In preceding investigations ('07, '19, '27) it was demonstrated that the response of *Volvox* to light of any given intensity depends upon preceding illumination of the colonies, and upon the extent of light or dark adaptation. It was found, e.g., that colonies which have been for a considerable time in a given illumination and are fully adapted to it become positive if the intensity is increased and negative if it is decreased, that the opposite obtains if they have not been exposed so long and are not fully adapted, and that, depending upon the extent of adaptation, they may be either positive or negative in any illumination in which they orient at all. It was found, moreover, that under certain conditions adaptation to darkness or to light for only a very short period may profoundly alter the responses. For example, it was found that if colonies which have recently become negative in a given illumination are subjected to darkness for as short a period as one second and then exposed to the same illumination again, they are positive, but that they remain so only a few seconds, after which they are negative again.

These results and others presented in the references cited, it is maintained ('27), lead to the conclusion that change in illumination induces in *Volvox* series of processes, that these processes are opposed by other processes in the colonies in such a way that their effect tends to become neutralized and that this results in what is ordinarily designated adaptation. It is consequently evident that adaptation is of great importance in the study of response to light in *Volvox*. This paper deals quantitatively with it and its relation to the antagonistic processes induced by change in illumination.

The experiments and observations considered in the following pages were all made several years ago. I had then planned to make a very intensive study of the phenomena but my supply of *Volvox* suddenly
The rate of adaptation to light and to darkness in *Volvox globator*. 

disappeared before the work was completed and I have since been unsuccessful in attempts to obtain this organism in sufficient quantities near enough to the laboratory to continue the work satisfactorily. I am presenting it in this incomplete form with the hope that some one more fortunately situated may continue it and unravel more details concerning the interesting phenomena found in this fascinating organism.

If *Volvox* could be grown in the laboratory so that its physiological condition and the illuminations to which it is subjected could be controlled, it would greatly facilitate matters. Several investigators maintain that they have succeeded in this, I have, during the past two summers, with the assistance of P. L. Johnson and D. M. Pace, tried to culture both *Volvox minor* and *Volvox globator* in the solutions used by these investigators as well as numerous others. We obtained considerable growth in some of the solutions tried but were unable to keep the cultures in flourishing condition long enough for experimental work of the sort referred to above.

**Material and Methods.**

All the observations and experiments described in the following pages were made on *Volvox globator* taken from a pond at Woods Hole, Mass. The colonies were found only in a few small partially isolated pools at one edge of the pond, but in these they were so abundant that the water was deep green. They were collected by merely dipping liter jars full of water from these pools and taking them to the laboratory. Collections were made nearly every day so that fresh material in excellent condition and in abundance was continuously on hand.

The observations were made in a large dark-room. The light used was obtained from 1000 W, 400 W and 250 W tungsten stereopticon lamps and 75 W and 25 W tungsten mazda lamps. These lamps were mounted in an adjoining room on holders of such a nature that any one of them could be placed in front of a small rectangular opening in the wall, so situated that a horizontal beam of light passed through the dark-room several centimeters above a long table and parallel with its longitudinal axis. The beam was so screened that it was practically the same size throughout its whole length. The table contained a dissecting binocular which could be moved so as to adjust the distance between it and the lamp as desired. The beam of light was so situated that its center continuously coincided with the surface of the stage of the binocular as it was moved.

The lamp holders contained a protuberance which projected into a groove in the upper surface of a long horizontal track which was so situated and adjusted that the lamps could be moved back and forth on it without changing the position of the beam of light in the dark-room (Fig. 1).