The variation in the magnitude of contraction with variation in the strength of stimulus indicates that the all-or-none law does not apply to the electrically stimulated muscle cell. Gelfan[4] has reached a similar conclusion for the fibers of the retrolingual membrane of the frog stimulated *in situ*. Before a definite conclusion can be reached in the present investigation it is necessary to determine whether the stimulating current is affecting only the excitable system involved in any type of stimulation no matter how produced, or whether there are also direct electrochemical effects of the current upon other components of the cell. Some evidence that such changes are involved has been obtained and the subject is now under investigation from the view-point of the relation between the chronaxie of the cell and the magnitude of the response. In any case a more rigid statement of the all-or-none law in terms of the excitable system of the cell than is customarily given is necessary.

DUGALD E. S. BROWN
FERDINAND J. M. SICHEL
WASHINGTON SQUARE COLLEGE,
NEW YORK UNIVERSITY

THE MYOCARDIUM IN YELLOW FEVER[1]

A PRELIMINARY REPORT

A SERIES of twenty rhesus and cynomolgus monkeys has been studied electrocardiographically before inoculation with yellow fever virus (Asibi strain) and at varying intervals during the course of infection with yellow fever. Of these animals only two recovered from the disease. The functional changes in the sino-auricular node, auricular muscle, auriculoventricular bundle and ventricular muscle recorded by electrocardiography have been compared with the histopathological changes in the corresponding cardiac tissues of each animal.

Bradycardia, regular in rhythm, absolute in degree and progressively more marked on succeeding days of the disease, has been a constant finding in experimental yellow fever in the monkey. The heart rate in these animals has been reduced in varying degrees ranging from 75 to 30 per cent. of the normal frequency. The bradycardia persisted independently of ether anesthesia and sodium iso-amyl-ethyl barbiturate anesthesia, and following bilateral section of the vagus nerves. This retardation of cardiac rhythm was associated with hyaline, granular, vacuolar and fatty degenerative lesions in the musculature of the sino-auricular node. In the animals which recovered from the disease the normal heart rate was gradually resumed.

Occasionally reduplication of the P wave of the electrocardiogram was observed in experimental yellow fever; more rarely this deflection was seen to be inverted. Well-marked degenerative changes have been found in the auricular muscle.

Prolongation of the conduction time of the auriculoventricular bundle, as measured by the P-R interval of the electrocardiogram, was observed in slight or moderate degree in 84 per cent. of cases. With few exceptions the delay in conduction was progressive, increasing from day to day of the disease. The P-R periods regained their normal values in the animals which recovered. This impairment of conduction was associated with the appearance of granular, fatty and vacuolar degeneration in the fibers of the auriculoventricular bundle.

Among electrocardiographic alterations in the ventricular muscle during the course of the disease, changes in ventricular preponderance were commonly observed. The R-T period was lengthened in 94 per cent. of cases, and frequently it was deformed. The T wave commonly took an early origin from the descending limb of the R wave or the ascending limb of the S wave with concurrent distortion of the R-T segment of the ventricular electrocardiogram. The normal upright T wave was replaced in 76 per cent. of the cases by a deflection either negative in direction or diphasic in contour, the latter change being represented either by two waves above the line of equipotential or by one positive and one negative wave in relation to the base line. In addition to these types of deformity of the terminal deflection, an upright T wave of increased height was frequently observed. These abnormal variations of the ventricular electrocardiogram appeared most frequently on the later days of the disease; but these disturbances were transient, fleeting in nature, present in one tracing and not in another, one type of variation being inscribed upon one occasion, a different deformity appearing during subsequent annotations. Their occurrence was associated with the presence in the ventricular muscle of these animals of hyaline, granular, vacuolar and fatty degenerative lesions.

A detailed account of which the above is a summary is in preparation and will be published in the near future.

WRAY LLOYD
DEPARTMENT OF PATHOLOGY
AND BACTERIOLOGY,
UNIVERSITY OF TORONTO

[4] S. Gelfan, *Amer. J. Physiol.*, 93: 1, 1930.

[1] This work was performed under the tenure of a grant from the Banting Research Foundation. The electrocardiographic studies were carried out in the Yellow Fever Laboratory of the Rockefeller Foundation and in the Physiological Laboratory of the Rockefeller Institute in New York, through the kindness of the directors of these laboratories, Dr. W. A. Sawyer and Dr. A. E. Cohn.