(2) Since the plant can feed successfully on adsorbed ions, it appears that the significance of the "soil solution" has been overestimated.

(3) The solubility concept is not adequate enough to account for plant growth in soils of humid regions. Ionic exchange must be taken into consideration.

(4) The study of the adsorbed (exchangeable) ions in the soil offers great possibilities for a better understanding of many soil-plant relationships and soil fertility problems (*e.g.*, utilization of fertilizers, distribution of pasture vegetation, soil acidity, activity of soil microorganisms).

HANS JENNY
E. W. COWAN

DEPARTMENT OF SOILS
COLUMBIA, MISSOURI

OBSERVATIONS ON EARLY DEVELOPMENTAL PROCESSES IN THE LIVING EGG OF DROSOPHILA

DUE to the fact that the egg of Drosophila is covered by a semi-opaque chorionic membrane, our knowledge of the course and rate of early developmental processes has, up to the present time, been gained only by a study of preserved material, prepared by means of the usual cytological technique. Such a study has not only been a laborious one because of the inherent limitations of a method requiring the reconstruction of a three-dimensional object from serial sections, but it has also been open to error because of the uncertainty as to the age of an egg at the time of deposition. This latter source of difficulty has heretofore been overcome to a large extent by keeping under observation a laying female, rejecting the first eggs laid, and carefully timing eggs laid subsequently. Under suitable conditions, fertilized eggs are not retained by the female for more than twenty minutes.

During the past summer, we found a simple and satisfactory method for observing early embryonic development in the living egg. An egg, firmly imbedded in the agar in which it has been laid, or fastened to a glass slide by a film of Ambroid cement, may be dechorionated with fine, sharp needles under a binocular microscope. It is then mounted in water, and a thin coverslip, supported by bits of glass, placed over it. As the inner membranes are transparent, developmental changes may be followed under high powers, though the definition of the earliest cleavage figures is somewhat obscured by the overlying yolk granules. While under observation, the egg can be rolled about by pushing the coverlip slightly from side to side.

In the early egg, the protoplasmic islands around the first cleavage nuclei appear as lighter spherical regions well marked off from the dense surrounding yolk. As cleavage proceeds, these islands increase in number and decrease in size, giving the egg a "dappled" appearance. Soon a lighter grayish cap arises at the posterior end, presaging the formation of the pole or germ-tract cells. These are pushed out as large buds, which then constrict off from the underlying ooplasm with great rapidity, forming a conspicuous layer; this is separated from the adjacent ooplasm by a clear fluid-filled space. At a temperature of 22° the pole cell formation is approximately complete within 20 to 30 minutes after the first bud forms. Protoplasmic islands containing the yolk nuclei now remain in the center, while the cleavage nuclei migrate to the periphery of the egg to form the blastoderm. Here they push out bud-like prominences over the entire surface, except in the region of the pole cells. This gives the cleaving egg a morula-like appearance, which is most pronounced at the anterior end. Dividing walls can now be seen growing inward and enclosing each blastodermic nucleus in a cubical protoplasmic area which is still continuous with the central yolk mass. As cleavage proceeds, these cells increase in number, are compressed against each other so that they are now distinctly columnar, and finally develop inner walls cutting them off from the central protoplasm. At the posterior end of the egg the blastodermic layer next forms a continuous wall beneath the pole cells.

At a temperature of 22° the pole cells retain their terminal position for approximately an hour, when suddenly they begin to migrate with great rapidity toward the dorsal surface. This migration initiates a series of changes: the first of which is a dorsal invagination in the mid line. Into this invagination, which arises about one fifth of the distance toward the anterior end, the pole cells are pushed.[1] At the moment when the pole cells begin to descend into the cup-like invagination, the cells along the entire dorsal surface begin to group themselves into metameres. These are pronounced by the time the pole cells disappear within the dorsal invagination. At 22° C. the entire series of growth changes, including migration, invagination and metamere formation, occurs within the brief period of 10 to 15 minutes.

Cinematographic records of the processes described above as well as of subsequent embryological changes are now being made, and will serve as the basis for a more extensive report to be given later.

GEORGE P. CHILD
RUTH B. HOWLAND

WASHINGTON SQUARE COLLEGE
NEW YORK UNIVERSITY

[1] The force exerted seems to be due to a rapid upward growth of the ventral blastoderm. This point, however, needs further careful study.