became moderately distended and there was well-marked jaundice. The animal died at the end of two months. The peritoneal cavity contained a small amount of fluid. The liver was large and bright yellow. Microscopical examination showed advanced fatty degeneration with cirrhosis. Connective tissue, which is more sclerotic than in the former experiments, occupies about one third of the liver substance. The parenchyma shows advanced fatty degeneration, but little evidence of regeneration. Newly formed bile ducts are rare.

In other animals, which have received chloroform, dilatation of the superficial abdominal veins indicates the presence of hepatic cirrhosis.

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Shaking experiments with protozoa.

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DeBary, Hofmeister, Horvath and Meltzer have observed that various species of lower plants (Myxomycetes, Diatoms, Oscillaria and Bacteria) when shaken, are brought to a quiescent condition, for a longer or shorter time or even killed. The present observations were based upon cultures of *Paramecium*, *Euglena*, *Stylonychia* and *Spirillum* (a species of Schizomycetes). Two methods of shaking were used: (1) Shaking was produced by means of a rotating arm moving in a radius of 25 cm. at a velocity varying from 66 to 83 revolutions per minute and carrying a tube, 6 cm. long within which was a phial holding 2.5 c.c. of the infusion of protozoa. During each revolution, consequently, the protozoa received two shocks from the falling of the smaller phial within the larger one. (2) Following the method of Horvath and adopted by Meltzer in his experiments, a horizontal shaker, making 100 excursions per minute through a path of 8.50 cm. was employed. A 250 c.c. bottle containing 10 c.c. of the infusion and bearing a pycnometer thermometer for registering temperature was fastened in the machine and another bottle similarly equipped was placed near as a check. The animals were shaken for from one to twenty-four hours.

Shaking for one hour in either machine showed little effect on any of the species, except that *Paramecium* became somewhat less active. With the horizontal shaker for a period of six hours, *Paramecium* and *Euglena* became sluggish and this sluggishness continued for several hours after removal from the machine. Twenty-four hour periods gave decided results, the two species just mentioned being either killed or rendered very sluggish. However, in all cases a few individuals were nearly normal. With *Stylonychia* and the bacterial species, *Spirillum*, the case was different inasmuch as no observable deviation from normal behavior was evident. The flattened shape of the former may have something to do with the results obtained with this form. The effects of shaking lasted for at least two weeks, during which period, there was a constantly decreasing number of individuals in the shaken cultures which were carefully compared with check experiments from "wild" forms and from the checks used with the experiment.

In order to test the hypothesis that shaking may increase or decrease the division rate in *Paramecium*, six individuals were isolated from the twenty-four hour cultures and their condition followed for seven days. During this period, the average rate of fission was approximately the same as that in the check forms.

That the sluggish movements were not the result of an emaciation due to lack of food, by the killing of bacteria, in shaking, which *Paramecium* uses for food, cultures were placed in sterile chambers immediately after their removal from the shaker. In such cases, no new bacteria were introduced. No difference was manifest from the control individuals.

Verworn, in commenting upon shaking experiments, suggests that the effect is that of establishing a tetanus in the organisms being experimented upon. That this explanation will scarcely hold in the present species is evident from the fact that as far as could be determined, the movements of the cilia and flagella were normal, or at least but slightly affected. If tetanus had set in, it is fair to assume that it would have reached the organs of locomotion as well as the body proper.

Metalnikoff, Mesnil, Moulton and others have demonstrated proteolytic, lipolytic and amylolytic enzymes in protozoa and the

suggestion is made that the effect of shaking is perhaps due to the destruction of these enzymes in the manner demonstrated for pepsin, trypsin and rennin by Meltzer and Shaklee and for tyrosinase and zymase by Abderhalden.