

RESEARCH ITEMS

International Standards for Biological Assay

AN inquiry on the assay of gas gangrene antitoxin (perfringens) carried out under the auspices of the Department of Biological Standards of the State Serum Institute, Copenhagen (League of Nations, *Bulletin of the Health Organisation*, 8, No. 6, 797-912 (1939). Biological Standardisation, iv), reached the following conclusions. Perfringens antitoxins show the same activity when assayed against different toxins, if the toxins contain one and the same predominant antigen. The hæmolysin content influences the assay when the ratio minimum lethal dose/minimum hæmolytic dose exceeds 100. Intravenous assays on mice give results corresponding to those obtained intracutaneously on guinea pigs when pure ζ or ζ, α toxins are used. There is a relation between the activities of a perfringens antitoxin determined *in vitro* (hæmolysis) and *in vivo* only if pure ζ toxins are used in both tests. A perfringens toxin suitable for estimating the ζ antibody content in perfringens antitoxins has been prepared in Copenhagen and is at the disposal of institutes. The international unit for gas gangrene antitoxin (Sardelli) is defined as 0.1334 mgm. of the dry stable Washington preparation. Contributions towards the international standard preparations for (1) the gonadotropic substance of pregnant urine; (2) the gonadotropic substance of pregnant mares' serum and (3) the lectogenic (crop-gland stimulating) substance of the anterior pituitary gland have been assayed in a number of different laboratories and the results analysed by C. W. Emmens of the National Institute for Medical Research, Hampstead, London. The international units for these three substances are respectively 0.1, 0.25 and 0.1 mgm. of the international standard mixtures. Suggestions for the use of these standards in biological assays are given.

Production of *pertussis* Antitoxin

EXTRACTS of *Hæmophilus pertussis*—the causal bacterium of whooping-cough—are toxic; they kill guinea pigs when a suitable dose is injected into a vein, and they produce necrotic lesions when injected into the skin of a rabbit. Investigation by independent workers of the problem whether the toxin can give rise to an antitoxin has led to conflicting opinions, and thus a recent paper by D. G. Evans (*J. Path. and Bact.*, 51, 49-58; 1940) is of interest, especially since he, in collaboration with H. B. Maitland, had previously failed to obtain positive results. Evans now finds that rabbits, when immunized subcutaneously with the toxin, give definite evidence of having acquired immunity to it and that, moreover, the serum of such rabbits is capable of neutralizing both the necrotic and the lethal action of the toxin. A toxic substance with similar properties is extractable from *H. paraptussis* and *Brucella bronchoseptica*, and it has been found that 'pertussis' antitoxin is able to neutralize each of these toxins, a result which confirms the view that the micro-organisms from which they are derived are closely related to *H. pertussis*. An antibacterial serum against *H. pertussis* can be prepared in experimental animals by inoculating them intravenously

with the whole organism or extracts from it, but this form of therapy has not been entirely effective in the prophylaxis and treatment of whooping-cough; nor has the serum from convalescent patients proved its value. The author considers that an antitoxic serum of high potency should be given a trial as a preventive and remedial agent in this disease.

Sunspots and Insect Epidemics

THE probable existence of some regularity in the fluctuations of animal numbers has been investigated by several workers. The results of such inquiries have not always been convincing, mainly perhaps on account of the difficulty of collecting sufficient detailed accurate records. D. Stewart MacLagan (*Proc. Univ. Durham Phil. Soc.*, 10, 175-199; 1940) has collected data relative to severe insect outbreaks in Britain. A historical study during the past hundred years of outbreaks of such insects as flea-beetles, cutworms, leather-jackets, antler moth and diamond back moth has been made. On epidemiological grounds it is claimed that the frequency of outbreaks of the species just enumerated is correlated with the periodicity of sunspots. The years of maximum frequency are nearly synchronous with epochs of sunspot maxima. The connexion between sunspots and outbreaks is considered to be climatic; the favouring circumstances it is claimed are probably increased humidity and more intense ultra-violet radiation. The article concludes with a bibliography of seventy papers.

British Pyrenomycetes

Messrs. G. R. Bisby and E. W. Mason have performed a very considerable service to British mycology in compiling a "List of Pyrenomycetes recorded for Britain" (*Trans. Brit. Mycol. Soc.*, 24, Pt. 2, 127-243; 1940). Taxonomy of all the Ascomycetes is still at a very low level, and any contribution is valuable. The present paper is more than the mere list implied by its title: it is a systematic evaluation of the Pyrenomycetes, and should pave the way for more detailed work upon the group, so urgently needed at present. The classification of Saccardo has usually been followed, and accordingly the Laboulbeniales, Gymnoascales and Perisporiales take their place along with the more obvious Pyrenomycetes. Detailed references are given, and an index to genera and species makes for easy consultation. It is greatly to be hoped that the superstructure of specific descriptions will follow this taxonomic foundation.

Triploid Sugar Beet

H. Peto and J. W. Boyes (*Canad. J. Res.*, 18, 273-282; 1940) have shown that triploid sugar beet resulting from the cross $4x \times 2x$ differs considerably in sugar content from diploid beets. The root weights of triploid beets exceeded those of diploids by 12.2 per cent, in sugar content by 14.9 per cent and in dry top weights by 17.8 per cent. The decrease in sugar percentage for each 100 gm. increase in weight was 0.34 per cent for the diploids and 0.17 per cent for the triploids. The economic possibilities of triploid sugar beet appear promising.

Temperature Differences in Lakes

IN "Temperature Measurements in Vänern and Götaälven", Angström and Jacobson (*Med. fran. Stat. Met. Hydro. Anst.*, 7, No. 6; 1940) describe the work done at the instance of the Swedish Royal Board of Waterfalls through a commission appointed in 1929 for investigating certain problems of ice formation in connexion with the regulation of Lake Vänern. The work consisted of a study of the variations of vertical temperature gradient in the course of the seasons and the influence thereon of wind; the measurement of the temperature gradient extended from the vast and not very deep lake itself down to the mouth of the Göte River, where the salt water of the Skagerrack often flows as a bottom current in the reverse direction to that of the overlying fresh water. It was only in the latter region of the river that large gradients were found, with temperature differences between the bottom and the surface of more than 1°C ., while in the lake the largest gradients were found only in the summer, late July providing differences of the order of 10°C . between the bottom and the surface where the depth is 35 metres. In contrast to deeper lakes, where the minimum temperature of the deeper layers at the time of ice-formation is often 4°C ., the minimum in Vänern is then very nearly 0°C . at all depths. The observations explained the remarkable fact previously observed, that after the lake has been frozen over and covered with deep snow the temperature of the river often rises, so that the river becomes clear of ice during the later parts of periods of great cold. This is clearly due to the checking of outward radiation by the ice and snow over the lake, which permits heat from the ground beneath the lake to cause the temperature of the water to rise. This heating from below was the cause of occasional differences of more than 2°C . between the bottom and surface layers of the lake in winter, to be found only when the ice cover is thick. This publication concludes with an extensive bibliography of the subject covering the period 1900-32.

Thiophosphoryl Chlorofluorides

THIOPHOSPHORYL fluoride, PSF_3 , is a colourless spontaneously inflammable gas, discovered by Thorpe and Rodger in 1888 and obtained by heating phosphorus sulphide and lead fluoride. H. S. Booth and M. C. Cassidy (*J. Amer. Chem. Soc.*, 62, 2369; 1940) have now prepared the two chlorofluorides PSF_2Cl (b.p. 64.7°) and PSF_2Cl (b.p. 6.3°) by the action of antimony trifluoride on thiophosphoryl chloride, PSCl_3 , in presence of antimony pentachloride as a catalyst. Thiophosphoryl fluoride is also formed. PSF_2Cl , like PSF_3 , is spontaneously explosive in certain concentrations in air. Thiophosphoryl chloride exists in two solid forms, freezing at -40.8° and -36.2° .

Convective Equilibrium and Solar Limb Darkening

A. D. THACKERAY has published a paper (*Mon. Not. Roy. Astro. Soc.*, 100, 8-9; June 1940) in which he shows the consequences of assuming convective equilibrium in the solar atmosphere when k , the mass-absorption coefficient, varies as p . The result of the analysis shows that both the darkening to the limb and also the distribution of energy in the spectra of disk and spot can be represented by the assumption of radiative equilibrium, or equally well by the

assumption of convective equilibrium. In the latter case, however, it is necessary to assume that $k \propto p$ and also that γ is $4/3$. These conditions may be realized at a certain level of the reversing layer or photosphere; but it must be admitted that they may not be true for the higher layers which affect the limb observations. In addition, there is no particular reason for adopting $4/3$ as the value of γ , which represents the lower limit for a whole star. It is suggested that it would be interesting to repeat the calculations for other values of γ . An important conclusion on the equilibrium of sunspots is worthy of notice. Minnaert and Wanders made use of Milne's adiabatic hypothesis and applied two tests—the variation of the ratio spot/disk (1) from centre to limb, and then (2) in different wave-lengths. They concluded that neither of these tests was satisfied by the assumption of convective equilibrium in spots, but that both were satisfied by the assumption of radiative equilibrium. Minnaert and Wanders assumed the relation $k \propto p/T^{3/2}$, but on the assumption of convective equilibrium used by Thackeray he found that the facts could be equally well explained by assuming that spot and disk are both in convective equilibrium, or alternatively, that they are both in radiative equilibrium. Observations did not support the hypothesis that wave-length variations result from a convective spot and radiative disk, or from a radiative spot and convective disk.

Spectrum of Bright Chromospheric Eruptions

It is well known that bright chromospheric eruptions on the sun produce definite effects on the atmosphere of the earth. From the nature of the effects it is inferred that the solar influence is transmitted by ultra-violet light and that the ultra-violet intensity in the eruption is of the order of a thousand times that normally emitted from the sun's surface. As it is impossible to photograph the short-wave radiation which is suspected of causing the ionospheric disturbance, owing to the earth's atmosphere, its nature must be a matter of conjecture. C. W. Allen, assuming that such great changes in ultra-violet spectrum would imply some corresponding effects in the spectral regions that can be seen and photographed, has described the results of his investigations on eruption spectra (*Mon. Not. Roy. Astro. Soc.*, 100, 8-9; June 1940). The observations were made with the 3-prism spectrograph of the Commonwealth Solar Observatory in conjunction with the sun telescope. The eruptions were set on the slit to give the brightest emission in $H\alpha$ or $H\beta$, and 116 emission lines were detected and tabulated in various discontinuous regions of the spectrum from 3922 Å. to 6700 Å. On comparing the intensities of the eruption lines with those of the flash spectrum, it was discovered that all Fe lines and all low $E.P.$ Fe lines are strongly enhanced in eruptions. The enhancement of the former is also detected in metallic prominences and 'hot spots' (this name has been given by Cillié and Menzel to regions of the flash spectrum which have shown signs of unusual excitation), but this does not occur with the low $E.P.$ Fe lines. It is a matter of some interest that in long-period variables of classes Me and Se several low-level Fe lines are emitted, while bright Fe+ lines are also present. It is possible to explain the small variations detected in the intensities of Fraunhofer lines from areas in eruption if the excitation temperature of the reversing layer is increased by about 100°K .