by the executive council of the association and awarded, at intervals, whenever, in its opinion, an outstanding project is proposed by some member of the association who has already achieved notable results in original research.

The officers chosen for the ensuing year are: *President,* W. L. G. Joerg, of the American Geographical Society, New York; *Vice-President,* Guy-Harold Smith, Ohio State University, Columbus; *Secretary,* Preston E. James, University of Michigan, Ann Arbor; *Treasurer,* John E. Orchard, Columbia University, New York; *Editor,* Derwent Whittlesey, Harvard University, Cambridge, Mass. The councilors are: C. C. Colby, University of Chicago; William H. Hobbs, University of Michigan; Kirk Bryan, Harvard University; Richard Joel Russell, Louisiana State University, and Richard Hartshorne, University of Minnesota.

The executive council has decided upon Ann Arbor, Michigan, as the place of the next annual meeting.

SPECIAL ARTICLES

LOCALIZED CORTICAL GROWTH AS THE IMMEDIATE CAUSE OF CELL DIVISION

CHAMBERS[1] supports the theory that cell division is caused by the growth of two viscous astral spheres separated by a liquid zone, in combination with a probable change in surface tension. Gray[2] thinks the growing asters displace fluid peripheral cytoplasm to the walls of the furrow, where cleavage occurs apparently because the fluid material is reduced in amount by conversion into the more viscous substance of the aster (see especially his figure 92). Spek[3] assigns the dominant rôle to an increase of surface tension in the region of the furrow and to the subsequent flow of peripheral cytoplasm into the furrow. Heilbrunn[4] is inclined to the view that astral rays "pull on the surface membrane of the cell" (p. 272).

In an analysis of the surface kinetics of the cleaving amphibian egg, I have obtained results which point to a mechanism different from any of the above. Vogt's method of localized vital staining,[5] in combination with a study of serial sections, was used to obtain a fairly detailed picture of the behavior of the egg cortex in the Pacific Coast newt, *Triturus torosus.* The explanation suggested seems equally applicable to certain invertebrate eggs, to judge from the recent descriptions of Motomura.[6] The main phenomena observed in *Triturus torosus* are as follows:

(1) Cleavage is initiated by a contraction of the egg cortex at the site of the future furrow. This is a contraction in the sense that the cortex becomes thicker and bulges toward the egg interior. At the same time the surface of the egg is displaced toward the site of thickening.

(2) The mid-portion of the contracted cortex begins to expand within one to two minutes after the above contraction (at temperatures ranging from 22° to 26° C.). The pigment of this expanding portion is rearranged in irregular streaky lines, plainly indicating that the cytoplasm is being stretched. The surface of the stretched material sinks below the general egg surface much as does the surface of a fluid material stretched between relatively firm supports. Chambers[1] gives other evidence that this zone is liquid in his observation of Brownian motion and his micro-dissection experiments. The stretched cortical material ("the primary furrow") has a lower concentration of pigment per unit surface and therefore appears lighter than the rest of the upper hemisphere (see Fig. 1).

(3) A secondary furrow appears at about the center of the primary furrow. It gives evidence of additional stretching of its materials.

(4) The pigmented cortex bounding the lightly pigmented "primary furrow" becomes the site of intense growth directed toward the egg interior. Vitally stained marks placed in this position are drawn out into long delicate hair-lines as the furrow deepens. Only a narrow strip of the cortex adjacent to the early furrow undergoes growth; this applies to the top (pigmented) surface of the egg (see Fig. 1). On the *lower* (unpigmented) side of the egg a much wider strip of cortex is involved. As surface-cortex is converted into furrow-cortex, its content of clear cytoplasm increases, with a corresponding decrease in the concentration of pigment and yolk "granules."

The streaming of peripheral cytoplasm from the sides of the egg into the furrow, which has been described by a number of persons,[7] is noticeably absent in the cortex. The streaming observed was in all probability a *sub*-cortical movement only, as has been suggested by Motomura[6] also. This is supported by the recent work of Motomura[6] and of Brown[8] as well as

[1] R. Chambers, in "General Cytology," ed. by E. V. Cowdry, Section V, 1924.

[2] J. Gray, "A Textbook of Experimental Cytology," chapter 9, 1931.

[3] J. Spek, *Arch. f. Entw.-mech.*, 44: 5, 1918.

[4] L. V. Heilbrunn, "The Colloid Chemistry of Protoplasm," chapter 15, 1928.

[5] W. Vogt, *Arch. f. Entw.-mech.*, 106: 542, 1925.

[6] I. Motomura, *Sci. Reports of the Tohoku Imper. Univ.*, 4th Series, 10: 212, 1935.

[7] See the works of Chambers, Gray and Spek already cited.

[8] D. E. S. Brown, *Jour. Cell. and Comp. Physiol.*, 5: 335, 1934.

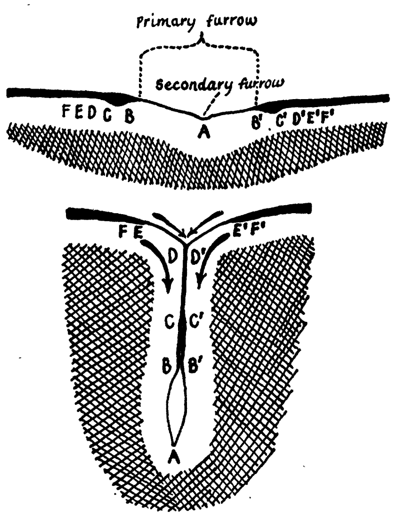

FIG. 1. Diagram illustrating the manner of cortical growth described in the text. Cortical pigment is shown as a solid black line. Remainder of cortex white. Subcortical cytoplasm cross-hatched. The top sketch represents an early stage of cleavage, the lower one a more advanced stage. Arrows indicate direction and approximate site of growth. Corresponding portions of the cortex indicated by letters A, A′, etc.

my own work which shows that the cortex (of the *Strongylocentrotus, Arbacia* and *Triturus* eggs, respectively) is a more or less rigid layer during cell division.

A reasonable explanation of the observed cortical growth, in view of its localized character, is that the increase may be due to an imbibition process, which of course does not imply that the cortex becomes "fluid." Indeed there are indications that the cortex of the furrow, excepting a small part near its tip, does not differ much in viscosity from the rest of the egg cortex. At least the difference is not great enough to give rise to the characteristic surface contours of fluids in contact with relatively solid materials. It is well known that the swelling pressure of bio-colloids may attain high values under proper conditions, and the relatively fluid material which Chambers[1] ascertained in the equatorial region of the cleaving egg would offer little resistance. It is also possible that the growth of the furrow-cortex is by intussusception of clear cytoplasm of *sub*-cortical origin; this might explain the part played by the cytoplasm which some workers have seen streaming toward the furrow. Both processes might be involved, since they are obviously not antagonistic.

This view of the mechanism of cell division has certain features in common with the sol-gel transformations generally regarded as important in the formation of pseudopodia in certain amoebae. The *protrusion* of the pseudopodium involves the localized growth of a peripheral gel cylinder at the expense of a centrally located sol. Is it a mere superficial coincidence that the *intrusion* of the cell surface seems also to involve a localized growth of peripheral cytoplasm at the expense of the more fluid elements of the cell?

Details will be published elsewhere.

A. M. SCHECHTMAN

UNIVERSITY OF CALIFORNIA AT
LOS ANGELES

HOW CONSISTENT ARE AN INDIVIDUAL'S BRAIN POTENTIALS FROM DAY TO DAY?

IN a previous article, we showed that an individual can be distinguished from other individuals by his brain potentials.[1] An important and related question left unsettled was: Are an individual's brain potentials consistent from time to time?

To answer this question, we obtained on five different days (as a rule not consecutive) an adequate sampling of brain potentials from each of 11 healthy university students (6 men, 5 women). No attempt was made to run a subject at a certain time of the day or to control in any way his daily routine of living. A strong effort was made, however, to keep the experimental conditions as constant as possible from subject to subject and from day to day for the same subject. The observer reclined on a cot in a dark and electrically shielded room. He was instructed to keep his eyes closed and his mind as "blank" as possible. The brain potentials were led off from the left occipital area by means of a surface electrode. A ground electrode was attached to the lobe of the left ear. Standard amplifiers and a Westinghouse oscillograph were used for recording.

Because of the amount of space necessary to display them, the 55 records (5 records from each of 11 subjects) were divided into three groups, two groups of 20 records each and one group of 15 records. Each group contained all the records of 3 or of 4 subjects, as the case might be. The records in each group were thoroughly "shuffled" and chosen at random for pasting on a wall. One group was studied at a time. Each record was given a number. Four of us, who had served as judges in the previous study on identification, served again here. The task was to study the mounted records and to arrange them according to their numbers into groups of five. Each group of five was to have in it all the records, and only the records, of one subject. The person comparing the records was not told whether he was wrong or right in his judgments until he had finished with an entire group of 15 or 20 records.

A total of 220 judgments were made (4×55).

[1] L. E. Travis and A. Gottlober, SCIENCE, 84: 532, 1936.