen to write "Barsipki," not "Barsip^{ki}," "Suanaki," "Tintirki," &c. If the critic had endeavoured to refute my general proposition, or had carefully examined my treatment of any particular constellation figure, *e.g.* the *Arrow*, how much more useful it would have been. But a policy of pin-pricks does not venture on this.

Berry Pomeroy, Boscombe, April 18. R. BROWN, JUN.

THE writer of the review did not suggest that Mr. Brown had discovered the Babylonian origin of the signs of the Zodiac. The theory which the reviewer laid to his charge was to the effect that the Greeks of the pre-Homeric and Homeric ages had a full knowledge of the constellations known to their descendants in Ptolemaic times; and, further, that they obtained such knowledge at this early period from the Babylonians through intercourse with the Phœnicians and the "Hittites." It is from this theory that the reviewer entirely dissents. Mr. Brown's wholesale assertions that representations of animals in early Greek art are astronomical symbols it was thought might be charitably explained by supposing that he began his studies with this part of his theory "ready made." Of the two cuneiform signs which Mr. Brown cites as proving the existence of the *h* in Assyrian, the first only represents the vowel *a*, the second is only used to indicate the smooth breathing; that he should rely on a grammar published more than twenty years ago shows that he has not made himself acquainted with the recent literature on this subject. It is satisfactory to learn that Mr. Brown is aware of the force of the determinative particle *ki*; but to transliterate such a determinative (which was not pronounced) as though it formed a syllable of the word to which it is attached is, to say the least, misleading—particularly so in a book for general readers. Mr. Brown's numerous blunders in citing Hebrew, Phœnician, and Assyrian words, show that he is not acquainted with these languages at first hand; and it was stated that such a knowledge is essential to a writer who treats the subject of Babylonian astronomy from the linguistic side.

THE ROYAL SOCIETY SELECTED CANDIDATES.

THE following are the names and qualifications of the fifteen candidates selected by the Council of the Royal Society, to be recommended for election into the Society this year:—

W. F. BARRETT,

F.R.S.E., M.R.I.A., Professor of Experimental Physics in the Royal College of Science for Ireland, Memb. Physical Society, Royal Dublin Society, and of General Committee of the British Association. Author of numerous original investigations and papers; amongst them are:—"The discovery of certain physical phenomena produced by the contact of a hydrogen flame with various bodies, and its application as a delicate chemical re-agent" (*Phil. Mag.*, November, 1865); "The discovery and investigation of a serious source of error in the determination of the absorption of heat by liquids" (*ibid.*, September, 1868); "The discovery and investigation of sensitive flames" (*ibid.*, March and April, 1867); "The application of sensitive flames as a delicate acoustic re-agent in illustrating the laws of the reflection, refraction, and interference of sound-bearing waves and the detection of inaudible vibrations" (*Proc. Roy. Dubl. Soc.*, January, 1868; *Science Review*, April, 1867; NATURE, May, 1877); "The discovery of recalescence and other molecular changes in iron and steel when raised to a bright heat" (*Phil. Mag.*, December, 1873; Brit. Assoc., 1890); "The investigation of the molecular changes accompanying the magnetisation of iron, nickel, and cobalt, and the discovery of the retraction of nickel, and the elongation of cobalt by magnetisation, with the determination of its amount" (*Phil. Mag.*, December, 1873, and January, 1874; Brit. Assoc., 1873, 1874, and 1882; *The Electrician*, October, 1882; NATURE, October, 1882); "The investigation of the magnetic properties and the determination of the physical constants of various alloys of manganese steel" (Brit. Assoc., 1887 and 1889; *Proc. Roy. Dubl. Soc.*, November and December, 1889, March, 1886, and in *The Electrician*). Also brief papers on the spheroidal state (*Proc. Roy. Dubl. Soc.*, December, 1877); on the magnetic properties of columnar basalt (*ibid.*, December, 1889), and on the magnetic moment of ingots of manganese steel (*ibid.*, December), &c.

CHARLES BOOTH,

Hon. Sc.D. (Camb.), Merchant and Shipowner. As having applied Scientific Methods to Social Investigation, exemplified by:—(1) A Study of Changes in the Occupations of the People in England, Scotland, and Ireland, from 1841 to 1881 (*Journ. of Statistical Soc.*, 1886); (2) A Study of the Condition of the Aged Poor in England and Wales from Official Statistics and Extended Private Enquiry ("The Aged Poor," Macmillan, 1894); (3) A Study of the Condition of the People of London, 1889 to 1899, in twelve volumes, of which nine are already published ("Life and Labour of the People in London," Macmillan).

DAVID BRUCE,

M.B., Surgeon-Major, Army Medical Staff. Has made important investigations relating to the nature and causes of Malta Fever, and discovered the micro-organism which is the cause of that disease, and proved its nature by experiment. Has successfully investigated the endemic disease of horses in Zululand, and proved the agency of the Tsetse Fly in producing it. Author of the following papers: "Discovery of a Micro-organism in Malta Fever" (*Practitioner*); "Sur une Nouvelle Forme de Fiévre rencontrée sur les Bords de la Mediterranée" (*Annales de l'Inst. Pasteur*); "On the Epidemic of Cholera in Malta during 1887" (*Trans. Epidem. Soc.*); "Report (to the Governor of Natal) on the Tsetse Fly Disease or Nagana" (1897); and a previous Report on the same subject; "Ueber die Virulenzsteigerung des Cholera Vibrio" (*Centralblatt f. Bacteriologie, &c.*). Eminent in Pathology and Bacteriology.

HENRY JOHN HORSTMAN FENTON,

M.A. (Camb.). Author of several papers on the action of hypochlorites and hypobromites on urea and other nitrogen compounds. Has made the remarkable discovery that hydrogen peroxide, although inactive alone, in presence of an iron salt, at once oxidises tartaric and other similar acids, carbohydrates, &c., giving rise to very characteristic products—a discovery of special importance in connection with plant metabolism, which he has elaborated with particular skill and thoroughness. His results are described in the following papers:—"Oxidation of Tartaric Acid in Presence of Iron" (*Trans. Chem. Soc.*, 1894); "A New Method of obtaining Dihydroxytartaric Acid, and the use of this Acid as a Re-agent for Sodium" (*ibid.*, 1895); "New Formation of Glycollic Aldehyde" (*ibid.*); "The Constitution of a New Dibasic Acid resulting from the Oxidation of Tartaric Acid" (*ibid.*, 1896); "A New Synthesis in the Sugar Group" (*ibid.*, 1897); "Properties and Relationships of Dihydroxytartaric Acid," I. and II. (*ibid.*, 1898); "The Oxidation of Polyhydric Alcohols in presence of Iron" (*ibid.*, 1899).

JAMES SYKES GAMBLE,

M.A. (Oxon.), F.L.S. Conservator of Forests, School Circle, N.W. Provinces, India, and Director of the Imperial Forest School, Dehra Dun. Fellow of the University of Madras, and *ex-officio* Fellow of the University of Allahabad. Author of a List of Trees, Shrubs, &c., of the Darjeeling District, Bengal (1st edit., 1877; 2nd edit., 1896); a Manual of Indian Timbers, published in 1881; a Monograph of the Bambuseae of British India, 1896. Also many papers on Forestry and on Botanical subjects in the "Indian Forester," which he has long edited.

ALFRED CORT HADDON,

M.A., M.R.I.A., F.Z.S. Professor of Zoology, Royal College of Science, Dublin. Vice-President of the Royal Zoological Society of Ireland. Member of Council of the Royal Dublin Society, Anthropological Institute and Folk-lore Society. Has considerably extended our knowledge of the Marine Fauna of Ireland (*Proc. Roy. Irish Acad.*, 1886–87). Received a grant from the Royal Society and spent eight months (1888–89) in studying the Marine Zoology, Geology and Ethnography of Torres Straits. Has made investigations upon British and Tropical Actiniaria (*Journ. Linn. Soc.*, xxi.; *Proc. Roy. Dubl. Soc.*, 1885–92, *Trans.*, 1889–92). Is the author of a memoir on "The Air-bladder and Weberian Ossicles in Siluroid Fishes" (with Prof. Bridge) (*Phil. Trans.*, 1893); "Report on the Polyplacophora collected by H.M.S. *Challenger* (Part XLIII., 1886); "Notes on the Development of Mollusca" (*Quart. Journ. Micros. Sci.*, 1882); and other papers on Marine Zoology. Has made a map and a geological survey of the Murray Islands, Torres Straits, which, with other geological observations, are published in the *Trans. Roy. Irish Acad.* in a joint memoir with Prof. Sollas and Prof. Cole. Has carried out extensive and detailed anthropological investigations on the mode of life, handicrafts, religion, and languages of the natives of Torres Straits (*Journ. Anthrop. Inst.*, 1891; *Proc. Roy. Irish Acad.*, 1893; *Folk-lore*, 1890; *Internat. Arch. f. Ethnogr.*, 1892–93). Has organized a scheme for the systematic study of Irish Ethnography (the Ethnography of the Aran Islands; Studies in Irish Craniology—Part I. Aran, II. Inishbofin. *Proc. Roy. Irish Acad.*, 1893–94). Has made an elaborate study of the evolution and degeneration and geographical distribution of the Decorative Art of British New Guinea (Cunningham Memoir Roy. Irish Acad.).

HENRY HEAD,

M.D. (Cantab.), M.A., M.R.C.P., M.R.C.S. Author of the following papers:—"Ueber positive und negative Schwankungen des Nerven Stromes" (*Pflüger's Archiv*, 1887); "Regulation of Respiration," Parts I.–II. (*Journ. Physiol.*, vol. x.); "On Disturbances of Sensation, with especial reference to the Pains of Visceral Disease" (Part I., *Brain*, 1893, Part II., *Brain*, 1894).

CONWY LLOYD MORGAN,

F.G.S. Professor of Biology and Geology, University College, Bristol, and Principal of the same College. Correspondent of the Academy of Sciences of Philadelphia and New York. As a geologist, Prof. Lloyd Morgan has done a considerable amount of original work in Pembrokeshire and the Bristol district. His chief claim to scientific distinction, however, rests upon his careful experiments and observations on the habits, instincts, and intelligence of Animals, and his critical study of the true biological significance of the facts and their bearing upon some of the most fundamental problems of Organic Evolution. The three volumes which he has published on these subjects are of very high merit, and, in the opinion of the signers of this certificate, place their author in the first rank as a philosophical biologist. Author of the following memoirs:—(1) "Animal Life and Intelligence," 1890; (2) "An Introduction to Comparative Psychology," 1894; (3) "Habit and Instinct," 1896; and of the following geological papers:—"On the Pebidian Volcanic Series of St. David's" (*Quart. Journ. Geol. Soc.*, vol. xlvi., 1890); "On the S.W. Extension of the Clifton Fault" (*ibid.*, vol. xli., 1885); and twelve geological papers in the *Proc. Bristol Nat. Soc.*, 1884–90, and other local scientific periodicals.

CLEMENT REID,

F.G.S., F.L.S. Geologist in the Geological Survey of England and Wales, and has served on the Staff since 1874. Awarded the Murchison Fund by the Council of the Geological Society in 1886. Has been Secretary and Recorder to the Geological Section of the British Association. Has added largely to our knowledge of the Lower Tertiary formations of the Isle of Wight and Dorset, the Pliocene deposits of Norfolk and the North Downs (including the fauna and flora of the Cromer Forest Bed), and the Glacial Phenomena of Norfolk and Sussex. To aid his researches he has made a special study of recent and fossil seeds (a subject previously much neglected), whereby much light has been thrown on the climatic conditions of later Tertiary times, and on the origin of the British flora. Author of Geological Survey memoirs on "Geology of the Country around Cromer," 1882; "Geology of Holderness," 1885; "Pliocene Deposits of Britain," 1890, and revised Tertiary portion of "Geology of Isle of Wight," 2nd ed., 1889. Also author of many original papers, including "Dust and Soils" (*Geol. Mag.*, 1884); "Norfolk Amber" (*Trans. Norf. Nat. Soc.*, 1884); "Origin of Dry Chalk Valleys" (*Quart. Journ. Geol. Soc.*, 1887); "Geological History of the Recent Flora of Britain" (*Ann. Botany*, 1888); "Pleistocene Deposits of Sussex Coast" (*Quart. Journ. Geol. Soc.*, 1892); "Natural History of Isolated Ponds" (*Trans. Norf. Nat. Soc.*, 1892); "Desert or Steppe Conditions in Britain" (*Nat. Science*, 1893); "Eocene Deposits of Dorset" (*Quart. Journ. Geol. Soc.*, 1896); "Report on Relation of Palæolithic Man to the Glacial Epoch" (Hoxne Excavation) (Brit. Assoc., 1896).

HENRY SELBY HELE SHAW,

LL.D. (St. And.), Engineer. Mem. Inst. C.E., Mem. Inst. M.E., F. R. Met. Soc., Harrison Professor of Engineering, University College, Liverpool. Senior Whitworth Scholar, 1876, and Miller Scholar of the Inst. C.E. Distinguished for his acquaintance with Engineering and Mechanical Science. Inventor of integrating and power transmitting mechanism. Was the first Professor of Engineering at Bristol and afterwards at Liverpool. At Liverpool he organised the School of Engineering and designed and supervised the equipment of the Walker Engineering Laboratories, in which there are now nearly 100 day students under instruction. Author of "Theory of Continuous Calculating Machines" (*Phil. Trans.*, 1884); also of the following communications:—"On Small Motive Power" (Inst. Civil Engineers, 1880); "On the Measurement of Velocity for Engineering Purposes" (*ibid.*, 1882); "On Mechanical Integrators" (*ibid.*, 1885) (awarded the Watt Gold Medal and Telford premium); "Sphere and Roller Mechanism," jointly with Mr. E. Shaw (Brit. Assoc., 1886); "First Report on Graphical Methods in Mechanical Science" (*ibid.*, 1891); "Second Report on the Development of Graphical Methods in Mechanical Science" (*ibid.*, 1892); "Third Report on Graphical Methods" (*ibid.*, 1893); "Experimental Investigation of the Motion of a Thin Film of Viscous Fluid," appendix by Sir G. G. Stokes, F.R.S. (*ibid.*, 1898); "A New Instrument for Drawing Envelopes, and its Application to the Teeth of Wheels, and for other Purposes" (*ibid.*, 1898); "Rolling Contact of Bodies" (Roy. Inst., 1887, Friday evening Discourse); "The Motion of a Perfect Fluid" (*ibid.*, 1899, Friday evening Discourse); "Experiments on the Nature of Surface Resistance in Pipes and on Ships" (Inst. Naval Architects, 1897); "Investigation of the Nature of Surface Resistance of Water, and of Stream Live Motion under Certain Experimental Conditions" (*ibid.*, 1898) (awarded the Gold Medal of the Institution); "Experimental Marine Engine and Alternative-centre Testing Machine in the Walker Engineering Laboratory" (Inst. Mechanical Engineers, 1891); and other papers to the Society of Arts, Physical Society, and Societies in Bristol, Liverpool and elsewhere.

ERNEST HENRY STARLING,

M.D., F.R.C.P., Joint Lecturer on Physiology, Guy's Hospital, Lecturer on Physiology, London School of Medicine for Women. Distinguished as a Physiologist. Author of the following: "Electromotive Phenomena of the Mammalian Heart" (*Proc. Roy. Soc.*, vol. l., and *Internat. Journ. of Anat. and Physiol.*, vol. ix., with W. M. Bayliss); "Innervation of Mammalian Heart" (*Journ. of Physiol.*, vol. xiii., with W. M. Bayliss); "Fate of Peptone in Blood" (*Proc. Physiol. Congress, Liège*, 1892); "Physiology of Lymph Secretion" (*Journ. of Physiol.*, vol. xiv.); "Absorption and Secretion in Serous Cavities" (with A. H. Tubby, *ibid.*, vol. xvi.); "Nervous and Capillary Pressures" (with W. M. Bayliss, *ibid.*, vol. xvi.); "Mechanical Factors in Lymph Production" (*ibid.*, vol. xvi.);

"Action of Lymphagogues" (*ibid.*, vol. xvii.); "Vaso-Constrictors of Portal Vein" (with W. M. Bayliss, *ibid.*, vol. xvii.); "Intraventricular and Aortic Pressure Curves by a New Method" (with W. M. Bayliss, *Internat. Journ. of Anat. and Physiol.*, vol. xi.); "Osmotic Pressures and Physiol. Problems" (*Science Progress*, 1896); "Absorption from Pleural Cavities" (with J. B. Leathes, *Journ. of Physiol.*, vol. xviii.); "Production of Pleural Effusion" (*Journ. of Pathol.*, vol. iv.); "Absorption from Connective Tissue Spaces" (*Journ. of Physiol.*, vol. xix.); "Ligature of Portal Lymphatics and Injection of Peptone" (*ibid.*, vol. xix.); "Absorption of Indigo Carmine from Peritoneal Cavity" (*Proc. Physiol. Soc.*, 1898, Arris and Gale Lectures); "Physiol. of Lymph Formation," 1894; "Causation of Dropsy," 1896; "Pathol. of Heart Disease," 1897. Author of "Elements of Human Physiol.," 3rd edit., 1897; of the following articles in Schäfer's Text-book of Physiology: "Formation and Absorption of Lymph"; "Secretion of Urine"; "Special Muscular Mechanisms of Respiration, Alimentation, Micturition," &c. Editor of Metschnikoff's Lectures on Pathology of Inflammation. Joint Editor of the Collected Works of L. C. Wooldridge.

HENRY WILLIAM LLOYD TANNER,

M.A. (Oxon.), F.R.A.S., A.R.S.M., Professor of Mathematics and Astronomy in the University College of South Wales and Monmouthshire, Member (and sometime Member of Council) of the London Math. Soc. Distinguished as a mathematical investigator, author of several papers on "Differential Equations" (*Proc. Lond. Math. Soc.*, vols. vii., viii., ix., x., xi.; *Quart. Journ. Math.*, vol. xvi.; *Mess. Math.*, vols. v., vi., vii.); "On Determinants of n Dimensions" (*Proc. Lond. Math. Soc.*, vol. x.); "On the Coordinates of a Plane Curve in Space" (*ibid.*, vol. xiii.); "On the Function $(ax + b)(cx + d)$" (*Mess. Math.*, vol. ix.); "On Spherical Trigonometry" (*ibid.*, vol. xiv.); "Sturm's Theorem" (*ibid.*, vol. xviii.); "Solution of $(a, b, \ldots, c) = (a^p, b^p, \ldots, c^p)$" (*ibid.*, vol. xix.); "Arbogast's Rule" (*ibid.*, vol. xx.); "Square Roots of Unity for a Prime Modulus" (*ibid.*, xxi.); "Quinquisection of $x^p - 1$" (*Proc. Lond. Math. Soc.*, vol. xviii.); "Cyclotomic Functions" (*ibid.*, vol. xx.); "Approximate Evolution" (*ibid.*, vol. xxiii.); "Complex Primes formed with Fifth Roots of Unity" (*ibid.*, vol. xxiv.).

RICHARD THRELFALL,

M.A., late Professor of Experimental Physics, University of Sydney, New South Wales. Author of the following papers: "On the Electrical Properties of Pure Sulphur" (in conjunction with Mr. Brearly, *Phil. Trans.*, 1896); "On the Conversion of Energy in Dielectrics" (*Physical Review*, vol. iv.); "On the Behaviour of Oxygen at Low Pressures" (*Phil. Mag.*, 1897); "On the Scattering of Light by Metallic Particles" (*ibid.*, vol. xxxviii.); "On an Approximate Method for Finding the Forces on Magnetic Circuits" (*ibid.*); "On the Electrical Properties of Pure Nitrogen" (*ibid.*, vol. xxxv.); "On the Elastic Properties of Quartz Threads" (*ibid.*, vol. xxx.); "On the Measurement of High Specific Resistances" (*ibid.*, vol. xxviii.); "On the Clark Cell as a Source of Small Constant Currents" (with Mr. Pollock, *ibid.*); "On the Specific Heat of the Vapours of Acetic Acid and Nitrogen Tetroxide" (*ibid.*, vol. xxiii.); "On the Theory of Explosives" (*ibid.*, vol. xxi.); "On the Velocity of Transmission through Sea Water of Disturbances of Large Amplitude caused by Explosives" (*Proc. Roy. Soc.*, vol. xlvi.); "On the Effect produced by the Passage of an Electric Discharge through Nitrogen" (with Prof. J. J. Thomson, *ibid.*, 1886); "Some Experiments on the Production of Ozone" (with Prof. J. J. Thomson, *ibid.*); "Laboratory Arts" (Macmillan and Co., 1898). Introducer of improvements in the Microtome.

ALFRED E. TUTTON,

F.C.S., Associate Royal College of Science. Member Mineral. Soc. Inspector, Science and Art Department. Has made discoveries in crystallography, and has invented instruments for research in this branch of science. Is the author of the following papers: "Connection between Atomic Weight of Contained Metals and the Magnitude of the Angles of Crystals of Isomorphous Series. A Study of the Potassium, Rubidium, and Caesium Salts of the Series $R_2M(SO_4)_2$, $6H_2O$" (*Journ. Chem. Soc.*, 1893, p. 337: and *Zeits. für Kryst.*, vol. xxi., p. 491); "An Instrument for Grinding Section-Plates and Prisms of Crystals of Artificial Preparations Accurately in the Desired Directions" (*Phil. Trans.*, 1894A, p. 887, and *Zeits. für Kryst.*, vol. xxiv., p. 433); "An Instrument for Producing Monochromatic Light of any Desired Wave-Length, and its use in the Investigation of the Optical Properties of Crystals" (*Phil. Trans.* 1894A, p. 913; and *Zeits. für Kryst.*, vol. xxiv., p. 455); "Connection between the Atomic Weight of Contained Metals, and the Crystallographical Characters of Isomorphous Salts. The Volume and Optical Relationships of the Potassium, Rubidium and Caesium Salts of the Series $R_2M(SO_4)_2$, H_2O" (*Journ. Chem. Soc.*, 1896, p. 344; and *Zeits. für Kryst.*, vol. xx ii., p, 113); "Comparison of the Results of the Investigations of the Simple and Double Sulphates, and General Deductions concerning the Influence of Atomic Weight on Crystal Character" (*Journ. Chem. Soc.*, 1896, p. 495; and *Zeits. für Kryst.*, vol. xxvii., p. 252); "Connection between the Crystallographical Characters of Isomorphous Salts and the Atomic Weight of the Metals Contained. A Study of the Normal Selenates of Potassium, Rubidium, Caesium" (*Journ. Chem. Soc.*, 1897, p. 846; and *Zeits. für Kryst.*): and of various papers in the *Journal* of the Chemical Society and other journals. Author of the following Memoirs, in conjunction with Prof. Thorpe: "Phosphorus Tetroxide" (*Journ. Chem. Soc.*, 1886, p. 833); "Phosphorus Oxide, Part I." (*ibid.*, 1890, p. 545); "Phosphorus Oxide, Part II." (*ibid.*, 1891, p. 1019); "Ueber Phosphoroxysulfid" (*Zeits. Anorg. Chem.*, 1892–5).

BERTRAM COGHILL ALLEN WINDLE,

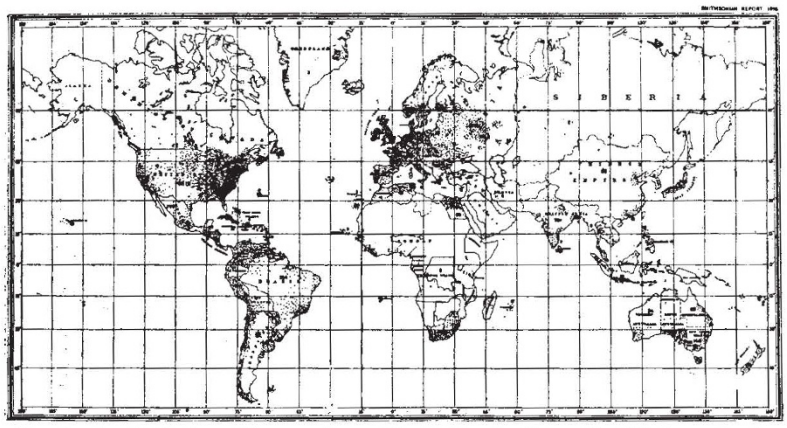
M.D., M.A., D.Sc. (Dublin). Professor of Anatomy, Queen's College, Birmingham. Has devoted himself to the study of Human and Comparative Anatomy and Morphology; and has published the following works and papers on these and kindred subjects:—(1) "On the Embryology of the Short Muscles of the Manus and Pes of the Dog" (*Proc. R. Irish Acad.*, vol. iii.); (2) "The Embryology of the Short Muscles of the Human Hand" (*Trans. R. Irish Acad.*, xxviii.); (3) "On the Pectoral Group of Muscles" (*ibid.*, xxix.); (4) "Teratological Evidence as to the Heredity of Acquired Characters" (*Journ. Linn. Soc.*, xxiii.); (5) "On the Anatomy of *Hydromys chrysogaster*" (*Proc. Zool. Soc.*, 1887); (6) "On some Cranial and Dental Characters of the Domestic Dog" (in conjunction with Mr. Humphrys) (*ibid.*, 1890); (7) "On an Abnormal Arrangement of the Large Intestine" (*Journ. of Anat.*, vol. xx.); (8) "On Primary Sarcoma of the Kidney" (*ibid.*, xix.); (9) "On the Condition of the Brain in a case of Motor Aphasia with Deafness" (*ibid.*, new series, i.); (10) "Man's Lost Incisors" (*ibid.*, i.); (11) "Anomalies of Muscles and Nerves" (*ibid.*); (12) "Two Rare Tumours connected with the teeth" (*ibid.*); (13) "The Myology of *Erethizon epixanthus*" (*ibid.*, ii.); (14) "On the Arteries forming the Circle of Willis" (*ibid.*); (15) "On a Teratoma from the Sphenoid of a Calf" (*ibid.*); (16) "On the Myology of *Procyon cancrivorus*, and others of the Ursidæ" (*ibid.*, iii.); (17) "On the Origin of Double Monstrosities" (*ibid.*); (18) "On the Flexors of the Digits of the Hand" (*ibid.*, iv.); (19) "Ununited Epiphyses" (*ibid.*); (20) "On the Stylo-auricularis Muscle and Ligament" (*ibid.*, v.); (21) "On the Occurrence of an Additional Phalanx in the Human Pollex" (*ibid.*, vi.); (22) "On Identical Malformations in Twins" (*ibid.*); (23) "Sacculation of the Human Stomach" (*Proc. Birmingham Philos. Soc.*, v.); (24) "Myology of *Midas rosalia*" (*ibid.*); (25) "Myology of *Hapale Jacchus*" (*ibid.*); (26) "The Adductor Muscles of the Hand" (*ibid.*); (27) "The Extensors of the Manus in the Ape" (*ibid.*, vi.); (28) "On Congenital Malformation and Heredity" (*ibid.*); (29) "Researches on the Maturation of the Ovum" (*ibid.*); (30) "Certain Malformations in Fishes" (*ibid.*); (31) "Investigations in Artificial Teratogeny" (*ibid.*, vii.); "Extra Cusps on Human Teeth" (*Anat. Anzeiger*, vol. ii.); (33) "Congenital Deficiency of Thumb" (*ibid.*, iii.); (34) "Malformations of the Face" (*ibid.*, iv.); (35) "Musculus sternalis" (*ibid.*); (36) "The Human Skull" (*Birmingham Med. Review*, vol. xviii.); (37) "Hermaphroditism" (*ibid.*, xx.); (38) "Development of Intermaxillary Bone" (*ibid.*, xxv.); (39) "A Manual of Surface-Anatomy" (London, H. K. Lewis, 1888); (40) "The Proportions of the Human Body" (London: Baillière, Tindall, and Cox, 1892).

Supplementary Certificate.—"On the Myology of the Pneucephalous Fœtus" (*Journ. of Anat. and Physiol.*, vol. xxvii.

p. 348); "On Certain Early Malformations of the Embryo" (*ibid.*, p. 436); "On some Conditions related to Double Monstrosity" (*ibid.*, vol. xviii., p. 25); "The Effects of Electricity and Magnetism on Development" (*ibid.*, vol. xxix., p. 346); "On the Myology of *Dolichotis Patagonica* and *Dasyprocta Isthmica*" (*ibid.*, vol. xxxi., p. 343); "On some Points in Comparative Myological Nomenclature" (*ibid.*, vol. xxxi., p. 522); "On the Anatomy of *Macropus Rufus*" (*ibid.*, vol. xxxii., p. 119); "On a Specimen of Bifid Clitoris" (*Proc. Anat. Soc. Gt. Brit.*, 1893, vol. xxii.); "On the Cusps of the Aortic Pulmonary Orifices" (*ibid.*, 1895, vol. iv.); "On the Double Malformations amongst Fishes" (*Proc. Zool. Soc.*, 1895, p. 423); "On the Myology of the Terrestrial Carnivora.—Part I., Muscles of the Head, Neck and Fore-Limb" (*ibid.*, 1897, p. 370); "On the Physical Characters of the Boys at King Edward's Schools, Birmingham, and at certain other Public Schools" (*Proc. Birm. Phil. Soc.*, 1892, 216); "On the Physical Characters of a Group of Birmingham Pupil Teachers" (*ibid.*, 1895, p. 97); "Note on a Roman Pottery near Mancetter" (*Proc. Soc. Antiq.*, vol. xvi., p. 404); "On the Prehistoric Implements of Warwickshire and Worcestershire" (*Birm. Arch. Soc. Proc.*, 1897); "Life in Early Britain: being an Account of the Early Inhabitants of this Island and the Memorials which they have left behind them" (London: D. Nutt, 1897).

WORK OF THE SMITHSONIAN INSTITUTION IN 1897–8.

THE report of Prof. S. P. Langley, Secretary of the Smithsonian Institution, upon the operations of the Institution for the year ending June 30, 1898, reached us a few weeks ago. It refers to the work of the U.S. National Museum, the Bureau of American Ethnology, the International Exchanges, the National Zoological Park, and the Astrophysical Observatory, all of which are under the direction of the Institution.



Map showing distribution of Correspondents of the Smithsonian International Exchange Service.

The promotion of original research has always been one of the principal functions of the Institution. Investigations in the anthropological, biological and geological divisions of science have been extensively carried on through the departments of the National Museum, and in the Bureau of American Ethnology there have also been special inquiries into Indian customs and languages. These lines of research being well represented by its bureaus, it has remained for the Institution proper to devote its energies more especially to some of the physical sciences.

Prof. Langley has carried on researches in the solar spectrum, which, by the active assistance of Mr. C. G. Abbot, have produced important results shortly to be published. He has not wholly discontinued the studies which he has made in regard to aërodromic experiments, and it is perhaps not improper that he should state that these have attracted the attention of other departments so far that during the war with Spain a commission was directed by the Secretaries of War and the Navy to inquire into them with a view of their possible utility in war.

In connection with the Hodgkins fund, several grants have been made for scientific investigations. Mr. A. Lawrence Rotch, of the Blue Hill Meteorological Observatory, Readville, Mass., has received grants for experiments with automatic kites, for determining, by means of self-recording instruments, meteorological data in atmospheric strata inaccessible except by some mechanical method of exploring the atmosphere.

A grant of 500 dollars has been made to Prof. William Hallock, of Columbia University, for an investigation having for its object the complete analysis of a particle of air under the influence of articulate sounds.

A final grant of 250 dollars has been made to Drs. Lummer and Pringsheim, of the Physical Institute of the University of Berlin. The investigation begun by them, in 1893, to determine the ratio of the specific heats, at constant pressure and volume, for air, oxygen, carbon dioxide and hydrogen has now so far progressed that the memoir submitted by Drs. Lummer and Pringsheim, noting the results already attained by them, has been published by the Institution in the Smithsonian "Contributions to Knowledge."

An additional grant has been made to Mr. E. C. C. Baly, of University College, London, to enable him to continue his research upon the decomposition of the atmosphere by electricity and upon the ozonising of mercury.

A grant of 250 dollars has been made to Prof. Arthur G. Webster, of Clark University, Worcester, Mass., for the continuation of a research on the properties of air in connection with the propagation of sound, special effort being directed to the securing of data relating to the influence of the viscosity of air on expiring or vanishing sounds. An instrument devised by Prof. Webster for use in this investigation gives the physical measure of sound, not only when constant, but when rapidly varying. It is expected that this research will furnish results of high practical value in connection with the question of the acoustics of auditoriums, and will contribute information upon points that have not heretofore been satisfactorily investigated.

The operations of the International Exchange Service continue to extend. In 1887 this branch of the Institution sent out 71 tons of documents, and had 2165 correspondents in the United States and 7396 foreign correspondents; during the year covered by the present report it transmitted 151 tons, and had 6915 correspondents at home and 22,543 abroad distributed among 93 countries.

Of the total number—29,458—of correspondents, 12,698 are libraries and 16,760 are individuals. There is no part of the Smithsonian Institution which more efficiently carries out the large purpose of its founder, to diffuse knowledge among men, and it is through this, as much as through any other branch, that its name is known throughout the world.

Appended to the report is a map of the world, a reduction of which accompanies this summary, showing the distribution of the correspondents of the Exchange Service.