

MAINTAINED ACTIVITY IN THE CAT'S RETINA IN LIGHT AND DARKNESS*

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(Received for publication, November 5, 1956)

INTRODUCTION

Maintained activity in the absence of obvious external stimuli has been observed in several sense organs of vertebrates and of invertebrates (Tasaki and Davis, 1955; Katsuki, Yoshino, and Chen, 1950; Bullock and Diecke, 1956; Cohen, 1955; Adrian, 1937; Löwenstein and Sand, 1940; Zotterman, 1953; Roeder, 1955; Autrum, 1952; see Granit's review, 1955). Such "spontaneous" discharges are of special interest in the retina because of its similarity in neuronal organization to the higher nervous centers in which continuous activity is well known (Bremer, 1949). The presence of maintained activity is also related to the problem of transmission of sensory information. It implies that visual stimuli are transmitted by modulation of ever present background discharges. The occurrence of a background discharge with a random component, or "noise," is essential evidence in support of the view that sensory thresholds should be regarded as signal/noise discrimination problems (Hecht, 1945; Tanner and Swets, 1954; Gregory and Cane, 1955; FitzHugh, 1957, Barlow, 1956), and it was therefore important to make sure that such noise was constantly present in the best preparations, and was not the product of experimental interference. In this paper the statistical properties of the maintained discharge are analyzed, and the changes in maintained impulse frequency with different levels of steady illumination and in the absence of light are described.

The cat's eye is well suited for these studies since it can be used unopened without appreciable surgical interference and with its circulation and optical pathways intact. Good physiological conditions are especially important in the registration of spontaneous discharges which are very sensitive to environmental changes. The great increase of sensitivity during dark adaptation gives an indication of the good condition of the present preparation. Further, the eye is isolated from possible efferent centrifugal nervous control and light can be excluded, thus providing a sense organ cut off from external stimuli.

* Supported by a research grant from the National Institutes of Health, United States Public Health Service.

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