globin percentage. From the 10th to the 19th day no further treatment was given and the reticulocyte percentage fell to the pretreatment level. Starting on the 20th day, a daily dose of 10 gm. of a concentrated dried extract of gastric tissue was fed with a subsequent reticulocyte response with a maximum of 17%. The experiment suggests that if pernicious anemia gastric juice, in quantities similar to that secreted by a normal person, is fed (after incubation with beef steak) hematopoietic activity develops. The experiment is now being repeated with various modifications to verify the conclusions.

7286 P

Effect of Ultracentrifuging on Paramecium.

R. L. KING AND H. W. BEAMS. (Introduced by J. H. Bodine.)

From the Zoological Laboratory, State University of Iowa.

The introduction of the air-driven ultracentrifuge described by Beams and his associates[1] affords a means of testing the viscosity and relative specific gravity of many cell components. The authors have been able by the use of this ultracentrifuge to establish the fact that the Nissl bodies of rat ganglion represent a definite material in the cell and are not the result of the action of the fixative used on homogeneous cytoplasm; likewise, for the Golgi apparatus in the uterine gland cells of the guinea pig. In general the nuclei of the cells mentioned above usually show a clearly marked separation of the chromatic from non-chromatic materials in such a way to show that the chromatin is the heavier. The details of this work are to be reported elsewhere. McClendon[2] and Yancey[3] have reported the effect on the division rate of centrifuging various species of Paramecium. McClendon has also described some of the nuclear effects of such treatment.

The ultracentrifuge used in this work was obtained from Professor J. W. Beams of the University of Virginia; the 1⅛ inch rotor was operated by an air pressure of approximately 15 pounds. *Paramecium caudatum* and *P. multimicronucleata* were centrifuged in gum solutions of approximately their specific gravity for varying

[1] Beams, J. W., Weed, A. J., and Pickels, E. G., *Science*, 1933, **78**, 338.

[2] McClendon, J. F., *J. Exp. Zool.*, 1909, **6**, 265.

[3] Yancey, Patrick H., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 877.

periods. After 10 minutes most of the animals had disintegrated, a few dead organisms remaining intact. These were dumb-bell shaped (length to width ratio varying from 13:1 to 22:1 compared with the normal 4:1 to 5:1) with prominent knobs on either end. The knob on the centrifugal pole consisted of crystals and the macronucleus, that on the other end of lighter materials of unknown nature. The cytopharynx and contractile vacuoles seemed stretched with the pellicle but otherwise normal in position. In many cases the exploded trichocysts remained in connection with the pellicle. The ratio of length to width in animals centrifuged for 5 minutes varied from 6:1 to 9:1. In such animals the contractile vacuole frequently is still pulsating, the undulating membrane in the cytopharynx and other cilia are still beating. A few of such animals recover. Animals centrifuged for 2½ minutes are more nearly average in bodily proportions (6:1 to 9:1); the body is almost cylindrical, being slightly constricted medianly. The contractile vacuole pulsates and the cilia in general are still active. There also seems to be a greater number of trichocysts in the endoplasmic stream than is the case in the uncentrifuged animals. Single animals isolated after centrifuging for 2½ minutes usually survive and reproduce.

Paramecium aurelia usually retains its shape longer and survives for a longer period than *P. caudatum* and *P. multimicronucleata,* probably because of its smaller size.

Cytological details were examined in animals fixed immediately after they had been centrifuged for 2½ minutes. They were fixed in Schaudinn's fluid and stained in Hemalum or in Feulgen's sulphurous acid-fuchsin. The crystals had been moved to the centrifugal pole where they form a mass. What appears to be the macronucleus is located next to the mass of crystals.

In some cases the chromatin and crystals have been extruded from the cell leaving an animal of almost normal shape; in still others the whole centrifugal pole seems to have exploded. The pellicle probably prevents a complete cleavage of the organism into 2 fragments as happens in centrifuged Arbacia eggs.

Closer examination shows that, in many cases, of the macronucleus only the chromatin has moved centrifugally; there is left in the usual position of the macronucleus an achromatic, alveolar mass. In other cases, shreds of chromatin material connect the two. An investigation of the history of the recovery of such animals, their reproductive and locomotor features is being carried out.