independent. In this they differ from stable systems which are isochronous. In the unstable systems a change, however small, tends to increase until a limit is reached at which a breakdown of some sort occurs. Instances might be given in great variety in which instability leads to a quasi-periodic motion or arrangement. Geysers which boil over at fairly constant intervals, the whistling of the wind (here the period is the rate of production of eddies round small obstacles), and the ladder-like shavings taken off various materials by cutting tools, are all cases in point, although drawn from such different quarters.

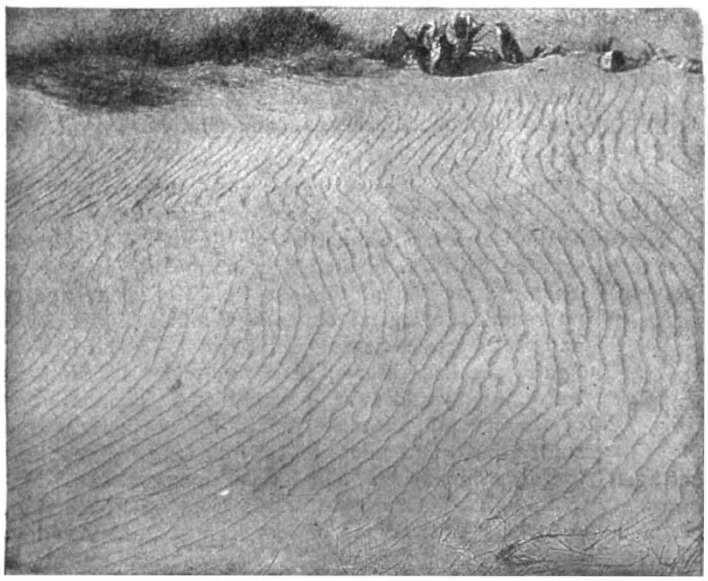

FIG. 2.—Aeolian sand-ripples at Southbour e. From "Waves of Sand and Snow."

Notice of many of the matters of which the author treats, such as snow mushrooms, and the ridges trodden out by cattle, must be omitted for want of space, and although it must be said that the explanations are not as good as the descriptions, the book is to be recommended as the most interesting collection of observations concerning the whole subject which has yet appeared.

A. MALLOCK.

MUTATIONS OF BACTERIA.

VARIOUS alterations in the morphology and in physiological characters of certain bacteria have been obtained by many observers. Thus *Bacillus coli*, the plague bacillus, and other organisms show considerable variation in the size of the cells on different culture media; the *Bacillus prodigiosus*, which forms a brilliant red pigment when grown at ordinary temperatures, completely loses the power of pigment production after cultivation at blood heat, at which temperature (98° F.) it grows as luxuriantly as at 65° F. Twort and Penfold have "educated" the typhoid bacillus to ferment sugars which ordinarily it does not attack, and Revis has obtained marked varieties of *Bacillus coli*, morphological and physiological, by prolonged culture in various media. Minchin holds that if there be no syngamy (sexual reproduction, *e.g.* conjugation) among bacteria, as seems to be the case, the so-called species of bacteria are to be regarded as mere races or strains, capable of modification in any direction.

A marked instance of the artificial production of mutations of *Bacillus anthracis*, a particularly well-defined and stable bacterial species (Fig. 1), is described by Mme. Victor Henri (*Compt. rend. Acad. Sci.*, vol. clviii., No. 14, 1914, p. 1032). The method employed was to expose an aqueous suspension of sporing anthrax in a quartz tube to ultra-violet radiations for times varying from one to forty minutes, and afterwards subculturing.

Whereas the majority of the organisms was killed by this treatment, the ultra-violet rays being markedly bactericidal, a few survived. Of the latter, while most presented a normal aspect, a few showed characters decidedly different from the typical anthrax bacillus. The principal of these were (*a*) coccoid forms (Fig. 2) which remained stable during a period of two months; (*b*) thin filamentous forms (Fig. 3), not taking Gram's stain, not liquefying gelatin, nor curdling milk, and producing an infection different from anthrax

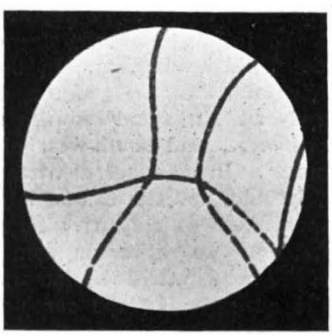

FIG. 1.

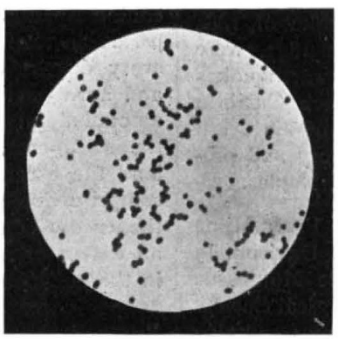

FIG. 2.

FIG. 3.

on inoculation. This form remained absolutely fixed after daily subculture for more than eighty days; but, though stable *in vitro, in vivo,* after passage through an animal, Gram-positive coccoid forms made their appearance, and subsequently, after subculture in broth, a certain number of bacillary forms, approximating to typical anthrax, were obtained. These experiments open up wide possibilities in the transformation of micro-organisms. R. T. HEWLETT.

NOTES.

THE first of the two annual soirees of the Royal Society will be held in the rooms of the society at Burlington House on Wednesday, May 13.

THE twenty-second James Forrest lecture of the Institution of Civil Engineers will be delivered on Tuesday, May 5, by Mr. F. W. Lanchester, upon the subject of "The Flying Machine from an Engineering Standpoint."

PROF. C. S. SHERRINGTON, Waynflete professor of physiology in the University of Oxford, has been elected a member of the Royal Danish Academy of Sciences, in the class of natural sciences.

THE death is announced, at fifty-eight years of age, of Prof. Adolf Fischer, director of the Museum for Asiatic art, founded last October at Cologne, and consisting almost entirely of collections made by Prof. Fischer himself during repeated journey to the Far East.

THE death on March 19 is announced of Prof. G. Mercalli, one of the leading Italian seismologists. Mercalli, who was born at Milan in 1850, is known chiefly for his researches on regional seismology, for his observations on Vesuvian phenomena, and for his scale of seismic intensity, which, in Italy, has displaced the widely used Rossi-Forel scale. In conjunction with Prof. T. Taramelli, he issued the principal reports on the Andalusian earthquake of 1884 and the Riviera earthquake of 1887. In 1897, were published his valuable monographs on the earthquakes of Liguria and Piedmont, and of southern Calabria and the Messinese district. At the time of his death he was director of the Vesuvius Observatory and professor of seismology in the University of Naples.

TWO articles on the work of the late Prof. Milne have appeared this month, one by Dr. C. Davison, in *Science Progress,* the other by Comte de Montessus de Ballore, in the Bulletin of the Seismological Society of America (vol. iv., pp. 1–24). The former contains a brief account of his life and a summary of the principal work accomplished by him. The latter is more bibliographical in form. Milne's papers are classified and briefly described under fourteen headings, such as earthquake-catalogues, earth tremors and pulsations, aseismic buildings and practical seismology, relations between earthquakes and variations of the vertical and changes of latitude, etc. Both writers claim for Milne the chief share in the growth of seismology.

THE twelfth annual meeting of the South African Association for the Advancement of Science will be held at Kimberley from Monday, July 6, to Saturday, July 11, inclusive, under the presidency of Prof. R. Marloth. The sections and their presidents will be as follows:—A, Astronomy, Mathematics, Physics, Meteorology, Geodesy, Surveying, Engineering, Architecture, and Irrigation, Prof. A. Ogg; B, Chemistry, Geology, Metallurgy, Mineralogy, and Geography, Prof. G. H. Stanley; C, Bacteriology, Botany, Zoology, Agriculture, Forestry, Physiology, Hygiene, and Sanitary Science, Prof. G. Potts; D, Anthropology, Ethnology, Education, History, Mental Science, Philology, Political Economy, Sociology, and Statistics, Prof. W. Ritchie.

THE precise physical cause which has brought the publicity of newspaper paragraphs to the shrinkage of the Caspian Sea must be, pending the official investigation by Prof. Shokalski, a matter for conjecture. That the surface of the sea stood formerly, and at no remote geological date, at a much higher level, and that its extent was much greater, is well known. Again, the level is subject to recognised fluctuations, both annually and over longer periods. The discharge of the several great rivers into the sea strives constantly but often unsuccessfully to keep up with the loss by evaporation. The level usually stands highest in the middle of the year, and lowest at the beginning. As to the fluctuations of longer period, observations extending from 1851 to 1885 showed maxima of height in 1868–69, in 1882, and in 1885, and minima in 1853 and 1873; these oscillations appear to have had an extreme range of some 42 in. The present fall may be associated with this phenomenon; a scientific investigation towards the close of last century led to the conclusion that no perceptible permanent shrinkage was in progress.

A SUMMARY of the weather for the first three months of the year has been given by the Meteorological Office in its Weekly Weather Report for the period ending April 4. The mean temperature for the whole period is shown to be in excess of the average in every district of the United Kingdom. In the east and north-east of England the excess of temperature amounted to 3°, and in the midland counties and in the south-east, north-west, and south-west of England the excess was 2°. In all other districts which comprise Scotland, Ireland, and the Channel Islands, the excess of temperature was only 1°. There was an excess of rainfall over the entire kingdom except in the north-east of England, where the fall was only 95 per cent. of the average. In the south-east of England the rainfall for the three months was 160 per cent. of the average, in the east of England 145 per cent., in the Channel Islands 143 per cent., in the south-west of England 142 per cent., in Ireland, north and south, 140 per cent., and in the east and west of Scotland 122 and 123 per cent. respectively. In the midland counties the fall was only 107 per cent. of the average. There was a slight deficiency of sunshine over the whole kingdom, except in the north of Scotland, where there was a slight excess. At Greenwich the mean temperature for the three months to