evaluate the role of weather and climate in malaria. Any effort in the field of medical geography is highly desirable, and should be encouraged; but we feel that in order to contribute effectively to a scientific understanding, medical geography will have to study the phenomena in all their complexity and keep clear from premature and oversimplified conclusions.

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Supplementary statistical data which I received, after publication of my article, by courtesy of the president of the Hebrew University of Jerusalem, and which are at present not available to me in Mexico, show rather well the relationship between rainfall maxima and peaks of malaria mortality. Even if the data given for previous malaria incidence in Palestine are inadequate, it is nevertheless suggestive to see the epidemics of (if I remember correctly) 1935 and 1939–40 occurring in years of greater rainfall. As for the irregularity of the rainfall cycles, seemingly apparent for certain stations, it must be remembered that such discrepancies may well be due to local microclimatic factors arising out of peculiar topographic location. However, this cannot distract from the general impression of periodicity. As for the cyclic control of these epidemics, it would seem that late spring rains in between the major rainfall peaks possibly introduce another climatic element which deserves further study in relation to malaria epidemics. While it is apparent that present data are suggestive rather than conclusive, I would personally only welcome a fuller investigation of this important problem of medical geography, not only through closer cooperation with medical specialists but through an effective and intensive field study in the Near East. Only thus will it be possible to eliminate the inadequacies disclosed by this discussion.

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Virus Encephalomyelitis in Buffaloes

In the western part of the Szechuan province, China, there is a disease among water buffaloes known as "Szegiao-han" (meaning "four-legs-cold") to the farmers. It occurs more in wintertime than in the hot seasons, and young and old buffaloes seem to be equally affected. Its occurrence in other provinces is also suspected, though not proved. A report of the disease in the scientific literature has not appeared before.

Onset of the disease is usually abrupt. The first symptom is a paralysis of the hind legs and inability to stand. The paralysis quickly extends to the fore legs and may be of either a spastic or flaccid type. Animals apparently well the day before may be found lying ill in the stable the next morning with all four legs rigidly extended. The body temperature is usually subnormal from the beginning of the illness. As death approaches, it often drops to below 35° C. Only occasionally is a middle-grade fever observed. The surface temperature of the legs feels colder than normal and thus the name. Sensation of the skin is dulled, especially over the paralyzed parts. In severe cases there is complete anesthesia of the whole body surface except over the head. Appetite and rumination are decreased and later entirely lost. Other rarer symptoms are retention or incontinence of urine, colic pains, bloody discharge from the anus, tremors of the muscles, and rigidity of the neck. The respiratory and circulatory systems are comparatively less affected. Consciousness is retained and excitement absent. The course of the disease is usually short, most animals dying within one to two days. The mortality rate is very high (probably over 95 per cent).

On post-mortem examination, the central nervous system is usually found to be highly congested. There may be hemorrhages under the meninges and petechiae in the spinal cord. The cut surface of the brain, however, looks apparently normal. Occasionally there is a gelatinous infiltration in the epidural space of the vertebral canal. Besides these changes in the nervous system there are always signs of septicemia of the whole body. Hemorrhages may be found in different organs. Constant and especially marked are hemorrhagic gastroenteritis, cystitis, tracheitis, and endocarditis, and occasionally effusions in the serous cavities. The parenchymatous organs show signs of albuminoid degeneration. Cultures taken from the blood and central nervous system are invariably negative.

Histological examination of the central nervous system reveals congestion and capillary hemorrhages in addition to the petechiae already visible to the naked eye. The nerve cells of the brain and spinal cord are mostly degenerated. The cytoplasm may be either swollen or, more often, shrunken so that the cells become irregular in contour. The nucleoli are masked by the deep staining of the pyknotic nuclei. In some cells there is complete dissolution of the nucleus and tigrolysis of the Nissl substance. The degenerated nerve cells are soon invaded by glial cells. This phenomenon of neuronophagia is especially marked in the pyramidal cells of the cerebral cortex and hippocampus, but less so in the Purkinje cells of the cerebellum and ganglion cells of the spinal cord. Perivascular spaces of the blood vessels of the brain are often dilated owing to an accumulation of edematous fluid. Adventitial proliferation is frequently seen, but perivascular infiltration is rarely encountered. There may be a mild degree of gliosis in the brain substance. Occasionally a small artery under the pia mater is thrombosed. Otherwise, the meninges are essentially negative. Inclusion bodies, whether intracytoplasmic or intranuclear, are not found.

In view of the facts stated above, the author believed this disease to be an encephalomyelitis caused by a filtrable virus. Experiments were soon planned and conducted to test its transmissibility to other animals. Brains and spinal cords of two buffaloes which had died of the disease were ground up in sterile normal saline and filtered through Seitz E. K. filters. The bacteria-free, clear filtrates were injected into goats, guinea pigs,

rabbits, pigeons, mice, a buffalo, and a sheep. Although the results in the sheep, mice, and pigeons were not sufficiently consistent to warrant a conclusion, the disease was found to be definitely transmissible to the rest of the experimental animals. A similar encephalomyelitis could be produced in the buffalo and goats by intravenous inoculation and in guinea pigs and rabbits by intracranial inoculation. Serial passage, however, was possible only for three generations in the guinea pig and two generations in the rabbit and goat. In the case of the buffalo, extensive experimentation was prohibited by its high cost, but judging from the typical symptoms and severe lesions produced in the only buffalo used, serial passage in this animal seemed to be easier than in any other host.

The incubation period among the experimental animals varied from 1 to 58 days and was shortest in the goat. The experimental disease in the buffalo resembled in every respect the natural infection. It developed suddenly on the twelfth day after injection, with subnormal temperature, paralysis of the legs, rigidity of the neck, and anesthesia of the body surface. The animal died about 14 hours after the onset of the symptoms. In the other animals, the course of the disease was even shorter, most of them dying within several hours. Invariably included among the symptoms were a lowering of the body temperature and a paralysis of the extremities. Upon histological examination, encephalomyelitic changes were always present. Cultures of the blood and central nervous system have never yielded any bacterial growth.

Attempts to cultivate the virus were not successful. Chick embryos of 8–10 days were inoculated on the allantoic membrane according to the method of Burnet. The birds seemed to be little affected by the virus and were hatched just as usual. Whether the titer of the virus had increased in the embryos was, however, not determined.

The disease seemed to be nontransmissible to human beings. In areas where the disease is prevalent, no human case has ever been reported. In our experimental work, the author and his assistants have never worn any rubber gloves or observed any other precautions, and yet none of us has ever contracted the disease.

Judging from its seasonal incidence, symptomatology, pathology, and infectivity to other animals, the author believes the disease to be a separate entity and different from all other known forms of encephalomyelitis. Further experimentation on the disease is still in progress, and a detailed report is in preparation.

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Book Reviews

Principles of physics III: optics. Francis Weston Sears. Cambridge, Mass.: Addison-Wesley Press, 1945. Pp. viii + 331. (Illustrated.)

The first course in physics at the Massachusetts Institute of Technology requires two years and is taken concurrently with analytical geometry and calculus. The result is that the present volume and the two earlier companion volumes of Sears' *Principles of physics* series, which serve as texts for this course, are far above the usual one-year elementary text in scope, rigor, and detail. Indeed, this book promises to be a competitor to the usual intermediate texts in optics, and will probably be considered in this connection by schools whose physics majors have not had the benefit of a first course as thorough as that at M.I.T.

It has much to recommend it. The unconscious technical slang and conventions of the usual textbook presentation are here carefully translated into operational meaning. Well-chosen plates (on color and on diffraction), and three-dimensional line drawings which have a rare feeling for space and projection, aid in setting a new standard in clarity of explanation. An attempt is made to justify qualitatively the few equations which cannot be derived by first-year calculus.

Much care was evidently spent in bringing the book up to date. The results are especially noteworthy in the chapters on Photometry and Color, which are better even than those of any current *intermediate* text, by virtue of the recent discussion and clarification in these areas. These two chapters on psychophysical units perhaps belong where they are, at the end of the book; but one may hope that optics, even in elementary courses, will some day be swallowed up by radiometrics, in which the quantities will all be measured in *physical* units, which can be then be discussed at the place where they belong in an exact science—that is, at the beginning of the course.

Some minor objections may be noted. Rigorous physicists will find fault with several equations which are dimensionally sloppy. Spectroscopists should protest against new texts which continue the emphasis on wave lengths rather than frequency or energy, but, of course, the author cannot be blamed for following the custom. Students will find difficult, as always, the unfamiliar thermodynamic point of view in the chapter on Thermal Radiation, as well as the unnecessary proliferation of units and symbols in Photometry and Color.

There are only a few mistakes. Several of them occur in the chapter on Polarization which, though good, seems less carefully written than the others. In particular, reflection and refraction are confused in discussing mirages and "looming." Fermat's principle of "extreme time" is restricted to "least time," thus making impossible the seeing of inverted images in a concave mirror! The false statement is made that the wave fronts in a biaxial crystal are ellipsoids.