

various scybala when dried (see graph). This relative equality of dry weight of scybala in the different sections of the gut may be most striking in some animals (see circle-bar series in graph); in other animals the variation in weight of the dry fecal residue is more pronounced.

The differences in the normal weight of scybala briefly described above are not found in those rabbits where peristalsis of the colon has been hurried by drugs or by disease processes.

Whether or not the rate of absorption varies in the different colonic segments will be discussed at another time.

The diet of the rabbits consisted chiefly of oats and hay, with some green stuff; water was available at all times.

162 (2685)

The relation of contractile and food vacuoles to rhythms in *Paramecium*.

By W. BYERS UNGER. (Introduced by L. L. Woodruff).

[From the Osborn Zoological Laboratory, Yale University, New Haven, Conn.]

Experiments were undertaken to determine the relation between metabolic activity, as indicated by the rate of contractile vacuole pulsations and the size and number of food vacuoles formed, and the occurrence of rhythms in the division rate. The animals studied were pedigree races of *Paramecium aurelia* and *Paramecium calkinsi*. Two cultures of each species were studied for 115 days under constant culture conditions. Observations were made daily and averages computed for the per diem division rate, food vacuole number and size, and the pulsation rate of the anterior and posterior contractile vacuoles.

In *Paramecium aurelia*,¹ depressions in the rate of contractile vacuole pulsation are, in general, synchronous with the low points of the rhythms in the division rate and with the occurrence of endomixis. The posterior contractile vacuole pulsates

¹ Woodruff, L. L., *Biol. Bull.*, 1917, xxxiii, 51.

more rapidly than the anterior. The variations in the number of food vacuoles formed are, in general, synchronous with the rhythms in the division rate and the fluctuations in the rate of pulsation of the contractile vacuoles.

Although endomixis does not occur in *Paramecium calkinsi*,² this species exhibits definite fluctuations in the rates of the two contractile vacuoles which corresponds to the rhythms in division rate. The anterior and posterior contractile vacuoles show no significant difference in rate. As in *P. aurelia*, the fluctuations in the number of food vacuoles formed in *P. calkinsi* is synchronous with the rhythms in reproductive activity and the fluctuations in contractile vacuole pulsations.

Paramecium calkinsi forms more food vacuoles than *Paramecium aurelia*, though the size of the vacuoles is smaller in the former. The rate of pulsation of the contractile vacuoles is faster in *P. aurelia* than in *P. calkinsi*; a difference probably correlated with the smaller size of *P. calkinsi*.

The fluctuations in the several phenomena observed are not caused by endomixis since rhythms are present in *P. calkinsi* (where endomixis does not occur) as well as in *P. aurelia* (where endomixis does occur). Apparently the rhythms in *P. aurelia* are accentuated by endomixis since the changes in the rate of the contractile vacuoles, in particular, are more abrupt and extend over a greater range than those of *P. calkinsi*.

In brief, fluctuations in nutrition and excretion, as indicated by food vacuole formation and contractile vacuole pulsation, are shown to be coincident with, and probably causally related to, the well-established rhythms in the reproductive activity of *Paramecium*.

² Spencer, H., *J. Morph. and Physiol.*, 1924, xxxix, 548.