ities, and critical parameters. The increased concentrations in bioconvective streams might be important in fertilization and in initial streaming and schooling behavior in many small marine organisms (*8*).

JOHN R. PLATT*
Marine Biological Laboratories, Woods Hole, Massachusetts

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* Present address: Physics Department, University of Chicago, Chicago, Ill.

12 January 1961

Recording of Single Unit Activity in Isolated Central Nervous Tissue

Abstract. The retina and attached segment of optic nerve isolated from the rabbit were maintained in a functioning state in vitro. Microelectrodes, introduced into the nerve, recorded unit discharges in response to light stimuli. The characteristics of these evoked discharges are described.

Nervous tissue that has been isolated from the host and is being maintained in a suitable incubation medium offers three advantages for experimentation not shared by the same tissue studied in the intact animal: (i) Its chemical and physical milieu can be precisely defined and easily altered. (ii) Certain metabolic processes can be monitored continuously during an experiment. (iii) The tissue can be removed without trauma at any instant for anatomical or chemical analysis. To be most useful, such an in vitro preparation must have been isolated without irreversible damage, must be maintained in a nearly physiological state, and must be amenable to measurement of function.

Rabbit retina has been used as an example of central nervous gray matter that is suited to in vitro study. It can be isolated and maintained in an incubating fluid without significant shifts in intracellular electrolytes (*1*) and with maintenance of function as recorded by gross electrodes (*2*). The present report describes measurement of single unit activity in this isolated preparation.

Details of the methods used in isolating and incubating the tissue have been presented (*2*). In brief, an eyeball with 1 cm of optic nerve is removed from an anesthetized, dark-adapted rabbit; and, as rapidly as possible, the retina and the attached segment of nerve are separated, under cooled medium, from the other tissues of the eye. The nerve is mounted on two 24-gauge platinum wires, one tied to the cut end of the nerve and the other encircling it near the disk. Besides their use as gross electrodes, these wires serve to suspend the preparation in the incubation medium and to fix the nerve for the introduction of the microelectrode. The medium resembles cerebrospinal fluid in electrolyte composition, is equilibrated with 5 percent CO_2 and 95 percent O_2, and is maintained at 30°C.

In the experiments reported here, the microelectrode was of tungsten, sharpened electrolytically to a tip diameter of less than ½ μ and insulated with vinyl lacquer according to the method of Hubel (*3*). It was advanced by means of a micrometer drive into the nerve about 4 mm from the disk at an angle of 45° from normal. One of the gross electrodes served as electrical reference. The signal was led through a high-input-impedance cathode follower to a preamplifier, having a band

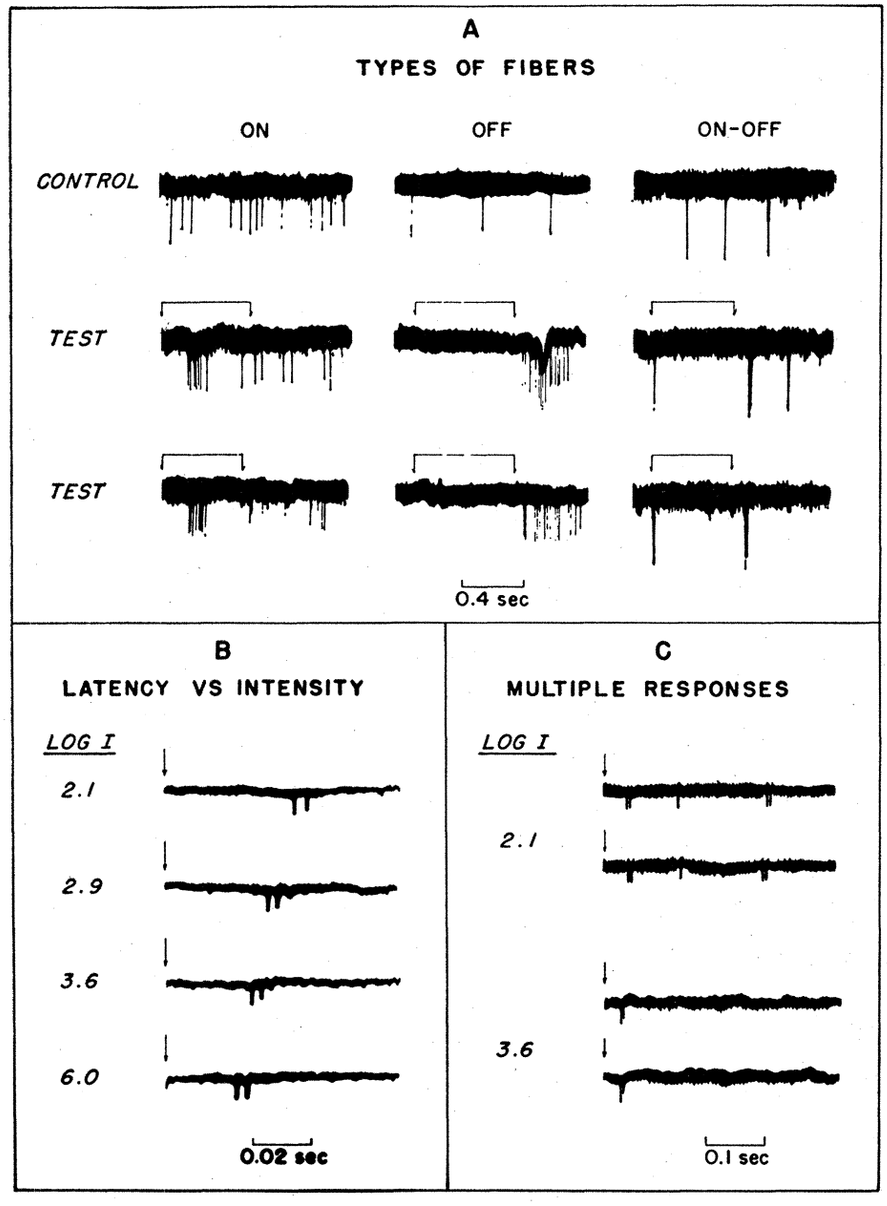

Fig. 1. (*A*) Spontaneous and evoked activity recorded from three fibers of different response types. (*B*) Relation of response to stimulus intensity in an "on" fiber. (*C*) Multiple responses following stimuli of low but not of high intensity. Durations of the longer light stimuli are indicated by horizontal lines above traces in (*A*). The times of presentation of the short (about 10 μsec) light stimuli are indicated by arrows in (*B*) and (*C*).

pass of from 1 to 30,000 cy/sec, on to a dual-beam oscilloscope. Short light stimuli, with a duration of the order of 10 μsec, were provided by a Grass photostimulator. Longer stimuli were provided by a 6-volt tungsten filament lamp. The entire retina was illuminated.

With the advance of the microelectrode, the sudden appearance of deflections of brief duration and uniform amplitude that were modifiable by light was taken as evidence that an active unit was being sampled. By this criterion, from two to six fibers were sampled in a single penetration of the nerve. An individual fiber could be observed for periods lasting from a few seconds to 90 min. In all instances the polarity of the responses was positive with respect to the gross electrode. The responses were sharply peaked. Their amplitude ranged from 0.05 to 0.3 mv, and their duration at the baseline was about 0.6 msec. In most cases the uniform amplitude of the responses recorded from a given site indicated that a single unit was being sampled, though occasionally responses of two amplitudes, suggesting simultaneous recording of two units, were observed.

Figure 1*A* shows records obtained from three fibers of different response types. In each instance the top record, showing the spontaneous activity, and the two lower records, showing the responses to a prolonged light stimulus, were taken in close temporal sequence. Fibers were observed that responded only to the "on" of the light, others that responded only to the "off," and still others that responded both to the "on" and the "off." This is consistent with observations made in vivo (*4*). Almost all fibers showed a rather high level of spontaneous activity. As shown in Fig. 1*A*, the spontaneous activity of the "on" fibers was diminished during the latent period between onset of the illumination and the burst of responses, and the spontaneous activity of the "off" fibers was diminished throughout the period of illumination. At occasional sites, deflections were recorded that could not be modified by light, though in all other respects they were identical to the spontaneous activity recorded from fibers responsive to light.

Figure 1*B* shows the response of an "on" fiber to a short (about 10 μsec) light stimulus, varying in intensity from about 130 to about 10^6 ft-ca. As intensity increased over this range, latency diminished by a factor of 2, but the number of evoked discharges did not change.

Figure 1*C* shows the multiple responses sometimes observed after short stimuli of low intensity. Though the successive intervals between discharges, or pairs of discharges, were not equal, they were reproducible from stimulus to stimulus. The number of response groups and the lengths of the intervals between them changed with the intensity of the stimulus. At higher intensities only the first group of discharges remained. It is possible that these multiple responses are related to the rhythmic activity observed in the cortex of man after photic stimulation (*5*).

Since several important features of electrical activity—the level of spontaneous discharge, the response of different types of fibers, the occurrence of multiple discharges—are revealed only by the microelectrode, it should be a useful addition to gross electrodes in experiments correlating the function of nervous tissue with metabolism and with changes in the chemical milieu (*6*).

ADELBERT AMES III
BENNETT S. GURIAN
Neurosurgical Service,
Massachusetts General Hospital, Boston

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27 December 1960

Strontium-90 and Cesium-137 in North American Milk

Abstract. The strontium-90 and cesium-137 concentrations in powdered milk in North America vary roughly with the specific activity of rain. The Sr^{90}/Cs^{137} ratios in over 800 powdered milk samples taken from 60 stations in North America from 1957–60 have a standard deviation of only 44 percent.

Powdered milk samples taken on a weekly basis from 1957 to 1960 at some 60 stations scattered over North America have been analyzed for Sr^{90} and Cs^{137}. The network was maintained by the Los Alamos Scientific Laboratory (*1*), and the Cs^{137} analyses were performed there. The Sr^{90} analyses were done under the supervision of the geochemistry laboratory, Columbia University (*2*). The raw data have been given in various reports by the Health and Safety Laboratory of the Atomic Energy Commission (*3*), and the Cs^{137} data from 1957–1958 have been discussed by Langham and Anderson (*4*) and by Anderson (*5*).

This program was designed to give information on the following subjects: (i) the average Sr^{90} and Cs^{137} levels in the North American diet, (ii) the mechanism by which these isotopes enter plant tissue and milk, and (iii) the relation of Cs^{137} and Sr^{90} concentrations.

It has been shown in a variety of studies (*6*) that the Sr^{90} concentration in Western diet is about 1.2 times the concentration in milk in micromicrocuries of Sr^{90} per gram of calcium. Since milk is the easiest food to sample in a comprehensive manner, it is the best food to monitor. The average values provided by the U.S. Public Health Service's networks for testing powdered milk and liquid milk are given in Table 1. There is no systematic difference between the Sr^{90} concentration in powdered and liquid milk from the same general area. The data are grouped by half years, rainfall, and geography. From these data the Sr^{90} concentration in the average North American diet is calculated for each year. The concentration of Sr^{90} in the diet increased each year from 1957 through 1959, but it appears that it will drop to nearly half the 1959 value in 1960. Similar results for Cs^{137} are shown in the lower part of Table 1.

The relative contribution to the concentration of Cs^{137} and Sr^{90} in plants by direct absorption from rain and by absorption through the soil is of great importance since it determines the concentration of these fission products in the diet in the long-term situation. R. S. Russell and his co-workers (*7*) have conducted experiments which suggest that for the typical milk-producing pasture in Britain, only 20 percent of the Sr^{90} in the plants under the fallout conditions up to 1958 was introduced through the soil. They assumed that absorption from the soil is the same for the vertical profile produced by fallout as if the Sr^{90} is homogenized in the upper 4 in. of soil.

The maintenance of the milk networks of the Los Alamos Scientific Laboratory and the Public Health Service through 1961 should answer this question empirically for the North American continent as a whole. The specific activity of Sr^{90} in rain in the spring of 1960 was down from that in 1959 by a factor of about 5, whereas the total cumulative deposit had only increased by 5 to 10 percent. Thus the milk levels in the summer of 1960 should give for the continent the first estimate of the relative contribution from these sources. Although the data