are not viewing the demonstration are disturbed by the walking about. A good example of such a demonstration is that illustrating the effect of dilute nitric acid on the surface tension of a drop of mercury in the presence of a crystal of potassium dichromate. Where a reflecting stereopticon is available it could be used to throw the image upon the screen, but this necessitates darkening the room. A much simpler method and one easily adaptable to almost any demonstration which is difficult for the entire class to see at one time is to place a mirror at an angle of forty-five degrees behind the demonstration and raise the whole a little above the level of the class. For small demonstrations a mirror from the five-and-ten cent stores is adequate. This can easily be held in place upon a board in which two finishing nails of the proper length have been driven at an angle of forty-five degrees, and one nail in the center set back behind these to keep the mirror from slipping.

If the demonstration is small so as to be seen with difficulty from the rear seats, a reading glass of a suitable magnification can be placed at the proper distance from the mirror. In this case the entire demonstration should be placed upon a board or platform so that it can be swung into the line of vision of those on the sides. Other modifications and applications will suggest themselves.

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SPECIAL ARTICLES

TRIANGULAR NEPIONIC COILING IN CARBONIFEROUS AMMONOIDS

A FRAGMENTARY cast of a fossil, which, except for its apparently triangular method of coiling, suggested the umbilical portion of a glyphioceran cephalopod, was collected by the writer in the fall of 1923 from the sparingly fossiliferous lower Pennsylvanian Winslow formation near Fayetteville, Arkansas. An extended search failed to yield additional material. About a year later, however, Dr. N. F. Drake, formerly state geologist of Arkansas, kindly placed at the writer's disposal several cephalopods which had been blasted out of the same formation on Mount Nord within the city of Fayetteville. Upon cleaning the material, the umbilical portions of these cephalopods showed that the coiling of their earlier whorls was distinctly triangular, although the individuals again assumed the ordinary circular method of coiling in their later stages of growth.

A canvass of the literature failed to find any reference to this phenomenon, and the questioning of a number of paleontologists over a period of several years led to the conclusion that it had not previously been observed. Because of the scantiness of the material and its rather poor preservation, as well as the unusual nature of the discovery, the writer has hesitated to record the phenomenon. Recently, however, as a result of continued questioning it was discovered that H. D. Miser, of the U. S. Geological Survey, had in 1927 collected from the Atoka formation near Clarita, Oklahoma, a number of unusual cephalopods which were sent to Dr. R. C. Moore, of the University of Kansas, for study. These specimens also exhibit this same peculiar triangular coiling of the earlier whorls. Furthermore, when this feature was called to the attention of F. B. Plummer and Gayle Scott, who are studying the Carboniferous cephalopods of Texas, they found that upon cleaning out the umbilical area of some of their specimens from the Bend group the same nepionic triangular coiling became apparent. In addition, the writer recently received from John McCormack, of the Oklahoma Agricultural and Mechanical College, a number of cephalopods from the Atoka (?) formation taken from a clay pit near Ada, Oklahoma. Among these specimens there are two individuals which illustrate perfectly this triangular method of coiling. Furthermore, although these specimens are not complete, their last preserved whorls fail to assume complete circularity, though they are somewhat more rounded than the earlier ones. Finally, in examining specimens of Bend group cephalopods in the Walker Museum collection it was found that a number of these individuals also show a definite tendency toward angular coiling in the nepionic and neanic stages, though the triangularity is less pronounced than in the other specimens mentioned above.

Additional interest attaches to this phenomenon since it is apparently confined to members of the cephalopod family Glyphioceratidae, and, as far as present information goes, largely to the genus *Paralegoceras*. Furthermore, although it has now been observed in specimens collected from a number of different localities, the extremes of which are nearly 500 miles apart, all the individuals have been found at essentially the same geologic horizon, that is, lowermost Pennsylvanian. The formations yielding the cephalopods are the basal Winslow, just above the Morrow group, at Fayetteville, Arkansas; the basal Atoka, just above the Wapanucka limestone (which carries a Morrow fauna), at Clarita, Oklahoma, and in north-central Texas, the Smithwick formation, which overlies the Marble Falls limestone (also with a Morrow fauna). The specimens from near Ada

are reported to have come from the Atoka formation also, and the general appearance of the associated specimens supports this statement. No Atoka, however, is shown in the vicinity of Ada on the new geologic map of Oklahoma. Therefore, these particular specimens may have come from somewhat younger beds than did the others.

In conclusion, it is interesting to speculate on the significance and origin of this phenomenon of triangular coiling. Aberrances of one sort or another are not uncommon in cephalopods of the phylogerontic type, but the Glyphioceratidae are simple rather than specialized ammonoids. Furthermore, these phylogerontic aberrances in most cases are also phenomena of individual old age, and not of youth, as is the case in the forms described above. In addition, if all cephalopods in their various stages of development recapitulate their ancestry, as certainly most of them do, these peculiar types point to an ancestral stage in which the adults were triangularly coiled. Not only is no such cephalopod known, however, but it is particularly difficult to imagine the existence of such a type prior to Pennsylvanian time. It therefore seems more probable that the cephalopods described in this note are pathological in respect to the manner of coiling of their earlier whorls. If the latter is the case, however, it is not a little remarkable that the same pathological feature should manifest itself in the same general type of cephalopod, at nearly if not quite the same geologic horizon, and in specimens found over a relatively large area, geographically speaking. Supporting the suggestion that the forms described above may be pathologic is the fact that normal nepionic coiling is found in most associated cephalopods. It has not yet been determined satisfactorily, however, whether some individuals of a certain species may be coiled normally and yet others of that species exhibit the triangular nepionic coiling, or whether this type of coiling characterizes all individuals of each species exhibiting this phenomenon.

The writer would appreciate additional records of the occurrence of this type of cephalopod.

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STIMULATORY EFFECTS OF ULTRA-VIOLET RADIATION UPON HIGHER PLANTS

THE apparently contradictory results of recent investigators concerning the possible stimulation of the growth of higher plants by ultra-violet radiation led to the work reported briefly here. Chief among these investigators are Eltinge[1] and Sheard and Higgins,[2] who have demonstrated that ultra-violet wave-lengths above the lower solar limit, 290 μμ, are beneficial to and seem to stimulate plant growth slightly; and Popp and Brown[3] and Newell and Arthur,[1] who failed to find any stimulation whatsoever in the ultra-violet spectrum.

It appears that these varying results are attributable to differences in methods of irradiation and to other parts of the technique employed by these workers, since similar portions of the spectrum were used in the investigations.

The plants used were tomatoes and cucumbers, reported by Newell and Arthur, and Popp and Brown, respectively, to be unaccelerated in their growth by the radiation from a quartz mercury vapor arc. The experimental groups were the following:

A—Controls.

B—Plants rayed with quartz-lite filter (transmitting to 313 μμ) one half minute on the first day, increased by half a minute on each following day.

C—Plants rayed with quartz-lite filter for 9 minutes daily.

D—Plants rayed with vita-glass filter (transmitting to 289 μμ), with periods as in set B.

E—Plants rayed with vita-glass filter with periods as in C.

The plants were rayed at 100 inches from the arc through a period of five weeks, with 100 plants in each group. The populations of 100 plants as shown by statistical analysis eliminated the factor of individual variation, which had been neglected by previous workers.

It will be noted that the periods of radiation were adjusted so that at the end of the experiment the incremental and constant period groups would have received equal amounts of radiant energy; hence differences in the reactions of the plants subjected to the two methods are attributable only to the differences in the arrangement of the irradiation periods, not to differences in amounts of energy received.

In general, the results point to definite stimulation where the distance was 100 inches. In a preliminary experiment at 50 inches, when the lamp was screened with the quartz-lite filter, there were no injurious effects and there was apparently a small amount of increased growth. At 100 inches, all rayed sets showed very definitely greater growth than the controls; in both plants, the greatest amount of increase occurred in the vita-glass constant-period group, set E; here, in the tomatoes, the plants at the end of the period showed an increase 33 per cent. greater than

[1] Eltinge, *Ann. Mo. Bot. Gard.*, 15: 169–240, 1928.
[2] Sheard and Higgins, SCIENCE, 65: 282–284, 1927.
[3] Popp and Brown, *Amer. Jour. Bot.*, 15: 623, 1928.
[4] Newell and Arthur, *Amer. Jour. Bot.*, 16: 338–354, 1929.