The perforatorium of the ripe spermatozoon tapers off in the form of a corkscrew. In Ringer's fluid it swells into a bleb-like process and as such is figured by Duesberg and Morse. The tail has two movements, a whip-like lash and a twirl, its base being used as a pivot. These two movements whirl the spermatozoon forward in a corkscrew fashion. It may be noted that the lashing movement of the spermatozoon tail is directly comparable to the waving of the axial filament within the spermatid.

In conclusion I wish to emphasize the following points drawn from this and from my previous paper:

1. As far as nuclear structures are concerned the study of fresh material corroborates, in many interesting details, the observations made in fixed material. Both methods are necessary for a proper understanding of the structures. Our present fixing methods, however, are useless for the study of cytoplasmic and mitochondrial structures and should be replaced by the study of fresh material.

2. "Physiological" salt solutions are more or less injurious to the cells studied which are normally bathed by organic fluids, *i. e.*, liquid colloids.

3. Puncture of a cell by a needle causes irreparable injury. When the injury is slight it at first hastens the normal reversible changes in the physical states of the colloids in the cell but soon transforms them to an abnormal condition from which the cell does not recover.

4. Injury to the cell is always followed by swelling accompanied by an increased inhibition of water.

5. A tension exists in the cell during division which is immediately lost when any part of the cell is torn.

6. Amœboid activities are prevalent among the germ cells. In this way extensive movements occur within the cysts of the testis follicle. When set free in a liquid medium, the amœboid processes are very soon retracted and the cells assume a spherical shape.

The movement in waves of the axial filament of the spermatid starts at the conical knob on the nucleus and accompanies the uncoiling of the filament from the surface of the Nebenkern.

7. The staining of the mitochondria by Janus is probably not due to a chemical combination. In time the stain fades out of the cell. If the stained structure be brought into immediate contact with a liquid it is washed out almost immediately.

8. Janus green, if used in sufficient concentration, will stain the nuclear structures. The dye is reduced to the red safranin even in the presence of abundant air. This has been observed in all stages of the germ cells and also in motile spermatozoa. Such cells, however, soon die. Dead cells take up the blue stain readily, the nuclear structures showing beautifully.

9. Janus green, being a basic dye, coagulates albuminous substances. In living cells this coagulating effect is very noticeable. The stain, therefore, can not be used as the sole means for identifying mitochondria.

10. The mitochondria, in the Orthopteran germ cell, are in accord with those studied by the Lewises[3] in the tissue cells of the chick. They can not be classed as persistent structures. They pass from a granular stage into strands; they may coalesce into homogeneous masses; they disappear and reappear and must be merely changes in physical states of the colloids which compose the cytoplasm.

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SOME NEW CASES OF APOGAMY IN FERNS. PRELIMINARY NOTE

SEVERAL cultures of *Aspidium tsussimense, Pellæa adiantoidis* and *Lastrea chrysoloba* were made beginning June 25, 1914. The spores were sown on sphagnum, which was first placed in small stender dishes, saturated with a one-tenth-per-cent. Knop's solution, and then thoroughly sterilized in an oven.

[3] M. R. and W. H. Lewis, "Mitochondria in Tissue Culture," SCIENCE, N. S., XXXIX., p. 330, 1914.

So far as I have been able to observe, nothing unusual occurs in the early stages of development of the prothallia of any of the three species. The prothallia of *Aspidium tsussimense* and of *Lastrea chrysoloba* grow to a large size and are typically heart-shaped. The prothallia of *Pellæa adiantoidis* are much smaller and in some respects resemble those of *Pellæa atropurpurea,* in which species I described apogamy in 1910.[1] Antheridia are produced in large numbers on many of the prothallia of each of the three species here under consideration. The antherozoids are actively motile and appear to be normal in every respect. Archegonia have been observed on some of the prothallia of *Lastrea chrysoloba.*

On the well-developed cushion of the prothallium of *Aspidium tsussimense,* usually at some distance back of the apical notch, a number of papillate projections appear. These projections frequently occur in groups. Sometimes each consists of a single cell, but more frequently of a single row of cells. In this portion of the prothallium, usually after the projections have been formed, a compact mass of cells appears which develops into an embryo. At an early stage in the formation of this apogamous embryo, tracheids are produced. The developing embryo never produces a foot. The primary leaf as a rule is formed in advance of the primary root. The stem appears later than the leaf and the root. Even while the embryo is very young, numerous scales appear on the petiole of its primary leaf. These resemble the scales so characteristic of the mature sporophyte.

The prothallia of *Pellæa adiantoidis* also produce embryos apogamously. The development of the embryos appears to be similar to that described in my previous paper for that of *Pellæa atropurpurea.* In a number of cases in my cultures the embryo has already formed the primary leaf and the primary root.

When the embryo of *Lastrea chrysoloba* is about to form, a small light region appears between the apical notch and the cushion. In this region the embryo is developed. In all of my cultures the apogamously produced embryo has just begun to project above the surface of the prothallium. Embryos developed from a fertilized egg have not been found. When prothallia-bearing archegonia are placed in a drop of water on a slide and examined microscopically, the archegonia can be observed to open, but antherozoids do not appear to be attracted to them.

While the prothallia of these species of ferns were being grown, numerous cultures of other species maintained under the same conditions of nutrition, light, temperature and moisture, contained prothallia bearing antheridia and archegonia, and in some cases embryos were produced upon these prothallia as a result of fertilization.

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[1] *Bot. Gaz.,* 42, 400–401, 1910.

THE AMERICAN SOCIETY FOR PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS

The sixth annual meeting of the Pharmacological Society was held in St. Louis at Washington University Medical School on December 27–30, 1914. There were five scientific sessions, three of them being joint meetings with the other members of the Federation of American Societies for Experimental Biology, the Physiological Society, the Biochemical Society and the Society for Experimental Pathology.

The following officers were elected in the Pharmacological Society for the year 1915:

President: Torald Sollmann.

Secretary: John Auer.

Treasurer: Wm. deB. MacNider.

Additional members of the council: Worth Hale and D. E. Jackson.

Membership Committee: S. J. Meltzer (term expires 1917).

Election of New Members: The following candidates were approved by the membership committee, passed by the council and elected by the society: Dr. F. C. Becht, University of Chicago; Dr. W. H. Brown, Rockefeller Institute; Dr. F. L. Gates, Rockefeller Institute.

The attendance was excellent, but the eastern section of the country was not as well represented as could be desired.

The scientific sessions were opened on Monday, December 28, at 9 A.M. by a joint meeting of the