which are capable of operating under a variation of head equal to 50 per cent. on each side of the mean, with efficiencies which do not fall below 70 per cent. over this range, and with reasonably high speeds of rotation under the heads available.

Even with such turbines, the number of technical problems to be solved before a tidal scheme of any magnitude can be embarked upon with confidence is large. The questions of single-*versus* double-way operation, of storage, of the effect of sudden changes of water-level due to strong winds, of wave effects, of silting in the tidal basin and of scour on the down-stream side of the sluices, of the best form of turbine and of generator, and of their regulation and of that of the sluice-gates, are probably the most important, though not the only, subjects to consider.

On the other hand, the possibilities of tidal power, if it can be developed commercially, are very great. Assuming a mean tidal range of only 20 ft. at springs, and 10 ft. at neaps, and adopting the single-basin method of development with operation on both rising and falling tides, each square mile of basin area would be capable, without storage, of giving an average daily output of approximately 110,000 horse-power-hours. In such an estuary as the Severn, where an area of 20 square miles could readily be utilised with a spring tidal range of 42 ft., the average daily output, without storage, would be approximately 10,000,000 horse-power-hours.

At the present time it is difficult to obtain an even rough estimate of the total cost of such a scheme, owing to the uncertainty regarding many of the factors involved. The whole question would appear to merit investigation, especially on matters of detail, by a technical committee with funds available for experimental work. As a result of such an investigation, it is at least possible that a definite working scheme could be formulated capable of generating power at a cost at least as small as, and possibly much smaller than, that of power generated from any coal-fired installation.

Obituary.

PROF. C. A. TIMIRIAZEFF, FOR.MEM.R.S.

THE death is announced of Clement Arkadievitch Timiriazeff, emeritus professor of botany in the University of Moscow. Timiriazeff was the only Russian botanist who was at all a familiar figure in England. In earlier days he came to England and saw Charles Darwin, while his last visit was made as a delegate to the Darwin celebration in Cambridge in 1909. His earliest publication appeared in 1863—a Russian book on "Darwin and his Theory," which ran through five editions. Here he made his mark as an attractive expounder of science for the general reader, and he followed this work with books on "The General Problems of Modern Science," "Agriculture and Plant Physiology," and "The Life of the Plant." The last was in great demand, there being seven Russian editions between 1878 and 1908, while in 1912 it was translated into English, and is widely read to the present day. Its characteristic note is an exposition of plant structure and function based on the chemical and physical processes at work in the living plant. Without comparison of the early editions we cannot tell at what date this book took the form in which it appeared in English, but it looks as if Timiriazeff was one of the earliest writers to take up this essentially modern outlook. His attitude was no doubt an expression of his early training under chemists and physicists. Born in 1843, he studied under Bunsen, Kirchhoff, Helmholtz, and Berthelot before working with Boussingault.

Timiriazeff made himself famous by work on one single problem—the participation of the different rays of the visible spectrum in the photosynthetic activity of the green leaf. The technique which he brought to the attack on this problem seems almost an exact expression of the combined influence of his teachers: good methods of gas-analysis, pure spectral illumination, and experimentation on isolated leaves; combined with the sound conception that rays utilised for work in the chloroplast must be rays abundantly absorbed by the pigment chlorophyll. Working with a micro-eudiometer, concentrated sunlight, and a narrow spectroscope slit, he was able to disprove the accepted view that the yellow region, which is so bright to the eye, is the most effective region of the solar spectrum, and to locate the efficiency in the red region where absorption by chlorophyll is greater. Afterwards he demonstrated the secondary maximum of photosynthetic effect in the blue region, where also absorption is great.

This work was published in different forms, at various dates, in scientific journals of most European countries, the final presentation being the Croonian lecture to the Royal Society in 1903. The actual experimental work seems to have been all done between 1868 and 1883. There is no evidence that he published research work on any other subject, so that we have in Timiriazeff the remarkable case of a man who, having achieved fame by one important line of research at forty, was content to devote the remaining half of his life to teaching and exposition.

THE announcement of a new book, "A Nation's Heritage," by HARDWICKE DRUMMOND RAWNSLEY, sadly coincides with the record of its author's death. Born on September 28, 1851, the distinguished canon died on May 28, to the last pursuing the self-imposed task of persuading his fellow-countrymen to take care of their own treasures. His mother was a niece of Sir John Franklin, the Arctic explorer. In education Canon Rawnsley had the good fortune to be at Upping-

ham under Edward Thring, and at Balliol under Benjamin Jowett, with fellow-undergraduates who in various ways became men of light and leading. As a poet and preacher, and in general a quickener of life and energy wherever demands were made upon his active genius, he met with well-deserved appreciation. As the obituary notice in the *Times* observes, "perhaps his chief work was the founding of the National Trust for the Preservation of Places of Historic Interest and Natural Beauty." For the qualifying word "perhaps" it would be better to substitute the word "undoubtedly." Men like Canon Rawnsley, by setting a courageous example, often accomplish much more than their immediate object.

BY the death, at fifty-eight years of age, of DR. GEORGE ERNEST MORRISON, "Morrison of Peking," as he was familiarly known, the Empire has lost a great explorer and expert in the politics of the Far East. An Australian by birth, Dr. Morrison began by explorations in that continent, New Guinea, and the South Sea Islands, his most notable exploit being his famous crossing from the Gulf of Carpentaria to Melbourne in 1882, when he marched 2043 miles on foot in 123 days. Coming to Europe, he took his degree of M.D. at Edinburgh, and wandered in the United States, Spain, and Morocco. Reaching China, he crossed to Rangoon and explored Siam. His life-work really began in 1897, when he was appointed correspondent of the *Times* at Peking. Here he recorded from day to day with the prescience of a statesman and the accuracy of a historian the momentous struggle which resulted from the German occupation of Kiao-chao, and he took an active part in the defence of the Peking Legations during the Boxer rising of 1900. In 1907 Dr. Morrison crossed China from Peking to Tonquin, and in 1910 he rode from Honan City to Andijan in Russian Turkestan. Two years later he resigned his post as correspondent of the *Times*, and became political adviser to the first President of the Chinese Republic. During his stay in Peking he collected one of the most comprehensive libraries of Chinese literature. His contributions to the study of the Far East, except his well-known book, "An Australian in China," largely consist of newspaper articles.

WE much regret to announce the death, on May 28, in his forty-third year, of PROF. LEONARD DONCASTER, F.R.S., fellow of King's College, Cambridge, and Derby professor of zoology in the University of Liverpool.

WE notice with regret the announcement in the *Times* of the death in India, at the early age of thirty-two years, of PROF. SRINIVASA RAMANUJAN, F.R.S., fellow of Trinity College, Cambridge, and distinguished by his brilliant mathematical researches.

Notes.

THE Romanes lecture at Oxford was delivered on May 27 by Dr. Inge, Dean of St. Paul's, before a large audience, by whom the lecturer's brilliant epigrams and trenchant criticism of conventional catchwords were evidently much appreciated. Dealing with the "idea of progress," the Dean made it clear that he had no belief in any natural law of continued progress in the sphere of morals or intellect, or even of physical organisation. The conception of such a law was, in fact, of comparatively recent growth, and had no foundation in the thought of antiquity or of the Middle Ages. At the same time he would not deny a temporary improvement of the race in fulfilment of a finite purpose, though he found little or no evidence of any advance during the historical period in either physical organisation or morals. The results of accumulated experience must not be confounded with a real progress in human nature. Dean Inge would scarcely be concerned to deny that the emergence of rational humanity from previous non-human conditions deserved in some sort the name of "progress," but he saw no warrant for the belief that such "progress" would be continued indefinitely under the domain of natural law. Huxley had pointed out in a previous Romanes lecture that ethical improvement ran counter to the process of cosmic evolution. Progress was a task for humanity, not a law of Nature. Civilisation was a disease that had hitherto been invariably fatal. The ancient civilisations had fallen by the attacks of outer barbarians; "we breed our own barbarians." But progress was possible for the individual, if not for the race, and hope was not only a virtue, but also a solid fact.

ON May 17 Mr. H. Morris, of Lewes, read a paper to the Oxford University Archæological Society on the evolution of Wealden flint culture from pre-Palæolithic times, including that of Piltdown Man. He exhibited many flints, which he claimed as intermediate between the early Harrison types of the North Downs plateau and the recognised Palæolithic types, representing man's transition from the stage in which he subsisted on a vegetable diet to the hunting stage. The earliest spear-head accompanies the Piltdown skull and marks the beginning of man the hunter. The flints are confined to a limited number of patches, and many prolific "river gravel" areas fail to produce anything resembling them; the proportions in which the various types appear are found to agree closely in all the patches. When the cortex of the flint did not interfere with the design of the implement, it has been cleverly and intentionally preserved; many of the fractures are of thermal origin, but man utilised these natural fracture-surfaces in the same way as he utilised cortex. It is significant that signs of man's work appear only in the places where it is essential for the attainment of the required form. Sir Arthur Evans, Prof. Sollas, Dr. Marett, Mr. Henry Balfour, Mr. Reid Moir, and others discussed Mr. Morris's paper, and hesitated to accept his conclusions.