

3. The sum total of the energies of these lesser units constitute cellular life.

4. Differentiation is caused by specific irritation of certain kinds or elementary units, instigating these to multiplication and therefore to supremacy over the other units.

5. The cell does not lead a double life; it leads only one life, namely, an independent life. There is, in fact, only one life that we know of.

6. The axiom that a function presupposes cellular structure is not proved. Structure presupposes function is more acceptable, as it may be supported by direct evidence. Cellular structure becomes more complicated if the function of the cell is more energetic.

7. Structure is a side product formed during the exchange between stimulus and reaction. (Was supported by examples from the organic and inorganic world.)

8. The elementary units of the cell are partly demonstrated in the microsomes, chromatin granules and centrosomes. The microsomes are of different kinds, some of which were demonstrated by slides.

1. *Origin of the Centrosomes in the Unfertilized Egg of Chætopterus.*
2. *The Behavior of the Centrosomes during the Maturation and Fertilization of Chætopterus.*
A. D. MEAD.

There is in the egg of Chætopterus a definite body, the centrosome, which is not an artifact, and which is not identical with the centrosphere or astrosphere, though the latter is sometimes present.

In the 'oöcite of the first order,' *i. e.*, the unmaturation egg, the centrosomes arise by a modification of pre-existing cytoplasmic structures. Those of the first and succeeding cleavage spindles are identical with, or derived directly from, the male centrosomes, which are probably brought into the

egg with the middle-piece of the spermatozoon.

The centrosomes, whatever their origin, are capable of growth and multiplication and persist through at least several cell generations.

There is no union of male and female centrosomes during fecundation—no 'quadrille of the centers.' The female centrosomes entirely degenerate, and therefore cannot be considered a special means for conveyance of hereditary qualities.

The centrosphere, a differentiated region about the centrosome, gives a different reaction from the centrosome, on the one hand, and the rest of the cytoplasm, on the other, both in point of color and resistance to certain reagents. Corrosive-acetic and certain other reagents will sometimes completely destroy the centrosphere, though the rays and other structures are fairly well preserved.

The centrospheres, unlike the centrosomes, appear and disappear with each succeeding karyokinesis. When they are present the cytoplasmic rays of the aster are not so strongly developed as when they have disappeared and the rays diverge directly from the centrosomes themselves.

The centrosomes divide and move apart within the centrosphere for a considerable distance without altering the spherical shape of the latter structure.

On the Origin of the Centers of the First Cleavage Spindle in Unio Complanata. F. R. LILLIE.

After the formation of the second polar body the inner centrosphere and a large part of the aster become converted into archoplasm, against which the egg nucleus lies. The archoplasm is vesicular (or reticular) in structure, and contains the centrosome, though the latter cannot be distinguished on account of the entire disappearance of radiations. The sperm nucleus

lying in the egg substance is, at this time, perfectly naked, *i. e.*, unaccompanied by archoplasm or radiation of any sort. As the sexual nuclei approach each other, radiations appear around the centrosome in the archoplasm; or these radiations appear first after the nuclei have met. *There can be no doubt in either case that the centrosome around which they appear is the egg center*, seeing that it lies within the archoplasm, which always accompanies the egg nucleus. The centrosome then divides in two, forming the amphiaster of the first cleavage.

The egg and sperm nuclei never fuse to form a single vesicular cleavage nucleus, but each forms its own group of sixteen chromosomes.

The study of the earlier stages shows, that the sperm head is accompanied soon after its entrance by a comet-like aster, with a minute centrosome. *This centrosome divides and forms an amphiaster, which entirely disappears in the late anaphase of the first maturation spindle. The sperm centrosomes never become functional again.* But a supernumerary central aster appears near the center of the egg during the metaphase of the second maturation spindle. This aster also disappears during the anaphase of the same spindle.

Thus the mode of fertilization in *Unio* agrees with that in *Myzostoma*, in so far as the centers of the cleavage spindles are derived from the ovum, but differs from it in as much as the spermatozoön in *Unio* brings in a centrosome, whereas the spermatozoön of *Myzostoma* does not introduce a centrosome into the ovum. *Unio* is thus in a certain sense intermediate between *Myzostoma* and those forms in which the sperm centrosome forms the active centers of the cleaving ovum.

Centrosome and Middle-piece in the Fertilization of the Egg. E. B. WILSON.

In an earlier paper the author had de-

scribed the sperm-aster in *Toxopneustes* as arising about the middle-piece of the spermatozoön as a center. Within the central mass thus formed no constant central granule could be found; the conclusion was therefore drawn that the middle-piece as a whole must be identified as the centrosome. Later studies on material differently fixed show that this conclusion was erroneous. In eggs fixed in picro-acetic and weak sublimate-acetic (1-5 per cent. acetic) the middle-piece stains intensely black and its entire history can be accurately followed in sections. As the sperm nucleus moves inward the middle-piece separates from the nucleus, is left behind, and finally breaks up and degenerates. The astral rays are thus found to focus at a point lying at the base of the nucleus, between it and the middle-piece. At this point is an extremely minute intensely shining granule, which undoubtedly is the centrosome, as described by Boveri, von Rath, Hill and Kostanecki. The centrosome occurs in the same form in *Arbacia* and *Asterias*. In some cases the sperm-aster and centrosome move away from the nucleus before the latter has separated from the middle-piece. These facts demonstrate that the middle-piece proper is not the centrosome, and that the latter is an infinitesimal granule which lies either inside the middle-piece or between it and the nucleus.

In *Arbacia* the sperm centrosome can be traced continuously though the first cleavage into the 2-cell stage, as in *Chaetopterus*, *Thalassema* and *Physa*; and precisely as in those forms in the late anaphases each cleavage centrosome, after doubling, gives rise to a daughter-amphiaster and central spindle which are, however, of extraordinary minuteness. In *Toxopneustes*, after exactly the same treatment, the result is apparently different, agreeing in substance with the author's earlier studies and with the accounts of Boveri and Reinke. In the 'pause,'