and the late A. W. Menzies-Kitchen traces its development up to 1951. H. H. Nicholson describes the evolution of field drainage investigations which commenced in 1930 at the suggestion of Sir Frank Engledow. J. Hammond gives an account of animal production research, including the breeding experiments of Punnett which led to the establishment of the Poultry Research Station. The history of Cambridge University Farm, from the leasing of Burgoynes Farm between 1900 and 1910 and its establishment on the present site, is related by W. S. Mansfield, the director. F. Hanley details the development of crop husbandry experiments from 1894 onwards. The final review is by Sir Frank Engledow, who describes the changes in agricultural teaching at Cambridge between 1894 and 1955.

These collected reviews give a very complete picture of the progress in agricultural research at Cambridge from the end of the past century, when it was considered doubtful whether it was proper for the University to raise agriculture to the status of a Department with a chair, to the present time, when the importance of agriculture in the national economy alone is ample justification for sound teaching and research.

E. C. Humphries

NIGHT-VISION EFFICIENCY

During the Second World War the practical need arose of selecting military personnel for tasks requiring high visual performance at night, and various tests of 'night-vision efficiency' were therefore devised. The Medical Research Council initiated a study of these tests, and has recently published a report* of its findings. The report consists largely of experimental work and makes the following positive contribution to this difficult topic: absolute thresholds vary from individual to individual, and the amount of light an individual requires to perform an acuity discrimination (detecting the orientation of a Landolt *C*) and a more complex perceptual task (identifying objects in a dimly lit Hogarth print) is strongly correlated with his absolute threshold, provided that these tests are such that rods, not cones, are operative.

Minor technical criticisms can be made; for example, the frequency of positive responses to 'blank' stimuli is not reported, though this is an important index of the subject's reliability, and the figure must have been used in making the 'guessing correction' when the thresholds were determined by the procedure described in an appendix (a war-time report by H. K. Hartline and P. R. McDonald for the United States Committee on Aviation Medicine). The absolute threshold seems to be more variable than many other visual functions, such as optimum acuity, critical fusion frequency and differential threshold; it would be interesting to know why this is so, but the authors offer no experiments which throw more light on the matter. Nor have they made a serious attempt to assess the relative importance of this particular factor compared with the many other factors (for example, variations in pupil size, residual refractive error, night myopia, avoidance of foveal fixation, pattern of eye movements, reliability of response, intelligence, motivation, etc.), which may also be important in causing variations in visual performance at low illuminations. Nevertheless, a positive, well-established result is valuable in a field full of conflicting claims, and the experiments on acuity at low illuminations will interest visual physiologists.

H. B. Barlow

* Medical Research Council. Special Report Series No. 294: Individual Differences in Night-Vision Efficiency. By M. H. Pirenne, F. H. C. Marriott and E. F. O'Doherty. With a section on The Frequency of Seeing at Low Illumination by H. K. Hartline and P. R. McDonald. Pp. viii+83+1 plate. (London: H.M. Stationery Office, 1957.) 8*s*. net.

STATISTICAL ANALYSIS OF A RANDOM, MOVING SURFACE

A theoretical study, by Dr. M. S. Longuet-Higgins, of the statistical properties of a surface the elevation of which is given by the superposition of a large number of simple harmonic waves with random phases travelling in different directions has recently been published under the title "The Statistical Analysis of a Random, Moving Surface"*. At time t, the elevation (measured from the mean level) at a point in the surface the co-ordinates of which are (x,y) is taken to be

$$\zeta(x,y,t) = \sum_n c_n \cos(u_n x + v_n y + \sigma_n t + \varepsilon_n)$$

where the phases ε_n are distributed independently and uniformly over the interval $(0,2\pi)$, and the angular frequency

$$\sigma_n = \sigma(u_n,v_n) = \sigma(\sqrt{u_n^2 + v_n^2})$$

the function σ depending on the type of wave motion and the medium in which it takes place. In the limit as $n \to \infty$, ζ becomes a two-dimensional stationary normal stochastic process, the properties of which are completely determined by the spectral density of energy $E(u,v)$, defined by

$$\sum_{\substack{u_n \leqslant u \\ v_n \leqslant v}} \tfrac{1}{2}c_n^2 = \int_{-\infty}^{u} du' \int_{-\infty}^{v} dv' E(u',v') ;$$

the correlation function of the process is the cosine transform

$$\int_{-\infty}^{\infty} du \int_{-\infty}^{\infty} dv\, E(u,v) \cos(ux + vy + \sigma(u,v)t)$$

This has recently been used as a model for surface waves in the open ocean; the author suggests that it may also be applicable to other geophysical phenomena such as microseisms or perturbations of the ionosphere.

The main part of the study is concerned with the use of the limiting representation to derive the following properties: (1) the probability distribution of ζ and the components of slope ζ_x, ζ_y at any point; (2) the average number of zeros of ζ per unit distance along a line in an arbitrary direction in the x–y plane; (3) the average length of surface contours per unit area and the distribution of their direction; (4) the average densities of maxima, minima and 'specular' points (points where ζ_x, ζ_y take given values) per unit area; (5) the probability distribution of the velocities of zeros of ζ along a given line; (6) the probability distribution of the velocities of contours and 'specular' points; (7) the probability

* *Philosophical Transactions of the Royal Society of London*. Series A: Mathematical and Physical Sciences. No. 966, Vol. 249 (21 February 1957): The Statistical Analysis of a Random, Moving Surface. By M. S. Longuet-Higgins. Pp. 321–387. (London: Royal Society, 1957.) 21*s*.