DISCUSSION

THE SPIRAL STRUCTURE OF PROTOPLASM

THERE is now fairly general agreement among certain cytologists that chromosomes or their essential parts, the chromonemata, maintain a spiral structure in all stages. The recent work of Koshy[1] is one example in which this view is maintained.

The writer has investigated the structure of the iron bacterium, *Leptothrix ochracea*. This bacterium was fixed and treated in different ways. It was found that the bacterium is composed of series of longitudinal spirals. Spiral structure has also been observed by the writer in his photomicrographs of fixed preparations of green, filamentous, fresh-water algae.

Five years ago Seifriz[2] stated that the spiral habit seems to be a fundamental heritable quality of protoplasm.

While recently looking through Seifriz's book on protoplasm I was arrested by his photomicrograph[3] of the quiescent protoplasm of a slime mold taken with a Spierer lens under dark-ground illumination. In some parts this picture shows complete spirals. Throughout the remaining parts of the picture structures typical of spirals in optical section are shown. For example, series of short parallel curves arranged one behind the other represent slightly obliquely placed spirals. Series of short, parallel lines arranged one behind the other represent spirals at right angles to the optical axis. A slight thickening at each end of the short lines shows the upward and downward coil in profile and results in slightly dumb-bell-like appearances. When seen end on, the spiral shows a comma-like appearance with the tail of the comma representing the spiral receding in depth. All these appearances are seen in Seifriz's photomicrograph and in the reproduction of it in his book. So it appears that this photomicrograph solves one of the major problems of protoplasm, for it shows the structure of the disperse phase to be spiral in the living state. Through Professor Seifriz's courtesy I have been able to examine the original photomicrograph.

With the spiral structure of Seifriz's photomicrograph as a guide the writer has examined living protoplasm microscopically with ordinary bright-ground illumination and conventional apochromatic lenses. The examination included living cells of stamen hairs of *Rhoeo discolor* and living epidermal cells of the bulb scale of the onion (*Allium cepa*). Spiral structure could be seen in each case. In the onion spiral structure was visible in the nucleus as well as the cytoplasm.

[1] T. K. Koshy, *Annals of Botany*, n.s., 1: 52, 56, 1937.
[2] W. Seifriz, SCIENCE, 77: 50, 1933; 78: 361, 1933.
[3] W. Seifriz, "Protoplasm" (McGraw-Hill), fig. 119, 1936.

The observations on the spiral structure of protoplasm, which are outlined above, bring the nucleus and the cytoplasm into the same structural class. The disperse phase of the nucleus and of the cytoplasm is evidently spiral in structure.

The remarkable elasticity of protoplasm is explained by its spiral structure. An example of protoplasmic elasticity is given by Scarth.[4] He showed that the nucleus of *Spirogyra* can be pushed by micromanipulation from one end of the cell to the other, but when it is released it immediately recoils to its original position.

The spiral structure of protoplasm can be correlated with several fundamental conceptions of life. One of these conceptions is that of crystalline character. The spiral is fundamentally a crystalline form with a screw-shaped axis. Accordingly, the spiral structure of protoplasm can be regarded as the basis of the crystalline conception of living material.

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THE STING OF THE ANT, PARAPONERA CLAVATA

IN an article, "The Sting of an Ant,"[1] I gave the history of the effect of the sting of a worker of the ponerine ant, *Paraponera clavata* Fabr., in British Guiana. The ant stung my knee over the patella through heavy khaki and produced paralyzing symptoms, then a large and persistent blister. The well-founded reputation the sting of this ant has in South America for producing severe systemic symptoms in humans was described.[2]

In discussing the effects of the stings of this species with entomologists and other scientists I was puzzled by accounts of their experiences in Ceneral America, especially Panama. Several persons described being stung by these ants without incurring such severe symptoms as resulted from stings in South America. The stings, however, were always equal to a bad wasp sting. This past summer on Barro Colorado Island in the Panama Canal Zone I was stung by this species[3]

[4] G. W. Scarth, *Protoplasma*, 2: 194, 1927.
[1] *Am. Jour. Trop. Med.*, 17: 765–768, Fig. 1, 1937.
[2] In the "Medical Report of the Hamilton Rice Seventh Expedition to the Amazon, in Conjunction with the Department of Tropical Medicine of Harvard University, 1924–25," Harvard University Press, Cambridge Massachusetts, 1926, Dr. J. Bequaert has reviewed (pp. 250–253) the effects of the stings of this ant upon natives and whites in the Amazonian basin. The worker ant is well figured on page 253 (Fig. 8). The reputation this ant has among the natives and the effects of the sting upon whites recorded by Dr. Bequaert are added proof that I was not unusually susceptible or allergic to such poison in British Guiana.
[3] The ant is called "chacha" by the Panamanians and

and the effect seems worthy of comparison with that previously described. Conditions under which I was stung were comparable, to the extent that both times I was in good health and accustomed to the stings of numerous kinds of ants.

June 25, 1938, at 2:19 P.M., while excavating the nest of the ant *Sericomyrmex amabalis* Wheeler, I felt a sting comparable to a severe wasp sting on the skin at the junction of the middle and upper third of the left forearm opposite the medial aspect of the biceps muscle. I was wearing a short-sleeved jacket and reflexively brushed the sleeve, whereupon a dealate female *Paraponera clavata* 27 mm. long tumbled to the ground. She had climbed up the sleeve as it momentarily touched the ground and the course of the sting could be followed into the skin as a reddish line 2–3 mm. long on a slight edema resembling that following a mosquito bite. No reaction of the surrounding tissues other than those described above had occurred eight minutes later. At 2:41 an urticarial-like lesion with a central edematous area 2 mm. in diameter and an erythematous halo approximately 40–50 mm. in diameter had appeared.

There was a dull, burning sensation associated with the lesion. By 5:00 P.M. an oval area fully 150 mm long on the inner surface of the forearm was reddened peripherally. A distinctly yellowish edematous area about 100 mm long occupied the center of the reddened area. The burning sensation continued. No systemic reaction was noticed and there was no evidence of lymphangitis extending toward the axilla nor any tenderness or enlargement of the axillary lymph nodes at any time. At 7:30 the lesion was disappearing, though the burning sensation was still present. No medication was applied to the lesion at any time, except that the customary evening shower with soap was taken just before 5:00 P.M. The next morning the area was slightly reddened but not painful. The process gradually disappeared, leaving the arm completely normal.

The effect of this sting of the Panamanian ant strikingly contrasts with that of the Guianan ant previously described. Both belong to the same species and have not been separated, even as different subspecies or varieties, though numerous specimens from both Central and South America have been examined by myrmecologists. The fact that it was a female and not a worker ant which stung me in Panama means that fully as much, if not more, poison was probably injected. Female ants are larger and commonly the sting is more intense than in workers. She had every opportunity to inject a full dose of poison directly into the flesh, while the Guianan worker stung through heavy khaki cloth and was brushed off almost at the time it started to sting. The Panamanian sting, on the medial surface of the forearm, was in an ideal place to be absorbed quickly into the axillary lymph nodes and produce systemic disturbances, while the Guianan sting was over the patella where the blood supply and drainage would be relatively poor.[4] Yet in the Panamanian sting recovery was complete in a few hours; in the Guianan it took over a week.

This difference in virulence of sting in the same species of ant suggests a physiological difference unaccompanied by obvious morphological characters which seems not to have been recorded among ants or related insects.

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is common in the rain forests of this region. Nesting and other habits are essentially similar to those in South America. This species excavates irregular chambers a few centimeters in diameter in the soil at the base of a tree, frequently a buttressed tree. From the nest a soil-covered chimney several centimeters in diameter is usually built to a height of sometimes 10–30 cm. This chimney may be washed down during heavy rains, leaving an opening to the nest occasionally 10 cm in greatest diameter. When their tree is sharply rapped or when the surrounding soil is stamped the ants come "boiling" out and wildly dash about in search for the disturber. Any moving animal in their path is viciously stung. Those ants of a Panamanian nest did not climb trees in their search for a disturber higher than 60 cm, usually about 10 cm. In South America I often found them climbing trees to a height of two meters.

A REVERSED CRYPTOBRANCHUS

A RECENT article in SCIENCE by Helen A. Wragg on a reversed cat leads to this brief report on the same situation in a large female Cryptobranchus. It was discovered this fall during routine laboratory dissections. As far as can be ascertained, the reversal is complete, with stomach and spleen on the animal's right rather than on its left side. The position of the gall bladder and duodenum has shifted to the left. This condition not only shows itself in the digestive tract, but is obvious in the position of the heart within the pericardial sac, and the relation of the portions of the heart to each other. It is reflected again in the distribution of the intestinal blood vessels. The animal was a perfect specimen and all organs were normal in size and appearance.

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VEGETATIVE REPRODUCTION OF SQUASH TYPES

VEGETATIVE reproduction of squash types, *Cucurbita* spp., has been developed and is now being used to sup-

[4] This probably accounts for the localized lesion which resulted compared with the severe systemic disturbance produced by stings in other parts of the body in the usual South American case.