'Klino-kinesis' of Paramecium

THE suggestion made by Gunn and Walshe[1], that the avoiding reaction of Paramecium fits into the scheme of klino-kinesis, receives some support from the behaviour of the animal in a uniform high temperature, as I described it in 1939[2]. If the temperature of a culture is gradually raised, nothing happens at first except an increase in the speed of the animals. Then at a temperature of about 30° C. avoiding reactions begin, and as the temperature is further raised they become more frequent, with the result that forward motion practically ceases and the animals dance backwards and forwards like particles in Brownian movement. If the temperature is kept steady soon after avoiding reactions have begun, they gradually become less frequent and finally cease altogether. Once the rate of occurrence of the reactions has become very high, however, there is no acclimatization and death soon follows.

But while the term 'klino-kinesis' may be useful as a description of the behaviour of ciliates in unusual experimental conditions, there does not seem to be any justification for its use, instead of the simpler term avoiding reaction, for the ordinary behaviour. For when a paramecium retreats from a hot region or from contact with a solid object, there is no question of sensory adaptation. What happens is that a stimulus is received, a reaction follows, and in many cases this directs the animal away from the stimulating region. There need be no teleological assumption that a reaction occurs *in order to* avoid things: the implication is the quite correct one that by the reaction the animal does, in fact, avoid certain situations.

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[1] Gunn and Walshe, NATURE, **148**, 564 (1941).
[2] Yapp, "Introduction to Animal Physiology" (Oxford, 1939).

Production of Proliferation-promoting Factors by the Ultra-violet Irradiation of Algæ

PREVIOUS papers from these laboratories have shown that the subjection of yeast, other micro-organisms, and several animal tissues to various forms of injury, such as ultra-violet irradiation, X-rays, mechanical injury, chemical irritation and oxygen lack, results in the release into the intercellular fluids of substances which stimulate cellular proliferation. Because of the mode of formation these substances have been spoken of as "intercellular wound hormones"[1].

In order to determine the generality of the phenomenon it has been of interest to extend the experiments to as wide a variety of cells as possible. Accordingly, preliminary experiments were carried out with mixed cultures of algæ in which the algæ were subjected to ultra-violet irradiation and the cell-free filtrates obtained from the irradiated algæ were tested for their power to increase the proliferation of fresh alga cultures. The preliminary indications having been favourable, more quantitative experiments were carried out and are reported in this note.

30–40 c.c. of a heavy suspension of *Hormidium floccidum*[2] in Detmer's 1/3 medium were irradiated with a Sperti Mercolite ultra-violet lamp (*42TC*) for from two to three hours at distances of 15–25 cm. The suspension was stirred mechanically throughout the irradiation period, as was a similar, but non-irradiated, control suspension. At the end of the irradiation period, both suspensions were filtered, first through filter paper and then through sterile Berkefeld "N" filters. 1 c.c. of the filtrate from the irradiated algæ was added to 5 c.c. of a very dilute fresh suspension of the algæ in Detmer's 1/3 medium, and 1 c.c. of the control filtrate was added to another 5 c.c. of the alga suspension. Four or five tubes were used in each run for both filtrates. Sterile technique was employed throughout. The tubes were kept for 2–3 months at a temperature of approximately 25°–30° C. in the light. At the end of the experimental period the number of algæ in the experimental and control runs were counted by means of a hemacytometer.

Eighteen determinations were made in four separate experiments. In every case the algal suspension treated with the filtrate from the irradiated algæ contained more cells than the corresponding suspension to which the filtrate from the non-irradiated suspension was added, the increase in the various experiments running from about 45 to 115 per cent. These results, in conjunction with the more extensive work in our laboratories on other organisms, indicate to us that algæ, when injured with ultra-violet radiations, release into the intercellular fluids substances which stimulate proliferation of the algæ.

These experiments are being extended to other algæ, including *Stichococcus bacillaris* and *Chlorella pyrenoidosa*. The results will be reported in detail later. The possible effect of the irradiated extracts on chlorophyll formation will also be considered.

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[1] See for example: Fardon *et al.*, NATURE, **139**, 589 (1937); *Studies Institutum Divi Thomæ*, **2**, 39 (1938) and **2**, 233 (1939); Loofbourow *et al.*, NATURE, **142**, 573 (1938); **143**, 725 and **144**, 553 (1939); *Studies Inst. Divi Thomæ*, **2**, 137 (1938); **2**, 155 (1939); *Arch. exptl. Zellforsch.*, **22**, 607 (1939); *Biochem. J.*, **34**, 432 (1940) and **35**, 603 (1941); Cook *et al.*, Atti X° congr. intern. chim., **5**, 26 (1939); *Biochem. J.*, **34**, 1580 (1940).

[2] We are greatly indebted to Dr. Florence Meier Chase of the Smithsonian Institution, Washington, D.C., for the algal cultures.

Simple Modifications of the Camera Lucida for Making Larger Drawings

WHEN drawing objects under a microscope with a camera lucida the size of the drawing is normally dependent solely on the magnification of the microscope. Usually this magnification can be adjusted to give a drawing of the required size; but when drawing objects which are only a few microns long, such as chromosomes or the spores of fungi, the image produced by even the highest powers of the microscope is too small to give a drawing of a reasonable size. The devices described below are for the purpose of making large drawings with a camera lucida in such circumstances.