rains negative electricity was slightly in excess. The charge per c.c. tended to be larger the lighter the rain, but the fall in two minutes was so small in light rains that it seems by no means improbable that with a more sensitive apparatus there would have been a smaller total excess of positive electricity recorded. Observations covering the complete annual precipitation, whether rain or snow, at a number of stations in different latitudes will be necessary before we can safely draw conclusions respecting the earth as a whole.

It was discovered by Lenard many years ago that in the case of an ordinary waterfall, or when water falls on a solid obstacle, the water drops formed take a positive, the surrounding air a negative charge. Lenard believed, however, that no such separation occurred when drops split up without falling on an obstacle. Simpson found a similar absence of charge when experimenting with Simla tap-water, but on trying distilled water he found that the splitting up of drops by means of a vertical air jet is accompanied by a marked separation of electricity, the water taking the positive charge. The breaking up of drops, each containing about 1/4 c.c. of water, gave the water a charge of about $+23 \times 10^{-3}$ E.U. per c.c. If the drops were already charged, this additional charge was added when they broke, so that the action is cumulative. Raindrops become unstable on attaining a certain size, and tend to break, so that natural conditions approach those of Simpson's experiments. A rational explanation is thus given of a positive charge on rain if it behaves as distilled water. This we should expect it to do, except perhaps in smoky districts, but further experiments on actual rain-water in various localities seem desirable. The presence on some rain of negative electricity is ascribed by Simpson to a transfer of charge from air which has previously surrounded breaking raindrops.

The theoretical problem mainly considered by Simpson is the relation of rain to thunderstorms. He believes that there are normally present in thunderstorm areas upward currents of air with velocities of at least 8 metres per second (18 m.p.h.). Such currents prevent raindrops from falling, and Simpson supposes the drops to go through frequent repetitions of the cycle; growth, breaking up (with separation of electricity), fresh growth, and so on, at a nearly constant height in the atmosphere until the charge is so great as to produce at a certain level a gradient larger than 30,000 volts per cm., which he takes to be the electric strength of air. When this limit is reached, a lightning flash neutralises the accumulated charge over a limited area, and the process goes on repeating itself. There are various difficulties in the way of accepting this explanation as complete, but some represent our present ignorance rather than positive knowledge. We should like to know, for instance, whether vertical air currents such as Simpson postulates really do exist near the precise level where the air breaks down, also what the true nature of a lightning flash is, whether unidirectional or oscillatory, what charge passes, and what is the expenditure of energy. For all we know, the air may be in a strongly ionised condition, possibly even there may be separation of the constituent gases, and a potential gradient much under 30,000 volts per cm. may suffice to cause a discharge. In the meantime, Simpson's theory of thunderstorms had better be regarded as a hypothesis, but, unlike some hypotheses, it promises to be useful in suggesting promising lines for observation and experiment. The separation of electricity by the breaking up of raindrops may not play quite so fundamental a part as Simpson supposes, but assuming it to take place with natural rain, it can hardly fail to play an important part in thunderstorm phenomena.

The memoir as a whole is most original and suggestive, and is one on which the meteorological service of India deserves to be congratulated. As many readers of NATURE are doubtless aware, Dr. Simpson's services have been lent by the Indian Government to the present British Antarctic Expedition, principally with the view of his studying electrical conditions in high latitudes, and we may, I think, entertain high hopes that the resulting increase of knowledge will be eminently satisfactory both to India and to this country.

C. CHREE.

THE PREVENTION OF PLAGUE.

A MEMORANDUM on plague has recently been prepared by Dr. Newsholme, medical officer of the Local Government Board, and has been sent to the sanitary authorities of England and Wales, with a request that their officers should endeavour to secure the adoption of the suggestions contained therein. The memorandum gives an interesting conspectus of the essential features of the disease, and deals mainly with its methods of spread and the measures which, in the light of recent researches, must be taken for its prevention. Fortunately, plague, although a disease capable of manifesting itself as an epidemic of a widespread and virulent character, is now so well understood on its epidemiological side, that the direction which preventive measures should take is obvious. The situation may be summarised in the dictum—"no rats, no plague." Practically, however, the matter is perhaps not so simple as it may seem.

The first section of the memorandum describes briefly the symptoms in plague. The injected eyes and the thick, "drunken" speech are noted as characteristic signs of the disease. There is no mention, however, of the tendency to "shouting" delirium and the impulse to get out of bed and wander off, utterly heedless of their condition—well-known symptoms in the natives of India. The "acute" ward of a plague hospital is at times a very noisy place, and mild restraint requires to be put upon patients to prevent their unconscious excursions.

The "ambulant" form of plague is referred to, and it is stated that persons with this type of the disease may spread the infection. Spread of infection by such persons would seem, however, to be very doubtful, by direct personal contagion at least, and it is equally doubtful whether effective carriers of the disease in the sense of typhoid carriers exist. The evidence for the existence of such carriers is not satisfactory, and although the possibility of the occurrence of "pneumonic" carriers must be considered, the rarity of this type, at least in India, and its extreme fatality, considerably limit its importance from this point of view.

The statement that there is little or no liability to infection from contaminated food is a comforting one, and is justified by the accurate observations on the pathology of human plague made some years ago in Bombay by the Austrian Plague Commission, and by the results of experiments on susceptible animals.

The memorandum accepts in its entirety the results of the recent investigations of the Plague Research Commission, viz., that the sole infective agents in an epidemic of bubonic plague to be reckoned with are the infected rat and the infected rat flea—the former an indirect agent and the latter the immediate infecting agent. It follows that the measures suggested for attempting to stamp out the disease are directed solely towards the destruction of rats and their parasites. It has indeed been claimed that domestic animals, such as cattle, pigs, fowls, ducks, &c., are susceptible to plague infection, but extensive experiments made by competent observers in several parts of the world completely agree in opposition to this belief.

In the memorandum the importance of preventing the access of rats to or their entrance into buildings is emphasised. It is pointed out that a cat in the house is a safeguard against domestic invasion by rats and mice, although it must be borne in mind that the cat is in some degree susceptible to plague. Major Buchanan, of the Indian Medical Service, has strongly urged the advisability of stocking the villages in India with cats as a preventive measure, but it must be said that no very definite evidence in support of the proposal has been produced.

With regard to the extermination of rats it is admitted that complete extermination is perhaps impossible. A material diminution in the rat population would undoubtedly lessen the spread of infection amongst them, but the fertility of the rat and the fact that it overruns the whole country in enormous numbers make the task of permanently suppressing the rat community in this country an extremely difficult one. It is certain that only a never-ceasing and complete organisation for rat destruction will appreciably reduce their numbers, and it is perhaps not sufficiently realised by some of the advocates of a general rat campaign that in order to be thorough and effective such a campaign would involve a most extensive and, in the aggregate, a most costly organisation. In this connection the experience of rat destruction gained in Japan is instructive. Kitasato has reported that in five years 4,800,000 rats were killed *in Tokio alone* at a considerable financial outlay, but that at the end of this time no appreciable decrease in the rat population could be detected. Kitasato attributed this to the circumstance that the rate of destruction, vigorous as it was, did not keep pace with the natural increase in the rat population. Recent experience in India appears to point in the same direction.

It is beyond question, however, that so far as plague prevention is concerned a great deal can be done in this country by diminishing or, preferably, abolishing rat infestation in human habitations and in their immediate neighbourhood.

G. F. PETRIE.

DR. THEODORE COOKE.

WE announced with regret last week the death, on November 5, of Dr. Theodore Cooke, C.I.E., formerly a member of the Bombay Educational Department. Born at Tramore, co. Waterford, in 1836, Dr. Cooke entered Trinity College, Dublin, where, after a distinguished career as a student, he graduated in 1859 in the faculties of arts and engineering. In the former faculty he was Hebrew prizeman, first honoursman, and senior moderator and gold medallist in science; in the latter he obtained special certificates in mechanics, chemistry, mineralogy, mining, and geology. Pursuing his profession as an engineer, he joined in 1860 the service of the Bombay, Baroda and Central India Railway, then under construction; during this service he built for the company the great iron bridge at Bassein. Five years later the Government of Bombay secured the services of the talented young engineer as principal of the Civil Engineering College, which later with widened scope became the College of Science, at Poona. The post proved congenial to Dr. Cooke; his wide and varied knowledge, with which were associated much tact and great administrative gifts, enabled him to fill it with signal success until he retired from India in 1893.

Throughout his service Dr. Cooke had taken a keen interest in botanical studies, and field-work connected therewith was one of his chief recreations. What he did as a pastime was, however, characterised by the thoroughness that marked his official work; he soon became a recognised authority on the vegetation of Bombay and Scinde, and it was only fitting that when, in 1891, the Botanical Survey of India was organised, Dr. Cooke should be placed in charge of the survey operations in western India. Encouraged thereto by Sir George King, then director of the survey, Dr. Cooke made preparations for the production of a "Flora of the Presidency of Bombay." Difficulties over which neither Sir George King nor Dr. Cooke had control at first prevented the realisation of the scheme, and when Dr. Cooke retired in 1893 his energies found an outlet in a post to which he was appointed at the Imperial Institute.

The difficulties that had stood in the way of the publication of a local flora of Bombay having at last been overcome, Dr. Cooke was able, some years later, to settle at Kew and commence the preparation of the work in the herbarium there. The first part was published in 1901; the seventh and concluding part appeared about two years ago. The work is marked by the thoroughness and attention to detail characteristic of all that Dr. Cooke did; nothing is taken for granted; every previous statement is carefully verified or refuted; and the "Flora" will remain a lasting memorial to Dr. Cooke's critical acumen, industry, and energy. On its completion Dr. Cooke continued to work in the herbarium with undiminished ardour, assisting as a volunteer in the preparation of the great "Flora Capensis," edited by Sir W. T. Thiselton-Dyer, until laid aside by the illness which has ended his career. Dr. Cooke, on whom his university had already conferred the degree of LL.D., was created a C.I.E. in 1891, and was a Fellow of the Linnean and the Geological Societies.

NOTES.

THE Nobel prize for chemistry has been awarded to Prof. Otto Wallach, professor of chemistry in the University of Göttingen.

WE regret to see the announcement of the death, on November 13, of Mr. W. R. Fisher, formerly assistant professor of forestry at Coopers Hill College.

THE Royal Geological Society of Cornwall at its annual meeting at Penzance on November 8 awarded Dr. George J. Hinde, F.R.S., the Bolitho gold medal for his valuable papers and services in connection with the geology of the county.

A REUTER telegram from Pisa states that on November 10, in the presence of King Victor Emmanuel and a Government Commission, Signor Marconi received wireless telegrams direct from Canada and Massowah by means of his extra powerful installation at Coltano.

MR. A. E. BROWN, secretary of the Zoological Society of Philadelphia, has died suddenly of heart disease in his sixty-first year. He was vice-president and curator of the Academy of Natural Sciences in the same city, and a frequent contributor of zoological and biological articles to various scientific journals.

DR. C. WILLARD HAYES, chief geologist to the U.S. Geological Survey, is now visiting Panama by the direction of President Taft to make a preliminary study of