

The mutations produced by the fast neutrons probably result from the action of the recoil protons and other atomic nuclei, in producing ionization along their tracts. This effect then falls in line with that of gamma and X-rays, of fast electrons, of ultraviolet and of alpha rays, in producing mutations, being most nearly akin to that of the last-named agent.

A more detailed account of the physical arrangements and of the results obtained is in course of preparation. We wish to express our thanks to Prof. Edgar Altenburg, under whose encouragement and guidance on the genetic side the work was carried out. We wish also to thank the American Oncologic Hospital of Philadelphia for the use of its 4 gm. radium bomb.

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A Short Periodic Growth Cycle and a Secular Variation in *Lemna minor*

THE rate of frond production in *Lemna*, when grown under constant conditions in which light, temperature and culture solution were all controlled, was found to be only approximately exponential and certain deviations from the ordinary compound interest law have been established. First, there is a secular variation which takes the form of a wave with a 25-35 day cycle and, secondly, superimposed on the long variation is a short periodic cycle of 4-6 days. The short wave has been followed through 15 successive cycles in one experiment. The length of the cycle of the short, and possibly also of the long wave, appears to be correlated with the mean rate of increase in frond number, in that when grown under conditions which give rise to a rapid rate of division the cycle is short, and vice versa.

Successive measurements of dry weight show a secular 'wave' as in the case of the rate of increase in frond number. The waves in both cases are of approximately equal lengths in any one experiment, but are opposite in phase. The presence of a short periodic cycle in dry weight determinations has not been definitely established, but the data available indicate its probability.

The experiments show that, while there is neither constancy in the dry weight per frond nor in the relative rate of increase in frond number, yet the rate of increase of total mass appears to be strictly exponential.

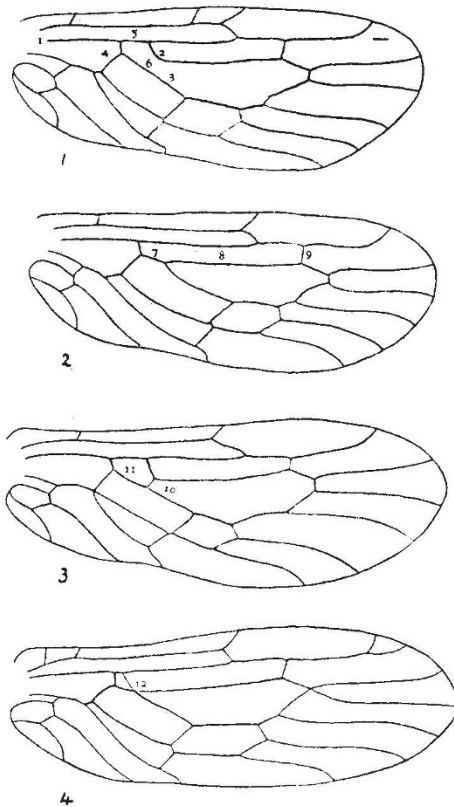
Little is known of the factors influencing the rhythmic increase in frond number and variation in dry weight, but they may be related to the fact that the growth data are those of colonies of numerous individuals, that is, that there is a social biological effect. This aspect of the matter is now undergoing investigation.

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Graded Mutations in Wings of a Stonefly

MORE than two hundred definable variants have been recognized in the wings of the variable stonefly, *Alloctenidia pygmaea* Burmeister. Some of them were mentioned in a former paper¹. The three following deviations are new and merit special reference. Figs. 1 and 2 are left and right forewings of the same female, the former nearly normal, the latter highly exceptional; Fig. 3 is the left forewing of another and Fig. 4 that of a third. Left wings are seen from below. In a typical plecopterous forewing (Fig. 1), the radial sector (2) arises directly from the radius (1) by its own radicle; it is separated from the arculus or basal anastomosis (4) by a radial internode (5) and from the median stem (3) by the basimedial



passage (6). The hindwing is characterized, typically but not invariably, by a partial fusion of radial sector and median vein, which leave the arculus by a common mediosectoral pedicel. In *A. pygmaea* these veins issue separately from the arculus on an average of 8 per cent in five hundred hindwings.

In two forewings from a sample of five hundred, there is a perfect mediosectoral pedicel (7) in the right forewing of one (Fig. 2), in the left of the other, so that there is no basimedial passage, no sectoral radicle, and the interracial cell (8) extends throughout the length of the discal area from the upper division of the arculus to the interracial crossvein (9). In several instances an adventitious mediosectoral basal crossvein (10) passes from the angle of the sectoral radicle across the intervening space to the median vein (Fig. 3), closing off a basimedial cell (11) from the median basin. This crossvein appears in three states: strong, weak and rudimentary.