air for the paraffin to seal to the sides and then the box with the contents is lowered into ice water.

After complete hardening, the paper may be peeled off. If the sides and corners of the box have been made in sharp creases, the block is now ready for sectioning without the usual trimming. In general, however, it is better to lose a few specimens by trimming, because accurate trimming aids in securing good serial sections. Frequently the specimens are so well concentrated that by mounting and sectioning the block at right angles to its position in the box only a small portion need be sectioned, to include all specimens. In cases where the protozoa used have one longer axis they will be likely to settle with that side against the bottom of the box, and so by orientating the block the majority of the individuals may be secured in a definite plane of section.

Concentration of both free-living and endozoic protozoa may be successfully carried out in this way.

Explanation of diagram. A square piece of paper is ruled into nine equal sized squares and cut along the dotted lines as indicated in Fig. A. Squares 7 and 8 are folded up over 4 and 5; 6 and 9 are folded to the left; then 2 and 3 are folded downward; squares 3 and 9 are then folded under the center square; the folds are next opened up and 2 and 3 are folded down over 5 and 6; 1 and 4 are folded to the right and 7 and 8 are folded upwards; the two ends, 1 and 7, are folded under the center square. If all the folds are now opened up, a box may easily be made with 1 outside of 2, 3 outside of 6, 9 outside of 8 and 7 outside of 4. The corners may be secured with gummed paper (Fig. B). This method of cutting and folding results in a box which has the four corners open at the bottom to facilitate the exchange of paraffin in the final imbedding. Fig. C shows the paraffin block secured by imbedding in this box.

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SPECIAL ARTICLES

INSULAR BIOTA AND DISPERSAL AGENTS

WORKING on a group of mites which are non-parasitic but common on vegetation, living or dead, the question of dispersal of these animals has often been brought to my attention. Sellnick[1] records two Oribatids from Krakatau. Halbert[2] records five from the Bills, sea-swept rocks off the west coast of Ireland. Praeger[3] summarizes the biota of these rock islands and endeavors to explain its origin. After suggesting every possibility that has been offered by former writers on distribution, he seeks refuge in the amplitude of another land bridge—this in spite of the fact that his collaborators have given him the clue. The majority of the animals listed were found in old nests of puffins and great black-backed gulls. These latter are builders of large nests, bringing material from the mainland.

A careful perusal of nesting habits of marine birds as brought together in the U. S. National Museum bulletins by Bent reveals that the gulls, more than any other marine birds, use considerable material for their nests which they place on islands to escape foxes (not man). This, coupled with their wide distribution and commonness, is enough to account for a great deal of transport of grasses, straws, plant material of all kinds even to sticks of wood.

Although Oribatid mites may be carried on sticks as adults, as many as thirty-three specimens representing three species having been taken from a single stick some two feet long within the limits of New York City, other larger animals may be transported on sticks, in straws and plant stems (or glued to them) *as eggs* or seeds. Many of the islands used by birds have no beach on which drift may accumulate. This necessitates carriage from the mainland—like Noah's dove. A catalogue of the spores, seeds and eggs that may be carried on nesting material will destroy a large number of land bridges. Certainly most of the hundreds of Oribatids described, many Collembolans and not a few beetles (especially wingless ones) may be carried thus as adults. Ernst[4] records gulls on Krakatau in 1906.

An extension of this type of carriage would include dispersal from place to place on land. An Oribatid traveling at the rate of an inch a minute on white paper, over a woodland or even a meadow floor may require twelve hours to advance three feet (especially if it has to crawl over a log), but a bird may carry it or its eggs thirty feet in a minute. On land, hawks, crows and squirrels are our chief distributors of dead wood. Although streams may check the latter, the first two would know but few boundaries. Vireos distribute lichen-dwellers, swallows disperse mud-dwellers, the majority of which tide over periods of desiccation in an encysted stage. The possibilities are as numerous as the habits of nest-builders, and the speed of dispersal per annum will be measured by the distance a bird will carry nesting material. The fauna of birds' nests has already been touched on by

[1] 1924, *Treubia*, 5: 371.
[2] 1915, "Clare Island Survey," pt. 39–ii, *Proc. Royal Irish Acad.*, vol. 31.
[3] 1915, *op. cit.*, pt. 68.
[4] "New Flora of the Volcanic Island of Krakatau," Cambridge University Press.

various writers but this field is barely touched as most analyses are based on old, abandoned nests when most of these litter dwellers drop to the ground as soon as their substratum becomes thoroughly desiccated. The potential fauna and flora of ungathered nesting material, then, should be the next step towards explaining origins of biota and dispersal of species of small size.

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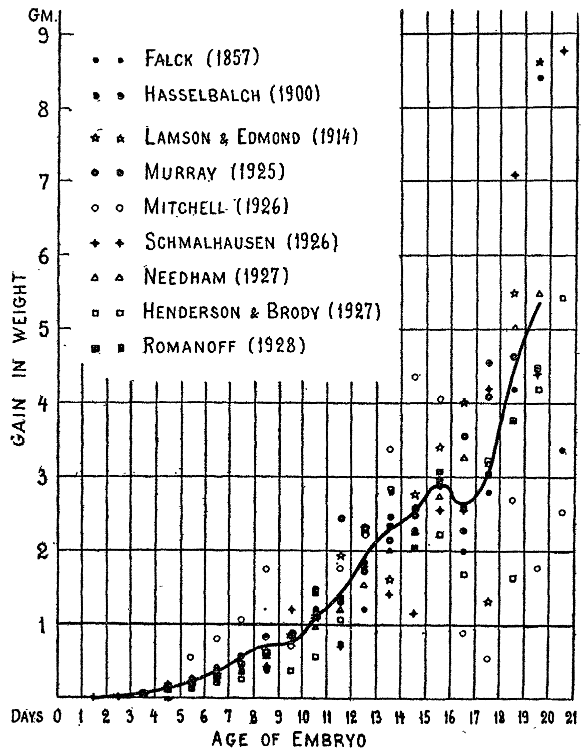
CYCLES IN THE PRENATAL GROWTH OF THE DOMESTIC FOWL

THE growth of the fowl's embryo, like the growth of mammalian embryos, of man's, for example,[1] consists of alternate periods of rapid and slow growth. These oscillations or growth-cycles are not accidental; they are easily distinguishable from accidental fluctuations, and they occur at very nearly the same places in the growth curve of every normal embryo.

This subject received very little attention in the past. The early investigations of Falck[2] and Liebermann[3] were insufficient to show the growth-cycles. Later, Hasselbalch[4] and Lamson and Edmond[5] gave more experimental data, from which Brody,[6] applying statistical methods, could demonstrate two growth-cycles. Then Murray,[7] adding his own data, concluded that there must be "three chief cycles."

Since the number of observations from which the above conclusions were made was very small,[4, 5] further study of the cycles seems to be necessary. The recent data of Mitchell,[8] Schmalhausen,[9] Needham,[10] Henderson and Brody[11] and Romanoff[12] may throw light not only on the number of cycles but on the approximate times of them in the life span of the embryo, as well.

The summarizing data on the accompanying chart of the daily gain in weight of the embryo show that:



(1) In general, the fluctuations in growth are not accidental and not the result of experimental error, but are oscillations caused by the normal chemical and physiological processes in the course of prenatal development. (2) There are at least three well-distinguished cycles in the growth of the fowl's embryo. (3) The retardation of the growth usually falls within a definite age of the embryo, that is, at nine and sixteen days of incubation.

These cycles are found to be regular only under uniform conditions of incubation, when the temperature and the humidity are accurately controlled.[13] If the conditions of incubation happen to be changed the cycles invariably occur, but the time of their occurrence will be shifted. For example, should the temperature be higher, the same cycles will appear earlier. On the other hand, should the temperature be lower, the same cycles will appear later.[11] If the conditions of incubation happen to be extremely abnormal, the cycles are not distinctly outlined, as in the case of extremely variable humidity.[12]

While there is enough evidence to believe that the growth-cycles have a pronounced influence on the physicochemical side of the embryonic development, they must have more recognition in future than they have had in the past by scientists working in the field of experimental embryology.

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1 T. B. Robertson, "The Chemical Basis of Growth and Senescence," viii + 389 pp., Philadelphia and London, 1923.

2 C. Falck, cit. by W. Preyer, "Spezielle Physiologie des Embryos," xxi + 644 pp., Leipzig, 1885.

3 L. Liebermann, *Archiv f. ges. Physiol.*, 43: 71–151, 1888.

4 K. A. Hasselbalch, *Skand. Archiv f. Physiol.*, 10: 353–402, 1900.

5 G. H. Lamson and H. D. Edmond, *Storrs Exp. Sta. Bul.*, 76: 219–258, 1914.

6 S. Brody, *Jour. Gen. Physiol.*, 3: 765–770, 1920.

7 H. A. Murray, Jr., *Jour. Gen. Physiol.*, 9: 1–37, 1925.

8 H. H. Mitchell, T. S. Hamilton and L. E. Card, *Illinois Ann. Rept.*, 38: 77–79, 1926.

9 I. Schmalhausen, *Archiv f. Entwick. d. Organismen*, 108: 322–387, 1926.

10 J. Needham, *Brit. Jour. Exp. Biol.*, 4: 258–279, 1926.

11 E. W. Henderson and S. Brody, *Missouri Agr. Exp. Sta. Res. Bul.*, 99: 3–11, 1927.

12 A. L. Romanoff, Ph.D. Thesis, Cornell University, 1928.

13 A. L. Romanoff, SCIENCE, 69: 197–198, 1929.