A Study of the Phenomena of Cleavage in Etherized Eggs : E. B. WILSON.

The Influence of the Germ Cells upon the Somatic Cells: G. W. FIELD.

Two Improved Forms of Automatic Microtomes : C. S. MINOT.

A Study of the Phenomena involved in the Chemical Production of Parthenogenesis in Sea Urchins : E. B. WILSON.

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Independence of the Germ Nuclei in Cleavage.

A New Method of Preservation of Fragile Specimens: A. D. MEAD.

Larval Stages and Metamorphosis of the Hermit Crab: M. T. THOMPSON.

Regeneration in Planaria maculata: C. W. BARDEEN.

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Notes on Variation in the Shells of Purpura capillus: R. P. BIGELOW and H. S. CONANT.

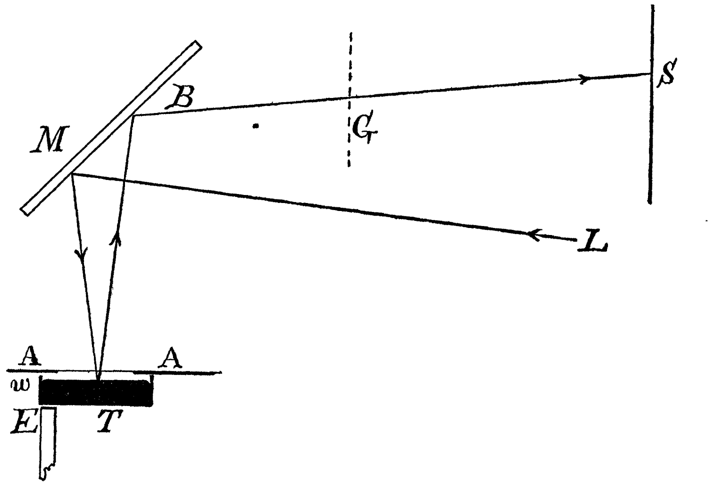
Variation and Elimination in Philosamia cynthia: H. E. CRAMPTON.

The Tentacles of Gonionemus: H. F. PERKINS.

THOS. H. MONTGOMERY, JR., *Secretary.*

THE PROJECTION OF RIPPLES BY A GRATING.

AFTER obtaining the condition under which one grating is projected by another, it seemed not unlikely that the method might be used for projection of ripples. If the latter are obtained in a trough of rectangular outline, the light reflected from them breaks up into two series of equi-



distant bright lines intersecting each other orthogonally. Hence the first grating* may be dispensed with, being replaced by

*See preceding article, SCIENCE, XII., pp. 617–627, October 26th, 1900. The bars of the grating *G* must be parallel to the projection of ripples at *S*, both being vertical lines like the axis of *G*.

the illuminated ripples which are then projected by the second grating. In the figure sunlight arriving at L is reflected from the large mirror M (one foot square), passing thence to and from the shallow rectangular trough T, containing mercury, to be again reflected by M, to the screen S. If a lens is placed at B, so that T is the conjugate focus of S, magnificent ripple patterns are seen on the screen whenever the table is slightly jarred by drumming on it with the fingers. These are stationary capillary waves originating at each of the straight edges of the trough. They may be obtained in different wave lengths in the ratio of 1:2, according as the table is more or less sharply rapped. Gravitational waves, though always markedly present, do not appear in the picture and may be ignored. To produce them observably it is necessary to have some special device for starting them. Two or three straight iron or steel wires, lying stably at w, on the capillary edge of the trough, are an excellent wave producer if controlled by the electromagnet E. Among interesting experiments of this kind I will only mention the reflection of waves, which advance with a crest and return with a trough, from a fixed obstacle, the lines in the image being respectively light and dark. It takes some practise, however, to see this, for with troughs as shallow as convenient the velocity will not lie much within six inches or a foot per second.

Returning from this digression, let the lens be removed and replaced by a grating, G, capable of rotation about a vertical axis. When the proper angle is obtained, a fairly sharp image of the ripples may be seen whenever the table is jarred. Care must be taken to avoid errors due to the diffraction by the grating of the light issuing from the round capillary edge of the mercury in T. These lines of light give rise to extensive streamers on the screen, intersected by sharp diffraction cross bands, the streamers intersecting each other at right angles in the patch of light due to the mercury surface proper. Hence an annular screen, AA, is added to blot out the convex edges.

If x is the (broken) distance between mercury and grating, G, if y is the distance between grating and screen, θ, the azimuth angle of G for which the image appears sharpest, finally if a is the distance apart of the ripples and b the grating space, the relation $a = b \cos \theta \, (1 + x/y)$ is available. To give an example of experiments tried in this way, I found roughly, $x = 105$ cm., $y = 670$ cm., $b = .21$ cm., $\theta = 30°$, whence $a = .2$ cm.

If the trough T is long (say two feet long and three inches broad), the waves from the end are dampened out before they reach the middle, and the cross waves are alone in presence there. These lines of light, if the long edge is parallel to the direction of projection, give sharper images. I have not yet, however, been able to develop this method to a degree useful for measurement, and I merely communicate it here as an interesting experiment. I may note, in conclusion, that if progressive instead of stationary ripples be produced, and if the grating move in a direction opposite to the ripples, with a velocity increasing until the shadow bands moving in the first instance become stationary, the velocity of the ripples would be deducible as well as their wave length.

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REVIEWS OF CURRENT BOTANICAL LITERATURE.

A LITTLE more than a year ago at the annual meeting of the Society for Plant Morphology and Physiology, held in New Haven, a committee, consisting of Dr. Farlow of Harvard University, Dr. MacDougal of the New York Botanical Garden and Dr.