vitalistic interpretations of life, especially of the life of man. The subject matter is considered under nine heads, such as metabolism, adaptation, behavior, instincts, mentality, social relations, and the like. The author concludes that in all nine aspects there is an irreducible residuum that can not be explained away on mechanistic grounds. This irreducible element, always present, is of a purposive character. Having thus shown the insufficiency of the mechanistic interpretation, Rignano concludes that a vitalistic interpretation of life is the only one tenable. To the reviewer this step seems to be a *non sequitur*, for in addition to vitalism and mechanism there are other possible ways of considering life, witness that embodied in emergent evolution. Thus the view of life from the standpoint of emergent evolution avoids the obvious limitations of the mechanistic conception and yet differs radically from vitalism. It may be, therefore, a much more truthful interpretation of life than either vitalism or mechanism. It is to be regretted that this aspect of the subject has not been discussed by Rignano, whose book, however, affords good reading, suggestive and stimulating.

G. H. PARKER

Traité de Geographie Physique par EMMANUEL DE MURTONNE, professeur à la Sorbonne. Tome troisième: Biographie (en collaboration avec A. CHEVALIER ET L. CUÉNOT) Un Vol. in 8°, 464 pages, 94 figures dans le texte, 24 photographies hors texte. Librairie Armand Colin, Paris.

THE first edition of the "Traité de Geographie Physique" appeared twenty years ago and a second edition later. The author has remodeled his work, which has now been published in a third edition. Volume III devoted to biogeography completes the work, and in it there are 404 pages of text, instead of 154 pages in the first edition, 94 figures in place of 62, and 25 pages of bibliography instead of 10 pages. The growing complexity of the subject, and the abundance of technical studies devoted to biogeography have been such as to necessitate the association of two other scientists: MM. Chevalier, director of the laboratory of colonial agronomy, and Cuénot, professor of zoology in the University of Nancy. The volume is a single complete treatise on biogeography and is based on current and recently pursued research on the subject. A chapter is devoted to general principles, as common to botanical and zoological geography.

Five chapters are devoted to phytogeography. One of them deals with the science of the soil, another to plant sociology, where are given in a detailed manner the most recent investigation of plant associations and their evolution. Another important chapter considers the influence of man on vegetation with an essay on the classification of the systems of cultivation.

Three chapters deal with zoogeography and are filled with matters of great interest to zoologists, such as the origin of species and their adaptation to diverse surroundings. For geographers, this book is a mine of information. It ought to appeal to agriculturists, economists, colonial experimenters and the public in general.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

ACCURATELY TIMED INTERMITTENT LIGHTING

IN many types of biological work a dependable, home-made apparatus for providing accurately timed alternate periods of light and darkness is desirable. Commercial machines are generally so high priced as to be out of the question in small laboratories.

The apparatus here described, which has the advantage of cheapness, consists of a revolving drum on the surface of which are made contact and break surfaces. A thermograph is readily adapted to this purpose, as illustrated in figure 1. The thermograph is insulated

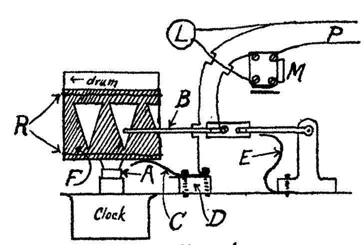

Fig. 1.

at *A* by a cone of fiber paper, and at the point *D* by fiber board. The lower end and the outer wall of the drum are brightened to make contact with *B* and *C*. Then a band of fiber paper *F* is held in place around the drum by two rubber bands *R*. Seven triangular pieces are cut from this band of fiber paper as shown in figure 1, to allow the point *B* to make contact with the drum. When this point comes in contact with the drum, the magnetic switch, No. 2829653Z2 General Electric, *M* closes the power circuit *P*, and the lights are on. As the point *B* runs onto the fiber paper breaking the control circuit the magnet is demagnetized, and the lights are turned off.

By simply raising or lowering the point *B*, by means of the adjustable support *E*, a long or short illumination period may be obtained. The drum is adjusted to the particular time of day requiring illumination, and the clock wound once each week.

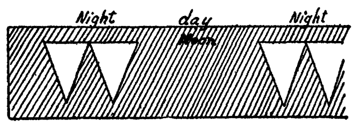

Fig. 2.

If illumination is required for any length of time during two or more different periods of the day, the band of fiber paper is cut accordingly. Figure 2 represents the type of band for any length period of morning and evening illumination.

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CENTRIFUGING FILTERABLE VIRUSES

FROM time to time there have appeared experimental reports in which attempts to concentrate filterable viruses by the centrifugal method have been described. Particles of such small size are incapable of any great velocity of sedimentation even when acted upon by centrifugal force. In a general sense, the same is true of bacteria.

By Stoke's law; the velocity **v** of a sphere of radius r and of density Δ falling under gravitational acceleration g in a liquid of density δ and viscosity η is:

$$\mathbf{v} = \frac{2r^2 g(\Delta - \delta)}{9\eta}$$

Substituting for g, gravitational acceleration, the centrifugal acceleration—

$$\omega^2 R = 4\pi^2 RP^2$$

where ω is angular acceleration, R is the radius of curvature (from the center of the centrifuge to the particle), and P is the angular velocity, or revolutions per second, we have:

$$\mathbf{v} = \frac{2r^2(\Delta - \delta)}{9\eta}(4\pi^2 RP^2) = \frac{8\pi^2 r^2 RP^2(\Delta - \delta)}{9\eta}$$

This, then, is the general equation.

Let us now solve for **v** in a general problem. We assume a virus particle 5×10^{-6} cm. in radius ($0.1\,\mu$ diameter), spherical, of density 1.1.[1] Let it be suspended in a liquid of density 1.0 and located 20 cm. from the center of the centrifuge. Let the viscosity be 0.01 (water at 20° C.) and the speed be 3,600 r.p.m. (P = 60). Then:

$$\mathbf{v} = \frac{8\pi^2(5 \times 10^{-6})^2 \times 20 \times 60^2(1.1 - 1.0)}{9 \times 0.01}$$
$$= 158 \times 10^{-6} \text{ cm./sec. or } 0.57 \text{ cm./hr.}$$

This velocity is certainly not great, since under the conditions stated some 8.8 hours of centrifuging would be necessary to carry a particle 5 cm. And if analysis is made of the values used in this problem it will be seen that they are taken to give **v** a probable maximum value. The viscosity in practice is ordinarily greater than that of water, and the radius of the particle is almost unquestionably less than 5×10^{-6} cm. Ordinarily centrifuge methods applied to filterable viruses are from the standpoint of physical laws of questionable value.

The surface-volume relationship in the illustration problem is such that a 1 cc. volume would have to be contained in a film less than a micron thick and over half a meter square to give relatively the surface exposure, considering both sides of the film. Or a centimeter cube with its 6 cm.² surface would have to have a density about 1/100 that of air to give the same surface-mass relationship as pertains to the minute particle described.

Thanks are due to Mr. W. W. Sleator of the laboratory of physics of the University of Michigan for checking and correcting this problem.

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[1] Investigation of a number of references on the density of bacteria gives various figures. A density of 1.1 is considered a fair average.

PERSIMMON SEEDS FOR CLASS USE

AN examination of the seeds of the common persimmon, *Diospyros virginiana,* convinced the writer that they should make excellent class material for embryological studies as well as for studies of the structures of a thick-walled endosperm. The comparatively large, straight embryo is easily removed from the endosperm and its parts are easily seen. Younger stages should make good microscopic preparations for embryological work, provided that the difficulties encountered in cutting the testa and endosperm are not too great. Carbohydrate is apparently stored in the thick cell walls of the endosperm in the form of cellulose or hemi-cellulose, and this being the case, the germinating seeds should be a good source of cytase-like enzymes.

During the past season the writer sent a supply of persimmon seeds to Dr. E. M. Gilbert, of the department of botany of the University of Wisconsin, who writes that they have been used successfully in