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Electrical Activity of the Invertebrate Eye in Response to Illumination

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ELECTRICAL ACTIVITY OF THE INVERTEBRATE EYE
IN RESPONSE TO ILLUMINATION

FREDERICK CRESCITELLI AND THEODORE L. JAHN

Definite electrical changes can be detected in the eyes of many animals in response to illumination of the eyes. In the vertebrate eye these changes take the form of characteristic electrical variations known successively as the a-, b-, c-, and d-waves. Similar waves can be elicited from the compound eyes of a number of invertebrates. The simplest method of studying these electrical changes in invertebrates is to lead off by silver-silver chloride electrodes from fluid-filled chambers built around each eye. One eye is illuminated while the second eye is kept in darkness. The electrical potentials are amplified by means of a vacuum tube amplifier and are then recorded by means of a cathode ray oscillograph and moving film camera.

The electrical changes that occur in response to brief illumination possess the same general features in all the invertebrates studied although with respect to details there are definite and unmistakable species differences. In various invertebrates (grasshoppers, butterflies, bees, king crab, crayfish, cricket) the electrical response of the dark-adapted eye consists of a rapidly rising wave and a slowly declining phase. The decline of the slow phase differs among the different species; in some the decline is relatively rapid, in others very slow. Light adaptation of the eye results in a decrease in the magnitude of the electrical variation and in a marked change in the force of the slowly declining phase. In a number of moths (*Cecropia*, *Promethia*) the electrical response of the dark-adapted eye is complex, consisting of a-, b-, and c-waves. Light adaptation causes a disappearance of the a-wave, a decline of the b-wave, and a marked decrease in magnitude and duration of the c-wave. In all animals studied, the changes produced by light adaptation are completely reversible.

The magnitude of the potential is related to the duration of exposure and to the intensity of illumination in such a manner as to indicate an adherence to the Roscoe-Bunsen photochemical law. In some animals, the grasshopper (*Melanoplus differentialis*), the form of the electrical response varies with the intensity of illumination.

Illumination with different colored lights of equal energy value does not result in electrical responses of equal magnitude. The response is greatest with the green light and successively less with blue, violet, orange-red, and red.

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COMPARATIVE EFFECTS OF GRADUALLY IN-
CREASED DAILY PERIODS OF LIGHT AND
ACTIVITY ON THE SEX CYCLE
OF THE SPARROW

GARDNER M. RILEY

It has been repeatedly demonstrated in birds that increased daily light periods during the inactive phase of the sex cycle results in precocious testicular development. An attempt has been made to determine whether light, itself, or the increased daily period of physiological activity is the essential factor in this development.

Three series of experiments were conducted with the House sparrow during the fall and winter of 1938-39. In each series, the daily period of awakesness was regulated either by gradually lengthening the light period or by adding a period of compulsory activity (in complete darkness) to the basal light day. Compulsory activity was maintained by placing the birds in a revolving drum. The daily increase in the duration of awakesness was the same in both cases.

Increased daily light periods caused an increase in spermatogenic activity, whereas, increased activity had no effect on the gonadal development. The findings support the view that activity, alone, is not effective in stimulating testicular development in the sparrow.

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