Apart from arbitrary choice, there seems to be complete equivalence between mechanical and thermal processes. Both show a one-way tendency in (*a*)—moving bodies tend to stop and hot bodies tend to cool. We do not need a special entropy clock to show which of two instants is the later; a grandfather clock will do—the later instant corresponds to the lower position of the weight. In favourable circumstances (for example, the rotation of the earth), 'uniform' motion may be eternal, and in favourable circumstances (for example, the radiation of the sun) 'uniform' radiation may be eternal. There is no evidence that the sun's temperature is falling, apart from the laws of mechanics, which presuppose fall and are therefore inapplicable: on the contrary, there is much difficulty in accounting for the fact that the sun radiates *without* observable fall of temperature. We are no more compelled to say that an isolated body would move uniformly than that it would radiate uniformly: in each case we can observe only bodies that are not isolated, and we find, first, that neither motion nor radiation is uniform, and secondly, that the nearer we approach isolation the nearer we approach a *common* uniformity of both motion and radiation.

Space prevents discussion of the possibility of re-expressing thermodynamics in terms of a thermal time measure, but there seems to be a reasonable prospect that choice of the proper thermal quantity for the purpose, and application of relativity methods of relating time with this quantity, would introduce the quantum of action, h, in a manner analogous to the introduction of the velocity of light, c, into spatial relativity. The relation of one constant to thermal processes at least partly resembles that of the other to mechanical processes. If this possibility were realized, the way would be open for a completely unified field theory. This, of course, is at present a speculation, but the three-fold arbitrariness of time measurement and the deductions drawn therefrom rest on logic and historical fact.

Obituary Notices

Prof. Max C. W. Weber, For. Mem. R.S.

DR. MAX WEBER, for many years professor of zoology in Amsterdam, doyen of late of the whole brotherhood of zoologists, died at Eerbeck on February 7, in his eighty-fifth year. He was born at Bonn on December 6, 1852, of a Dutch mother and a German father, and learned his natural history from Franz Leydig in Bonn and from Eduard von Martens in Berlin. Leydig was an excellent anatomist, who gave Weber his lifelong bent towards mammalian anatomy; von Martens, a famous conchologist, who had travelled and collected in the East, was a man of fine taste and liberal education. In 1879, Weber went to Holland, where he taught anatomy, first in Amsterdam then in Utrecht, and presently went back to Amsterdam as professor of zoology. In 1883 he took out papers of naturalization, and married Mlle. Anna van Bosse, a young botanist of his own age, who proved herself the perfect wife and helpmeet.

Weber had already made a voyage to Barents Sea, in a little schooner 75 ft. long, the *Willem Barents*, named after Willem Barents who had discovered Spitsbergen at the end of the sixteenth century and so opened the way to that rich whale-fishery in which the Dutch had a paramount share for the next hundred years. The *Challenger* had not long come home, and Weber, like many another young naturalist, was all agog to go fishing in unexplored seas with dredge and trawl. For a few years after their marriage the Webers went every summer to Tromsö, he mostly to dissect whales, and she to study corallines or calcareous algæ, on which she was even then becoming the chief authority. In 1888 they went to the Dutch East Indies, where they made large and varied collections and where Max Weber took up in earnest the study of geographical distribution. He belonged to an age, and he was of late its most conspicuous survivor, when a man could take all natural history for his province, and could make discoveries in many diverse fields. In the *Ergebnisse* of this Dutch East Indian Expedition, in which many colleagues including his old master von Martens came to help him, Max Weber himself wrote on the freshwater sponges, on that queer trematode worm *Temnocephalus*, which is a parasite (and yet scarcely a parasite) on a river-crab, on the anatomy of certain Siluroid fishes, on local species of reptiles and of mammals, on the scaly coat of the pangolin and its associated hairs—which led him to think that all mammals were once scaly, and that in many the arrangement of the hairs recalled the ancestral pattern of the scales—and lastly, together with his wife, on the green and yellow algæ symbiotic (to use a word lately coined by De Bary) in *Spongilla*.

The Webers' next journey was to South Africa—it was always to some homeland of the Dutch—again to study the freshwater fauna, and in Max Weber's case to study the anatomy of *Chrysochloris* and certain other South African mammals: the results

of this expedition were published in the *Zoologische Jahrbücher*. Then, in 1899, Weber, resigning his professorship and becoming professor extraordinarius, embarked (of course with his wife) on their famous Siboga expedition to the Dutch East Indies. The *Siboga* was twice as big as the *Willem Barents*, but was still a very little ship; she was of some 800 tons burthen, and carried a crew of fifteen all told. But the scientific work she did and the collections she brought home were out of all proportion to her size and the modest cost of the expedition. The splendid series of Siboga reports have been coming out under Max Weber's editorship for all these years, and are scarcely finished yet: they carry on the work that Rumphius had begun two hundred years before and that had been in abeyance ever since; and they give the *Siboga* an honourable place among the reports of the great historic voyages of exploration.

The Dutch East Indies are classic ground for the study of geographical distribution, and Max Weber had it from the first in mind to re-study Wallace's line, or whatever better boundary there might turn out to be between the Indian and the Australian regions. He was soon out of conceit with Wallace's line, which runs in the channel, not a deep one, between Bali and Lombok—"diese unglückliche Linie von Wallace", as he called it; rather does the Indian fauna begin to be impoverished in Bali, and to dwindle out in Lombok and Timor. Celebes is the great puzzle, not only as to the boundary-question but also for other questions of its own. It is an old story, but a truly amazing one, that the rich fresh-water fish fauna of Sumatra, Borneo and Java, each of them with a hundred and fifty species less or more, practically disappears in Flores and Timor and Celebes: there is nothing left but one or two immigrants from the sea like *Symbranchus*, and one or two widespread fishes, tenacious of life, like *Anabas* and *Ophiocephalus*. Great families, Silurids, Cyprinids, Mastacembalids, simply disappear as we pass from Borneo to Celebes. As to what is often called the mixed fauna of Celebes, Max Weber was, I think, the first to lay stress on the great difference between the north and south halves of the island. Each half has its own population of squirrels; *Babirusa* and *Paradoxurus* and certain monkeys are confined to the north; and of sixty-four species of land-snails, only two are common to the two halves of the island. It was Max Weber who pointed out that, while Celebes occupies a deep-water area and Borneo, Java and Sumatra a shallow-water or continental one, the deep water around Celebes has a temperature of above 3°, instead of the usual 1° of oceanic bottom-temperature; there must therefore be some unknown barrier to separate the deep waters of the archipelago from the main ocean.

Conspicuous among the many Siboga reports are Max Weber's own on the fishes, marine and fresh-water, and his wife's on the coralline algæ, or so-called nullipores. Mme. Weber van Bosse found these latter in vast abundance, though of few species; Stanley Gardiner had already shown their important share in the building of coral-reefs, and geologists knew their vast importance as rock-builders, even (or so we are now told) in pre-Cambrian antiquity! As to the fishes, Bleeker, who had studied them for twenty years, had made known many hundreds of species from the rich tropical East Indian fauna; but among a thousand species in all, Max Weber found a hundred and thirty-one that were new to science, and two hundred and forty more that were new to the area in question. In Bleeker's time the deep-sea fishes were all unknown, there and elsewhere, for the *Challenger* and the *Valdivia* had not begun to discover them. Max Weber dedicated his great work on the Siboga fishes to his wife—"die mir im hohen Norden, in Süd-Afrika, im indo-australischen Archipelago, und auch während der Siboga Expedition eine immer freudige und hülfreiche Reisegefährtin war". In his later years, with the help of his pupil and successor Prof. L. de Beaufort, Max Weber undertook the task of setting in order the whole Indo-Australian fish-fauna, of some three thousand species in all. Of this great and laborious work seven volumes have appeared, and the old scholar was busy with the proof-sheets until within a few weeks of the end.

In the midst of all these great undertakings Max Weber had found time to write what is in some ways the greatest of them all, his text-book of the Mammalia. We have seen how comparative anatomy was his first love; he worked for years in Amsterdam in an old and rich museum, and next door to a fine zoological garden, which gave him continual work to do. His book "Die Säugetiere", did for mammalian anatomy what Owen had done when Weber was a boy; it was first published in 1904, and a much enlarged edition appeared in 1927–28, to which Otto Abel contributed the palæontological part and Prof. de Berlet (now of Groningen) certain anatomical chapters. From the days when he first learned his anatomy from Leydig, Max Weber never ceased to work at that inexhaustible and delightful theme; and among all his other abundant work, "Die Säugetiere" stands out a monument to his industry and his learning.

Max Weber was a childless man, but he had all else that should accompany old age. He was rich in honours. He had the order of Orange Nassau, the knightly order of the Lion of the Netherlands, and several foreign decorations. He was a foreign member of many academies, including our own Royal Society.

Weber was a great figure of a man. He had both charm and dignity, and he enjoyed for many years such general admiration and esteem as are only given to the very best of men. Fifteen years ago, when he reached his seventieth birthday, a letter was sent him by a number of English zoologists. They spoke with unaccustomed warmth, saying in conclusion: "Your solid learning has upheld the great scientific traditions of your country, your investigations have influenced and stimulated many of us, your broad interests, your singleness of purpose, the simplicity of your life and your genius for friendship have set an example for us all" (NATURE, **110**, 780, Dec. 9, 1922).

D'ARCY W. THOMPSON.