to this cause is calculated and shown to depend on the masses and separation of the components and on the local stellar density. In the neighbourhood of the sun, the time τ of disruption of a typical binary of semi-major axis a astronomical units is shown to be

$$\tau = 2.2 \times 10^{15} a^{-3/2} \text{ years,}$$

τ being the time needed to produce enough relative acceleration to make the kinetic energy of relative motion exceed the gravitational binding energy between the components. For separations in the range $10^3 - 10^4$ astronomical units, this formula gives times varying from 7×10^{10} to 2×10^9 years. But observation shows that in this range statistical equilibrium has not yet been reached in the separations. That is to say, sufficient time has not yet elapsed for the fluctuating gravitational field even to modify appreciably the semi-major axes, much less to dissociate the systems. Here again, then, the time-scale indicated is of the order of a few thousand million years.

These investigations on the stability of star clusters and of binary stars reinforce the many other lines of evidence which point to a 'short' time-scale of $10^9 - 10^{10}$ years for the universe. The 'long' time-scale of $10^{12} - 10^{13}$ years suggested, for example, by considerations of equipartition of translational energy among the stars, and by study of the evolution of moving clusters, finds less and less support among astronomers. Many of the arguments which seemed to demand it depend on mechanisms which, though they operate in one way now, may have operated quite differently in the early history of the universe. Gravitational interactions, for example, were possibly of a different order of magnitude then from what they are at present. The long time-scale is, indeed, appropriate if, as was thought likely some years ago, the energy-producing mechanism in stars is simple annihilation of matter; but the current theory identifying it with the synthesis of helium from hydrogen favours the short time-scale, and is the only one which has been made even remotely consistent with the facts at present known. Furthermore, direct measurements of the uranium/helium and uranium/lead ratios in pre-Cambrian rocks, and of the helium, uranium and thorium contents of iron meteorites, give ages ranging from 2 to 7×10^9 years. Again, if we accept the red-shift in the spectra of the extragalactic nebulae as a velocity effect and extrapolate backwards using their present velocities, we find that they must have taken about 1.8×10^9 years to reach their present positions.

This is no doubt a somewhat naïve approach to the subject, but in a very recent paper on the recession constant of the galaxies, Eddington concludes¹ that "the time-scale for the evolution of the universe is definitely less than 90×10^9 years, and I do not see much prospect of evading this limit". But all these lines of argument are not so conclusive that we can dismiss other methods of attack, and these recent researches of Chandrasekhar provide a valuable check on the currently accepted theory that the time-scale appropriate to the universe is the short one of $10^9 - 10^{10}$ years.

A. HUNTER.

¹ *Ann. New York Acad. Sci.*, **45**, 131 (1943).

² *Astrophys. J.*, **97**, 255 (1943).

³ *Astrophys. J.*, **98**, 54 (1943).

⁴ *Science*, **99**, 133 (1944).

⁵ *Nature*, **137**, 537 (1936).

⁶ *Astrophys. J.*, **99**, 54 (1944).

⁷ *Nature*, **149**, 235 (1942).

⁸ *Observatory*, **65**, 211 (1944).

OBITUARIES

Sir Henry Lyons, F.R.S.

SIR HENRY LYONS was born in 1864: he was educated at Wellington and Woolwich and passed into the Royal Engineers in 1884; in 1896 he was appointed director-general of the Geological Survey, Egypt, and four years later director of the Survey Department of that country; during the War of 1914-18 he was commandant of the Meteorological Section R.E., and during 1916-18 he administered the London Meteorological Office; from 1919 until 1933 he was at first secretary and then keeper of the Science Museum, South Kensington. What a strange series of occupations: the army, geology, surveying, meteorology and museum management; yet it contains the key to his great and undoubted success, for it will be noticed that from the age of thirty-two years he was in charge of important Government departments. Lyons was first and foremost an organizer and administrator; he loved administration for its own sake, especially the administration of scientific organizations, but he was always ready to undertake administration of any kind so long as it involved reorganization and development.

Going to Egypt in 1896 as director-general of the small Geological Survey, he soon saw the need for a much more extensive survey, as little was then known with accuracy of the topography of the vast valley of the Nile and of the regime of the great river which flows through it. The Survey of Egypt was created, and Lyons organized it and directed it for eleven fruitful years. The valley was surveyed and the flow of the river scientifically measured; at the same time archaeological remains, especially those to be submerged by the enlarged Aswan Dam, were studied and recorded. In 1906 Lyons published his book "The Physiography of the River Nile and its Basin", which reviewed all that was then known of the geology, climate and hydrology of the whole basin of the Nile. It is the most important scientific work on the Nile which has been produced up to the present time; it contains matter of the utmost importance for science and for the economy and government of Egypt. This work with other smaller publications earned for Lyons his position as one of the outstanding geophysicists and geographers of the British Empire. In 1909 Lyons returned home and lectured for a time on geography at Glasgow.

When war broke out in 1914, our army authorities had never even considered what meteorological help the army would need. The use of the aeroplane and the greater precision required by the artillery soon made it necessary to have a meteorological service at the front, and in 1916 it was decided to form a Meteorological Section of the Royal Engineers; and Lyons was put in charge as commandant. With Lyons' organizing ability in London and Ernest Gold's technical knowledge and immense drive in France, the new service was soon in full operation. By the end of the War the Meteorological Section R.E. had achieved a success which is not sufficiently known and appreciated. The experience and organization of the service built up in 1916 have been the foundations of the vastly increased meteorological service for the forces which is playing such a responsible part in the present War.

In 1916 Sir Napier Shaw, director of the Meteorological Office, found himself completely occupied with the preparation of meteorological information

required for the prosecution of the War; to relieve him Lyons took over the administration of the Office. He carried out the work with his usual ability for more than two years; but his period of service was too short and the conditions too abnormal for him to have left any permanent impression on the organization of the Office.

In 1920, after having served for a year as secretary, Lyons was appointed keeper of the Science Museum. Only those who knew the Science Museum in 1920 and were familiar with it just before the present War broke out can appreciate the great work carried out by Sir Henry Lyons at the Museum. In 1920 the Science Museum was a good museum, one of the best—if not the very best—of its kind in the world; but it was only a museum, governed by all the traditions of museum keeping and museum visiting. Lyons had no use for traditions; in fact the chief element in his success as an administrator was his willingness to break with traditions. Lyons wanted the museum to educate, and he knew that to do that the visitors must be interested. So every exhibit which could work was made to work, and if it could not work a working model was constructed in many cases. Life-size reproductions of famous workshops and laboratories were erected and demonstrations of modern scientific developments, such as radio and television, were arranged. Perhaps one of his most successful innovations was the series of demonstrations, accompanied by lectures and discussions, of new technical processes, such as the properties and manufacture of plastics. Instead of considering children a nuisance in a museum, he welcomed them and arranged one of the galleries especially for them. These are but a few examples of the changes made, but they illustrate the breath of life which Lyons breathed into the Museum. The Science Museum, while remaining one of London's greatest holiday attractions, has become one of its greatest educational institutions.

Lyons retired from the Science Museum in 1933 and was then free to devote himself to the voluntary work which had occupied so much of his time even while holding official posts. Varied as had been his official work, equally varied was the services he gave voluntarily to science and other interests. These probably occupied as much of his time, after returning to England in 1906, as his paid posts. It is quite impossible even to mention them all here, so I will confine myself to a few of which I had personal knowledge.

I first corresponded with Captain Lyons, as he then was, in 1913 or 1914, when I was engaged in India on writing up the meteorological results of Scott's Antarctic Expedition, 1910–12. As secretary to the committee appointed to publish the scientific results of the Expedition, Lyons was responsible for organizing the staff engaged on the work, and he supervised the printing and publication of the resulting books and monographs. It was a big undertaking and all of us engaged in the task were grateful to him for his helpful interest in our work. The imposing array of volumes containing the scientific records of the Expedition is a lasting monument to his disinterested zeal for science.

When I became director of the Meteorological Office in 1920, Lyons was one of the two representatives of the Royal Society on the Meteorological Office Committee, of which he was a member for twenty-three years (1918–41). The senior representative of the Royal Society is always the vice-chairman

of the Committee (the Under-Secretary of State for Air being the permanent chairman) and generally presided at the meetings. Sir Henry became vice-chairman on the retirement of Sir Arthur Schuster in 1932. At the meetings and between meetings Lyons was always helpful; his short term as administrator of the Office had given him an insight into the difficulties with which the director has to contend, and his advice was always good and willingly given.

Sir Henry also succeeded Sir Arthur Schuster in 1928 in a much more important voluntary office, namely, the secretaryship of the International Council of Scientific Unions. It was a great piece of good fortune for international science that these two able Englishmen should have directed the work of the Council for the first eighteen years of its existence (1919–37). Lyons' great administrative ability, perfect command of the French language and unfailing good temper were valuable assets in guiding the Union through the difficult time between the two world wars, when international relationships were not easy.

The great work which Sir Henry has done for the Royal Society, as foreign secretary and treasurer, has been recorded by the president of the Royal Society (*The Times*, August 12). He was not just a good treasurer, he pulled to pieces and built anew the whole financial side of the Society's business. In this work his bent for science, his pride in the Society and his love of administration all found scope, and the result is worthy of a great Society and of a great administrator.

I cannot detail the work Lyons did for the Geological, Royal Geographical and Royal Meteorological Societies—he was a fellow of the first, a secretary of the second and president of the third; it is sufficient to say that he left his mark on all three. Needless to say he received many honours, including the Grand Cordon Medjidieh, 2nd class Osmanieh, Hon. D.Sc. Oxon., Hon. D.Sc. Dublin, F.R.S., knighthood (1926) and several medals awarded by scientific societies.

It was not, however, his great ability which endeared Lyons to those who came in contact with him; it was his utter absence of affectation, his friendly greetings and pleasant smile. Everyone who knew Lyons even slightly feels a loss in his death on August 10, and those of us who knew him well realize that we have lost a friend who cannot be replaced.

Sir Henry Lyons was the son of General T. C. Lyons, C.B., and married Helen Julia, eldest daughter of the late Mr. P. C. Hardwick in 1896. Lady Lyons was often with Sir Henry on his visits to international meetings and at official ceremonies, and was equally successful as hostess or guest. Our sympathy goes out to her and to their son and daughter in their great bereavement.

G. C. SIMPSON.

WE regret to announce the following deaths:

Dr. Agnes Bluhm, an authority on social hygiene and heredity, of the Kaiser Wilhelm Institute for Biology, Berlin-Dahlem, aged eighty-one.

Mr. A. Deane-Butcher, C.B.E., formerly director-general of irrigation, Sudan and Southern Nile, on August 21, aged sixty.

Dr. Ethel Miles Thomas, formerly head of the Department of Botany in University College, Leicester, on August 29.

Sir Arthur Smith Woodward, F.R.S., keeper of geology in the British Museum (Natural History) during 1901–24, on September 2, aged eighty.