

even, in some instances, in native risings. The small area which may be required on any given holdings, and the temporary character of the exclusion, both points which are stressed, are irrelevant. There are other points in which the memorandum of the Colonial Office falls short in facing the difficulties of the situation. These cannot be discussed within the compass of a brief note; but it is evident that further deliberation is a vital necessity.

George Edwards, F.R.S.

An illustrated article by Mr. T. E. James in the first quarterly issue of *Science Progress* for 1933 recalls the work and interests of George Edwards, an eighteenth century naturalist (1694-1773) and Copley medallist in 1750 of the Royal Society. Edwards was made library-keeper of the Royal College of Physicians in 1733, on the recommendation of Sir Hans Sloane, its president, remaining in office at Warwick Lane for thirty-six years. During that period he devoted himself to the portrayal in colour of birds, quadrupeds and fishes (mostly new to science) from actual specimens. The Linnean Society has recently received from Major V. Seymer a set of Edwards's works, containing annotations and memoranda by a contemporary and correspondent of Edwards, namely, Henry Seymer, of Hanford, Dorset. It may be of interest to mention that the Linnean Society already possessed copies of Edwards's works, these having originally belonged to Joseph Grote, a collector of rare books on natural history and botany. At his death in 1805, his brother inherited his property, and ultimately the books, with many fine engravings, passed into the ownership of George Grote, the historian. His widow gave the greater portion of the collections to University College, London. Mrs. Grote reserved, however, the works by Edwards, but in 1877 placed them at the disposal of Sir Joseph D. Hooker, whom she designated as "the worthy and distinguished president of the Royal Society". In the end, Sir Joseph gave the books to the Linnean Society.

Arthur Woolf, 1766-1837

ONE of the most interesting chapters in the history of the steam engine is that relating to the Cornish pumping engine. Early in the eighteenth century, Newcomen engines were installed for pumping at the Cornish mines, and in 1777 these began to be superseded by the low-pressure condensing engines of Boulton and Watt, which required much less coal. While the mines gained greatly by the use of the latter, the all-embracing patent of Boulton and Watt prevented other inventors from putting their ideas into practice. The expiry of this patent in 1800 was a boon to the whole county and through the work especially of Woolf and Trevithick, the pumping engine of the nineteenth century proved as superior to the Boulton and Watt engines as the latter had been superior to the Newcomen engines. Of Trevithick's work a great deal will be said at the forthcoming centenary celebrations, while of Woolf's work a review was given in a paper entitled "A Cornish Engineer, Arthur Woolf, 1766-1837", read

to the Newcomen Society by Mr. Rhys Jenkins on January 18. The first great improvement due to Woolf and Trevithick was the use of steam pressures up to 40 lb. per sq. in., while Woolf was one of the pioneers of the compound engine. Like all their contemporaries, these engineers worked at a time when the caloric theory still held sway, and they were quite ignorant of the true theory of heat. Carnot, however, in his famous essay of 1824, referred to Trevithick and Woolf as being among the veritable creators of the steam engine, and it is as such they will be remembered.

British Science Guild Research and Development Lecture

THE Council of Management of the British Science Guild, at a meeting held on January 19 last, decided to establish an additional lecture to be known as the Research and Development Lecture. The main object of this annual lecture, which will be delivered in London in April or May, is to promote attention to the importance of research—both purely scientific and technical—and the utilisation of its results in the service of mankind. The increase of knowledge thus secured has direct relationship with industrial development, the daily needs of the community, economic principles and social problems, human welfare and progress as well as methods of thought and the trend of civilisation. Each lecturer will be asked to select from his own particular field suitable examples of contacts with any of these factors of progressive thought. In establishing the lecture, the British Science Guild associates it with the name of Sir Richard Gregory and his work as editor of *NATURE* in securing increased recognition for scientific work and scientific workers in national life and in international affairs. The first of these research and development lectures will be given in May by Sir Harold Carpenter on "Metals in Industry".

Papal Observatory in Castel Gandolfo

HIS HOLINESS POPE PIUS XI has shown himself a frequent patron of science. On the occasion of the official opening of the new academic year at the Papal Academy of Science, in the presence of the Pope, Dr. Joh. Stein, S.J., who has succeeded the late Father Hagen as director of the Papal Observatory, announced, as reported in the *Osservatore Romano* of December 19-20, that the Papal Observatory is to be moved from the Vatican to Castel Gandolfo, where it is to be rebuilt on a much larger scale. Castel Gandolfo is an old summer residence of the Popes, which has been returned to them by the Italian Government according to the terms of the Lateran Treaty and is being thoroughly restored. Joined to this historic building, a new observatory with the most modern equipment is to be constructed at the Pope's instructions, with easy access from the State apartments for his convenience during his summer visits to Castel Gandolfo. The contract for the supply of the instruments has been placed with Messrs. Carl Zeiss, Jena. The equipment includes two domes of about 8½ m. diameter, a large double astrograph with a 400 mm. refracting and a 600 mm. reflecting camera, a

co-ordinate measuring apparatus, a spectrograph, several objective prisms, a Blink comparator and an astro-wedge-photometer, as well as a new refractor-mounting for an existing telescope objective. The domes will each be equipped with an observation platform of the latest type, the so-called tilting platform, which is moved by electric motors controlled by switches within easy reach of the observer. On these sliding platforms the observer can easily follow any movement of the telescopes. The instruments and apparatus are to be supplied within two years.

Crystals of the Living Body

THE first Friday evening discourse of the new session was delivered at the Royal Institution on January 20 by Sir William Bragg, who chose as his subject "The Crystals of the Living Body". Growth and purpose require directed arrangement of the protein or other molecules of which the body is made. The protein of a silk fibre is a long chain-like molecule consisting of a sort of backbone in which two carbon atoms and one nitrogen make the regularly recurring links, and this structure is common to the various forms of protein. Of every pair of carbon atoms one has, so to speak, a spare hook to which other atoms or strings of atoms may be attached, like pendants to the links of a mayor's chain. In the case of silk these pendants are very simple, consisting alternately of a hydrogen atom and a group containing one carbon and three hydrogens. The new methods of X-ray analysis enable us to prove the arrangement of these chains, and to measure the dimensions of the links. They show that the chains tend to group themselves into bundles, and they find the forms which the bundles take. This arrangement is obviously appropriate to the functions of the silk fibre, to its flexibility and its tenacity. The fibre is spun, in fact, just as we spin a rope on a far grosser scale, laying the vegetable fibres side by side. Such a parallelism is no surprise, for in all our examinations of organic substances in the laboratory, physical, chemical, or biological we have always found that our best practice is foreshadowed. A particularly interesting comparison can be made with the structure common to hair, wool, horn, feathers and the like. These are built on the same principle as the other proteins, from which they differ only in the nature of the pendants. The latter in this case attract each other strongly, and in drawing together give the chain a wavy or crumpled form: the process has lately been explained by Astbury. The in-curved proteins, with their internal attractions satisfied, are not susceptible to many reagents which bring about the dissolution of proteins of the extended form. Thus hair long outlasts other parts of the body in their decay.

Synthetic Sound Films

ACCORDING to a report in the *Times* of January 11, an interesting curiosity has been on exhibition in Germany in the form of a sound film "Die Tonënde Handschrift" in which the sound part was originally prepared without the use of sound. Details are not

available but from the illustrations it appears that the film uses the contour method of sound recording in which a constant density of blackening is produced over varying widths of the film. Normally this is produced by light reflected on to the moving photographic film from an oscillograph operated by electric vibrations transformed from the original sound vibrations. Herr R. Pfenninger in the new process makes templates each containing several sound waves and photographs a reduced image of these in turn on to the stationary film. Both the preparation of the templates and their photographing naturally take much longer and the object is not to reproduce graphically the tones of well-known musical instruments but to construct music of new timbre. The report states that the laboriousness of preparing the templates is to be reduced by the use of a typewriter which uses wave-outlines instead of letters, a separate sound-wave typewriter being used for each timbre. It would be interesting to know if the characteristic wave-forms of singing or string playing of exceptionally good quality could be successfully copied so as to give reproductions of melodies which had not been actually performed. This might make possible the performance of a new musical work by the voice, or playing, of an artist no longer living.

Migration from and to Great Britain

A PAPER by Mr. H. Leak and Mr. T. Priday on the subject of migration from and to Great Britain was read at a meeting of the Royal Statistical Society on January 17. Factors affecting post-War migration, of which the chief are social insurance, national assistance to emigrants, and the United States quota system, were fully considered and also the main features of post-War migration, particularly in regard to the inter-censal period 1921-31. A comparison of pre-War and post-War migration shows that the annual average of the net outward movement of British subjects from the British Isles to places out of Europe was about 193,000 in the ten years 1904-13 and 112,000 in the years 1921-30. In 1931, however, there was a change from net emigration to net immigration, the excess inward in that year amounting to 37,000, while for 1932 the figure is estimated to be about 50,000. Although, in the future, emigration may be on a considerably smaller scale than in pre-War days, it may still, within the next one or two decades, be on a scale commensurate with the ability of Great Britain to release population of the ages which the Dominions require, regard being had to the diminishing numbers of new entrants into the labour market.

Anomalous Eskimo Vertebrae

SOME suggestive results, which may possibly turn out to have a bearing on the question of the existence of evolutionary tendencies in modern man, emerge from an examination by Dr. T. D. Stewart, of the Smithsonian Institution, Washington, D.C., of skeletal material brought back by one of the Institution's recent expeditions to Alaska. The material consists