UPON deposition, a series of changes is inaugurated leading to the formation, entirely from the germinal vesicle, of a barrel-shaped maturation spindle. *This spindle is devoid*, as far as can be ascertained, *of centrosomes, asters, centrospheres*, etc., at both ends. The spindle moves as a whole to the periphery, the sixteen chromosomes divide, the daughter chromosomes diverge to the head of the barrel, and the first polar body is extruded. The spindle fibers withdraw from the chromosomes and condense at the middle of the extent, forming a dense Zwischenkörper. A second maturation spindle is formed, a counterpart of the first, except that eight chromosomes pass into the second polar body, while eight remain in the egg. A vesicular nucleus is formed by these latter. The polar bodies arise at the area destined to be the vegetative pole.

The sperm enters at or near the future animal pole. The sperm-head is preceded by a double centrosome, surrounded by a distinct aster. The centrosomes diverge, as they progress inwards, each surrounded by an aster, but without any fibers passing between them comparable to the 'central spindle' of the annelid, mollusk and other types. After the asters have taken up their positions for the future cleavage-figure the now vesicular sperm-nucleus and the egg-nucleus take up their positions side by side midway between the asters.

A *barrel-shaped spindle*, precisely similar to that of the maturation stages, is formed *entirely from the segmentation nucleus*. The presence of an aster and a double centrosome at either end of the figure gives the appearance of a continuous spindle passing from center to center. Such, however, is not the case. After division of the chromosomes the daughter products diverge only to the heads of the barrel, not one-half the distance to the centrosome. There they become vesicular and ultimately fuse, while the spindle-fibers withdraw from them to form a 'Zwischenkörper,' as in the maturation stages. Only then does the cell divide. And only after the formation of the vesicular daughter-nucleus do the two centrosomes in each cell move apart. When they do, the daughter-nucleus moves up between them, and the series is repeated. A comparative independence, then, of the processes undergone by the nucleus on the one hand, and the centrosomes and asters on the other, is indicated.

The Asters in Fertilization and Cleavage. E. G. CONKLIN.

IN *Crepidula* and several other genera of marine gasteropods there is a well-marked centrosome and sphere in both polar spindles. In the metaphase this centrosome is a single densely-staining body; in the anaphase it greatly enlarges, and the center of the body does not stain; in the telephase it becomes a large sphere with an extremely thin surface layer, containing a large number of coarse granules. During the metamorphosis the centrosome has changed its staining reactions; in the prophase and metaphase it takes only nuclear stains; in the telephase it takes only plasma stains, while in the anaphase it takes both.

Though the spermatozoon frequently enters before the first polar body is formed no sperm aster appears until the metaphase of the second polar spindle. This aster is large and conspicuous, though not as large as the aster of the second polar spindle which remains in the egg; it frequently contains several dark-staining granules. At the same time one or more accessory asters appear in the egg; these are much smaller than either the egg or sperm aster, and no centrosome could be found in them. The sperm and egg asters become very large and have the same structure and staining reactions, the radiatio nsfrom them proceeding for some distance through the egg. Each remains in close contact with its own nucleus, so that there is no possibility of confusing and mistaking them. When the pronuclei come together the asters also come into contact. The origin of the cleavage centrosomes has not yet been satisfactorily determined.

In the prophase of the first cleavage the chromatin is clearly distinguishable into two kinds, oxychromatin and basichromatin; the latter only takes part in forming the chromosomes; the former becomes arranged like beads on the spindle fibers and is apparently drawn to the two poles. It seems to take no part in the formation of the daughter nuclei and probably forms a part of the granular substance of the sphere. All the cleavage centrosomes undergo a metamorphosis similar to that of the polar spindles and in the telephase of each cleavage the poles of the spindle are occupied by a granular sphere frequently as large as the nucleus, or even larger. These spheres, in every case, move to those portions of the cells which lie nearest the polar bodies. In this position they can be recognized through one and, in some cases, two or three subsequent divisions. It results from the fact that after the first two cleavages the sphere substance is differently distributed to the different cells, the entire sphere substance of one generation always going into those cells of the next generation which lie nearest the animal pole. This differential distribution of the spheres has been followed through every cleavage up to the 24-cell stage. As the form of cleavage is perfectly constant it follows that the sphere substance of any generation goes into certain definite cells which have a perfectly constant origin and destiny. This differential distribution of the spheres is not caused by their specific weight, since their movements are the same in whatever position the egg may be placed. It seems to be the result of a form of polarity which, like that of the egg itself, is not the result of gravity.

The centrosomes do not apparently arise from the sphere substance of the previous division, but some distance from it, and the sphere substance itself never divides, but each sphere ultimately grows ragged at its periphery and gradually fades out into the general cytoplasm.

The differential distribution of these spheres and their subsequent conversion into cytoplasm suggests that they may be important factors in the differentiation of the cleavage cells, and if further investigation should establish the fact that they are in part composed of the oxychromatin of the nucleus it would furnish a basis, in fact, for certain well known speculations of DeVries, Weismann and Roux.

Considerations on Cell-lineage and Ancestral Reminiscence, based on a Re-examination of Some Points in the Early Development of Annelids and Polyclades. EDMUND B. WILSON.

THIS paper attempted to reconcile the apparent contradiction in cell-lineage between the annelids and polyclades, and to show that homology and ancestral reminiscence may appear as clearly in the cleavage period as in other stages. In *Leptoplana*, a polyclade, all of the first quartets of micromeres produce ectoblast, as in the annelids or mollusks, while the main mass, if not all, of the mesoblast arises by delamination from the second quartet. The formation of ecto-mesoblast ('larval mesenchyme,' or 'secondary mesoblast') from cells of the second or third quartets in the mollusks was interpreted as a reminiscence of what occurs in the polyclade, and evidence was given that a similar reminiscence occurs in some annelids (*Aricia*).

In the polyclade the fourth quartet is purely entoblastic; but the posterior cell