THE REGULATION OF SWIMMING SPEED AND THE RATE OF CELL DIVISION BY SEROTONIN IN PARAMECIIUM AURELIA

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The serotonin content in Paramecium aurelia was estimated at 88 + 0.8ng/mg protein, and the presence of serotonin 5HT1A and 5HT2 receptors was demonstrated using a binding receptor assay. Subsequently, we examined the effect of serotonin on forward swimming and cell divisions of Paramecium aurelia.

The observations were conducted on three depression slides loaded with protozoans and serotonin solution (from 10^-7 to 10^-4 M). The control group was incubated in a Tris-HCl buffer, pH 7.2. The behavior of Paramecium was observed on a monitor connected to a microscope and a video camera. Parasites were scored after 24h and 48h incubation.

At concentrations of 10^-7 to 10^-4 M, serotonin stimulated forward swimming in a dose-related manner. The maximal acceleration of swimming was observed during incubation in the medium containing 10^-4 M serotonin, and it was about 135% of that observed for the control group.

The cell division rate of Paramecium decreased to 80% of the control value after 24h incubation, and to 90% of the control value after 48h incubation.

The membrane potential of Paramecium controls the frequency and direction of the ciliary beat, thus determining the cell’s swimming behavior. Stimuli that hyperpolarize the membrane potential increase the ciliary beat frequency and therefore increase forward swimming speed. Serotonin hyperpolarizes the cell membrane by increasing the intracellular cyclic AMP. A higher sustained level of cAMP decreases cell divisions, and this effect was particularly observed after 24h incubation.

Current studies of swimming behavior and the rate of cell divisions suggest the role of stimulation of serotonin receptor sites in the regulation of membrane potential in Paramecium aurelia.