

SCIENTIFIC PROCEEDINGS.

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An examination of Fröhlich's theory of the treppe.

By **FREDERIC S. LEE** and **E. N. HARVEY.**

[From the Department of Physiology of Columbia University, at the College of Physicians and Surgeons, New York.]

It is commonly believed that during the treppe a muscle possesses a progressively augmented power of performing work. According to Fröhlich, the augmentation is not real but only apparent. He believes that fatigue of the muscle elements begins with the beginning of the series of contractions, and that, from the first, it is manifested by a slowing of relaxation, a diminution in the extent of contraction, and a diminution in irritability. Successive elements of a stimulated muscle contract successively and those first in contraction begin their relaxation before later elements have reached the maximum of shortening. Since the total amount of shortening of the whole muscle represents the algebraic sum of the amounts of shortening of the several elements, with the slowing of relaxation, the total amount of shortening is increased. This more than counterbalances the diminution in the extent of contraction. The treppe is thus a physical expression of delayed vital processes and signifies a diminished, rather than an increased working power. Fröhlich has extended this theory to the augmentation observed in the preliminary stages of the action of cold, asphyxia, carbon dioxide, alcohol and other narcotics on various tissues, in the central nervous system under various conditions, in the current of action of nerves, and even in the production of heat in fevers. His theory conflicts with the theory advanced by the present senior author, according to which the

treppe represents increased irritability and increased working power, due to the action of small quantities of carbon dioxide, lactic acid and, possibly, other fatigue substances.

If Fröhlich's theory be correct, there should be a progressive increase in the length of the successive muscle curves throughout the treppe. This is found not to be so. When a muscle lever is made to close an electric circuit automatically at the precise end of each relaxation and thus to stimulate the muscle anew, it is found that the length of the muscle curves at first increases and then decreases, while the treppe is still proceeding. This fact does not seem explicable by Fröhlich's theory, but is what might be expected if the treppe were due to the augmenting action of fatigue substances.

Fröhlich's theory demands that the irritability of the muscle should progressively decrease from the time of the first contraction. This also is found not to be so. When the irritability of the excised and non-curarized muscle, as indicated by the threshold of stimulation, is determined at intervals throughout the course of the treppe, it is found that the irritability progressively increases. This again is in harmony with the theory of the treppe, proposed by the senior author.

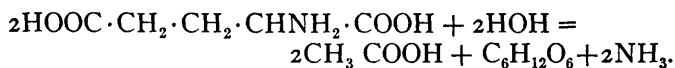
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An attempt to discover the cause of the specific dynamic action of protein.

By **GRAHAM LUSK.**

[*From the Physiological Laboratory of the Cornell University Medical College at New York.*]

The writer has shown that if glutamic acid be given to a phlorhizined dog three of its carbon atoms are converted into glucose. One can write the reaction thus:



Rubner sought to explain the increase in heat production which followed meat ingestion—its *specific dynamic* action—by the supposition that protein could be used for the vital activities of the cells only in so far as it was converted into dextrose; all the oxidations of other portions of the protein yielded free heat within the