7512 C

Some Physical Properties of the Nuclear Membrane.

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During the last 50 years several investigators have described processes which bring into evidence such physical properties of nuclear membranes as resistance to deformation, extensibility, elasticity, etc. (Albrecht,[1] Mottier,[2] Kite,[3] Chambers,[4] Nemec[5]). Our observations made on resting nuclei of the embryonic region of the onion root tip, centrifuged at 30,000 g., (35,000 r.p.m., radius: 22 mm.) are a contribution to the stock of facts already accumulated by these authors.

The root tips, cut off at a length of 18 mm. were fastened by their cut end in a brass tube 15 mm. long and slightly wider than the roots; their free ends were in the centrifugal direction. The tubes were fixed firmly to the rotor of a Sharples electric super-centrifuge. The rotor contained some Knop's plant medium in order to keep the roots steadily immersed. The centrifugation lasted from 10 minutes to 2 hours. The roots were then fixed in Flemming's fluid; and stained either with Heidenhain's iron haematoxylin or Flemming's triple stain.

After a short centrifugation, the nuclear content is concentrated at the bottom of the nuclei and a clearer space appears at the top. Then the whole nuclei are thrown to the bottom of the cells. (Fig. 1 A.) So far these results are the same as those obtained by previous investigators working with a much lower centrifugal force.

After a longer centrifugation the nucleus flattens against the floor of the cell, taking a more or less hemispheric shape, eventually forming an angle of less than 90° between the horizontal diameter of the hemisphere and the vertical portion of the nuclear membrane (Fig. 1B). The diametric line is perfectly straight and shows no evidence of any folding or shrinking. At the top of these hemispheric nuclei one can almost always observe an elevated portion of the membrane which encloses a transparent region and reminds one of a blister. The elevated portion takes often the shape of a

1 Albrecht, E., *S. Ges. Morph. Phys., München,* 1898, **14**, 133.

2 Mottier, *Annals of Bot.,* 1899, **13**, 325.

3 Kite, G., *Biol. Bull.,* 1913, **25**, 1.

4 Chambers, R., *Biol. Bull.,* 1918, **34**, 121.

5 Nemec, B., *Protoplasma,* 1929, **7**, 423.

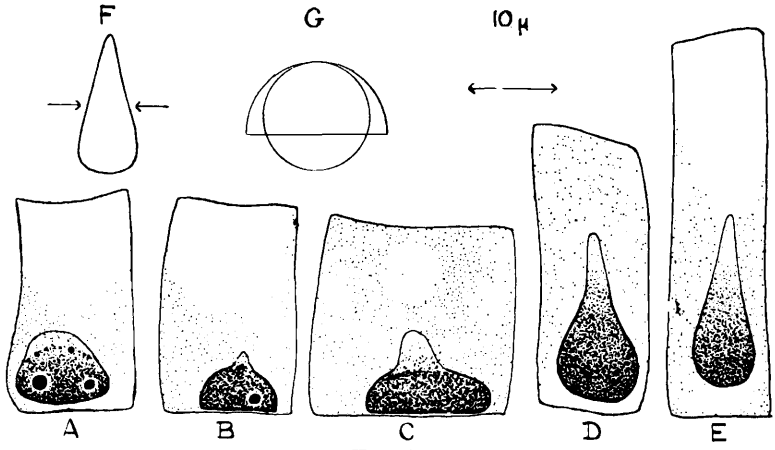

FIG. 1.

A-E, camera lucida drawings of deformed nuclei, centrifuged: *A*, 10 min., *B* and *C*, 30 min.; *D* and *E*, 2 hours; *F* and *G*, diagrams illustrating the discussion. The scale applies only to the five drawings.

conical beak (Fig. 1C and D) pointing towards the center of the cell. The length of the beak is often more than the diameter of the nucleus. The membrane is thin in the elevated portion; it becomes abruptly thick on the spherical part of the nucleus and is still thicker on the diametric line. In some longer cell (Fig. 1 E) the centrifuged nucleus does not reach the bottom of the cell even in two hours; the shape of the nucleus is that of a bottle gourd with a long neck.

The transformation of a sphere into a hemisphere of the same volume requires that the membrane expand its area by 19% (Fig. 1G). The formation of the neck in bottle gourd shaped nuclei increased the length of the peripheric line, as seen in a plane section, by 68% in the specimens with the longest neck; the base of comparison being the average peripheric length of uncentrifuged spherical nuclei. Since the distension appears to be localized in a small area, the coefficient of ductility is apparently very high. The absence of wrinkles or of a reversed curvature on the diametric side of the hemispheric nuclei, where the surface from spherical became plane, might indicate a possible local reduction of area by contraction or by fusion of the wrinkles; but since the total area of the nucleus is increased, no sure conclusion concerning contractility can be reached. We do not think that the differences in the thickness of the membrane can be used to show ductility or contractility; they are probably due to differences of thickness in the optical section.

The fact that no rupture has ever been observed, either in the hemispheric form on the weak points constituted by the right angles or in the bottle gourd forms at the points where the pulling action of the heavy portion of the nucleus is exerted with more intensity (Fig. 1F, arrows) shows a certain mechanical resistance.

In general the physical properties of the nuclear membranes described here are of the type found in interfaces between 2 immiscible fluids of different specific gravity and viscosity.

7513 C

Absence of Antiviral Substance in Normal Adults for the Virus of the St. Louis Encephalitis Epidemic.*

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Webster and Fite[1, 2, 3] have reported, that on the basis of serological tests, the virus isolated from the St. Louis encephalitis epidemic is not related to that of louping-ill, vesicular stomatitis, equine encephalomyelitis, acute anterior poliomyelitis, Japanese encephalitis (Type B), herpes, or chronic cases of von Economo's disease. The present work confirms and extends some of these findings.

To determine further whether or not there exists any relationship between the virus of the St. Louis epidemic and herpes virus, since there is a possible relationship between the latter virus and that of epidemic encephalitis (reviewed by report of Matheson Commission[4]) both of these viruses were studied. Since neither rabbit, guinea pigs, nor rats could be infected with the encephalitis virus and since animals actively immunized against the latter were found not immune to herpes virus, it was evident that, as far as our tests went, there was no apparent relationship between the 2 viruses.

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1 Webster, L. T., and Fite, G. L., *Science*, 1933, **78**, 463.

2 Webster, L. T., and Fite, G. L., PROC. SOC. EXP. BIOL. AND MED., 1933, **31**, 344.

3 Webster, L. T., and Fite, G. L., *Science*, 1934, **79**, 254.

4 Epidemic Encephalitis—Report of a Survey by the Matheson Commission, New York, Columbia University Press, 1929, 1932.