number of species. The word 'yelk' is spelled according to the most approved usage throughout my memoir, both Webster and Worcester agreeing in this; and I would commend to my critic's attention the remarks relating to this word to be found in the work of the latter authority, where both Johnson and Walker are also cited in favor of the same spelling.

The expression of opinion by my critic as to the relative value of previous literature is unfortunate. Hoffmann's paper on the teleostean egg was cited for the very good reason that it was undoubtedly the most thorough and consecutive upon its special subject, which had appeared up to that time, or even to the present. No American work can yet claim such a distinction.

The charge that I have 'padded' my paper with unnecessary quoted matter is unfair; for, out of one hundred and eighteen pages of text, nine are taken up with citations,—a proportion greatly exceeded in the papers of many competent authorities. And I ask my critic, in all fairness to me, if, by throwing out any one of the quoted passages, the paper as a whole would not lose in thoroughness and clearness of statement; for the object of my paper was to give a general statement of the facts relating to the development of fishes, so that it might be safely referred to, especially as to the early stages.

Whether my critic sees fit to accept my views upon the layer which I have termed the 'yelk-hypoblast,' is a matter of indifference to me. For his benefit, I may cite the names of the following masters in embryology, who agree with me more or less closely: Vogt, Kupffer, Hoffmann, Rauber, Gensch, Ziegler, and even, in one sense, His and Kölliker.

JOHN A. RYDER.

Smithsonian institution, Washington, D.C.,
June 30.

[Mr. Ryder will not find 'yelk' used by the leading embryologists, either in England or America; 'yolk' being the form used by Huxley, Balfour, Allen Thompson, Agassiz, etc. 'Embryology' is also similarly employed, instead of 'embryography.' In our notice, it was not said that either word was incorrect; but we meant exactly what was printed, that they are a 'little eccentric.' In regard to Hoffmann's paper, it is by no means 'the most thorough,' but contains important errors. We fail to see how the value of Hoffmann's paper is affected by American work being considered less good. We regard Mr. Ryder's own essay as much more valuable than Hoffmann's. As to the padding, we think the charge fair that the essay contains 'an unnecessary number of lengthy extracts *and abstracts:*' the latter Mr. Ryder ignores. It is generally understood that very little editorial supervision is exercised over most of our government publications: hence they are often diffusely written, and charged with much which might better be omitted. We do not think that Mr. Ryder intentionally put in matter to fill out; but we do think he failed to leave out much that he would have omitted if his article had been for a carefully edited scientific journal. As to the 'yelk-hypoblast,' the future will decide between our opinions.

Mr. Ryder is under a misapprehension, if he thinks our notice was intended to be unfavorable; for although we pointed out some blemishes, as we held them to be, we intended to convey the impression that the substance of the work appeared to us very meritorious: therefore we said that 'the work had been done with evident care and patience,' and mentioned a long series of observations which might be 'signalized as being of especial interest and importance.' — ED.]

A remarkable new type of mollusks.

A very remarkable new form of Mollusca has recently been submitted to me for examination by Mr. G. W. Tryon of Philadelphia, who received it from Mr. C. R. Orcutt of San Diego, Cal. It was collected near that place on a stony bottom, where other bivalves are found in their season, and which appears to be nearly dry at low water. Other specimens were received direct from Mr. Orcutt, who collected about fifty. This animal is a pelecypod or lamellibranch with an *internal shell.* Nothing of the sort, or in the least approaching it, has ever been described.

The animal, from the collector's drawings, is, when living, somewhat of the shape of a small globose Cypraea, of inflated ovoid form, translucent, jelly-like, dotted above with small, rounded papillae, which appear of an opaque white on the general translucent ground. When living, Mr. Orcutt states, it was over an inch in length. The specimens sent have been contracted by alcohol to less than half an inch in length. The mantle which covers the dome of the body is tough and thick: the sides are smooth, and nearly free from papillae. The superior median line is a little depressed. The basal part of the anterior end in life is prolonged beyond the general mass in a wide trough, with the convexity upward, and somewhat expanded at its anterior extremity. About one-third of the way from the anterior end, the mantle is perforated by an orifice, which pierces it in the vicinity of the mouth. The edges of this orifice project from the general surface, and it is lined with close-set, small papillae. At about the same distance from the posterior end is another tubular perforation, holding a similar relation to the anus; which has, however, plain edges, and is not internally papillose.

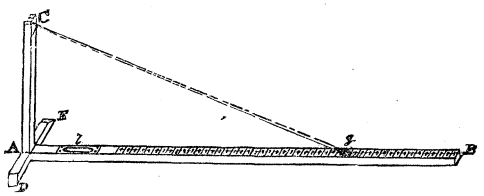
Turning the animal over, we find the anterior trough of the mantle prolonged backward, like a slit with plain edges, to about the posterior third; from this projects a narrow, hatchet-shaped foot, with a strongly marked byssus-gland at its posterior angle; from this a bunch of white byssus extends to the stone or other object to which this mollusk attaches itself. The cavity of the mantle extends some distance behind the commissure of the pedal opening. The anterior point of the foot is roofed by the trough-like expansion above mentioned. The mouth is provided with two pairs of small palpi. Two gills, very finely microscopically laminate, extend backward from near the mouth, on each side, to the posterior end of the body, the wider one being the inner: between their posterior ends a thin reticularly perforate veil connects the two pairs, and shuts off the anal area from the rest of the mantle cavity. The intestine contains a hyaline stylet, and is considerably convoluted; but the viscera offer no marked peculiarities when compared with ordinary pelecypods. The shells are enclosed in two little sacs in the substance of the mantle. The umbones are near together, apparently connected by a brown gristle resembling an abortive ligament, and are nearly over the heart. The valves are about ten millimetres long and one millimetre wide, destitute of epidermis, prismatic, or pearly layers. There are no muscular or pallial impressions, no adductors, hinge, or teeth. They resemble in form the exterior of Gervillia, as figured by Woodward, and are pure white. As they lie in the body, they diverge at a rather wide angle from the beaks, forward. The embryonic valves are retained like two tiny bubbles on the umbones.

Under as recent a classification as that adopted by Lankester, in the new edition of the Encyclopaedia Britannica, this creature would form a new order, Amyaria, as opposed to the old Mono- and Dimy-aria. These orders being pretty generally given up, though not yet out of the text-books, it is probable that no others can yet be formulated. Whatever be its relations to the higher groups, a point to be determined by further study, there can be no doubt that the animal forms the type of a new family, Chlamydoconchae, and may take the name of Chlamydoconcha Orcutti. It is evident already, that the genus does nothing toward bridging the gap between the gastropods and pelecypods, but is simply a remarkably aberrant form of the latter group, and probably derived from some form with an external shell. It is able, according to Mr. Orcutt, by sphincter-like contractions of the mantle, to produce currents of water over the gills, which are probably finally ejected by the anal tube.

A paper on the subject, with figures, will be published shortly. WM. H. DALL.

Time without instruments.

Students usually feel little interest in the method of time in astronomy by 'a single altitude of the sun,' because they do not expect to own an instrument with which to measure the altitude. They can easily make the apparatus described below, by which, with careful handling, time may be found with a probable error of fifteen seconds.



Frame together the three pieces AB, AC, and DE, at right angles, — AB about sixty inches, AC eighteen inches and a half, and DE ten inches long, and each an inch and a quarter square. Cut a half-inch slit, one inch deep, in the end C, and in the direction AB. Fasten a piece of tin one inch square, with a hole an eighth of an inch in diameter, on the right-hand face of AC at C, with its hole opposite the centre of the slit. Set in a bubble at l by which to level AB. Let fall a perpendicular from the hole in the tin plate to AB; and at about twelve inches from the foot of that perpendicular commence the graduation on the centre line AB, dividing into inches and half-inches, and numbering 12, 13, etc., towards B. It will be well to paste a strip of drawing-paper on the face AB, on which to make the graduation.

Measure once for all the exact height in inches of the centre of the hole in the tin plate above the upper face of AB, which should be about eighteen inches, and multiply it by the decimal .9994358, which product designate by h. By using this for the height of AC, all altitudes will be corrected for mean refraction.

To use it, place in the sunlight, — best when the sun is not less than 16° nor more than 45° high, — with AB levelled by the bubble, estimating by eye when AC is perpendicular, so that the bright spot from the hole in the tin shall fall on the graduated centre line of AB. With watch in hand, read the hour, minute, and second when the centre of the elliptical bright spot is exactly on some dividing-line of the scale, and call the scale-reading r: then the sine of the sun's altitude $= \dfrac{h}{\sqrt{r^2 + h^2}} = \sin a$.

For the hour-angle $= P$, the most convenient formula is, — letting δ = sun's declination, and l = the latitude of the place, $-\cos P = \dfrac{\sin a - \sin \delta \sin l}{\cos \delta \cos l}$.

This formula, with the known latitude (say, 36° 12′ 45″), may be put in the form

$$\log \cos P = \log \{\sin a - [9.77143] \sin \delta\} + a.c. \log \cos \delta + 0.09322.$$

A nautical almanac is needed for declination and the equation of time, though tabulated mean values of these for every tenth day of the year will answer for the usual accuracy required in common local time.

The form of apparatus may be varied to suit the taste of the student, or he may use the tin disk with a plumb-line suspended from it, in connection with a straight-edge levelled by a carpenter's level, and these of any lengths he chooses.

Time by 'equal altitudes of the sun' may be found by the same device.

A. H. BUCHANAN.

Cumberland university, Lebanon, Tenn., July 4.

Rotation experiments on germinating plants.

The opposite growth of the root and stem of a germinating plantlet, under other influences than that of gravity, we have recently shown by the following experiments. A circular trough (seen in section, b b, fig. 1) some sixteen inches in diameter and three

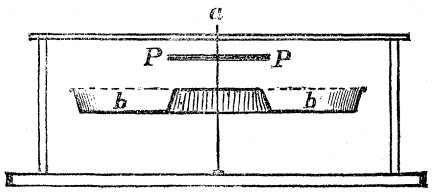


FIG. 1.

deep, rotates about the vertical axis a a. The trough, closely filled with earth, was planted with a quantity of well-soaked beans and seed-corn, and the whole covered with the fine gauze represented by the dotted lines. Forty-eight hours were allowed for the seeds to begin their growth, before the trough was started in rotation. By means of a Tuerk's motor, a uniform and continuous motion, at the rate of one hundred and eighty revolutions per minute, was then maintained for four days. At the end of this time the earth was carefully removed, and the positions of the young plants precisely noted. It was universally observed that the stems were accurately directed towards the axis, and the roots towards the circumference, of the trough. Figs. 2–6 represent several specimens. A B is the horizontal, A being towards axis, and B towards circumference; those of figs. 2, 5, and 6, were at a radius of six inches from axis; figs. 3 and 4 had radii of five and four inches. The curves at the points C, C, C, C, are quite significant, being the points to which the radicals had extended before