

## XIV. NEUROPHYSIOLOGY\*

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Our work in the last several months has included these experiments:

1. We traced the pyramidal tract in cats by our method of stimulating antidromically through microelectrodes the fibers and their collaterals in the cervical cord and recording from the pyramids in the bulb. Our data bear out the contention of Lloyd and others that this tract ends in the dorso-lateral grey matter, communicating directly neither with the ventral horn nor the intermediate nucleus of Cajal. By similar means we made a map of the projection of the medial longitudinal fasciculus into the cord and found it to travel in the ventral columns, as already shown by Papez, but with collaterals seemingly distributed everywhere throughout the grey matter.

2. We mapped the potential field around the tip of a microelectrode delivering square pulses of current and found marked anisotropies in the dorsal columns distributed in a manner conforming to the known anatomy. These results will be used in an attempt to reconstitute the dorsal root potentials from the sources and sinks previously plotted.

3. We have made several interaction maps in the lumbar spinal cord. That is, we have attempted to discover what changes in threshold occur very locally in the passive fibers of one root when a neighboring root is excited. Since enough current flows between active and passive fibers to establish an electrotonic transient out on the root, we expected the interactions to be large, and they were. However, although we found sharp local differences in the temporal course of interaction throughout the cord, they are somewhat difficult to interpret clearly until both the electrotonic constants of intramedullary fibers as well as the anisotropies in the cord substance are known in greater detail.

4. In examining the ventral root response to a dorsal root volley, one usually marks variations in the height of the monosynaptic reflex – neglecting, save for rough qualitative comments, the ragged, longer transient said to be "multisynaptic." The synchrony of firing in the monosynaptic regions allows the height to be a direct measure of the number of fibers excited; the asynchrony of the later responses causes profound variation in its height. On taking the indefinite integral of the multisynaptic transient we found it to be extremely constant, despite large fluctuations in number and height of the peaks, and to exhibit smooth temporal changes with facilitation and inhibition. We are now engaged in comparing the simultaneous course of conditioning in the mono- and multi-synaptic responses.

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#### (XIV. NEUROPHYSIOLOGY)

5. The preliminary results of Mr. Andrew's work on the superior colliculus are embodied in a separate report (1). Briefly, he checked by physiological means the anatomically reported paths. In the cat, the colliculus receives only crossed retinal fibers, chiefly from the periphery of the visual field. It also receives fibers directly from areas 18 and 19 of the cortex. Both inputs map on the surface. The colliculus projects indirectly to those areas of the cerebellum discovered by Smith and Stowell to respond to flashes of light, and directly to the medial longitudinal fasciculus. However, there seems little if any direct connection of the superior colliculus to the oculomotor and trochlear nuclei, despite the experiments of Apter.

In the frog, stimulation of the colliculi locally produced no specific responses either in limbs or eyes. A general increase in activity or retraction of the eyeball occurred from many points and no clear representations of the one or the other were found.

Mr. Andrew's present work is directed at interpretation of the transients accompanying local stimulation in various parts of the visual field of the frog. The slow potentials have much steeper gradients normal to collicular cortex than along it and from them can be computed the temporal course in one dimension of sources and sinks through the depths of the colliculus. Cell responses occur everywhere and are extremely stable over long periods of time. An attempt is being made to see whether or not the patterns of response suggest a coding of visual stimuli; for example, velocity, direction, and size of moving spots.

#### Reference

1. A. M. Andrew, Final report for Project No. 46, Illuminating Engineering Research Fund, Research Laboratory of Electronics, M.I.T. (Dec. 1954).