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Some Characteristics of the Electro-Myograms of Quick Voluntary Muscle Contractions.

STARKE HATHAWAY. (Introduced by A. T. Rasmussen.)

From the Department of Psychology, University of Minnesota.

The electro-myograms making up the data from which these observations are reported were obtained from oscillographic records of amplified muscle action potentials. Ten adult human subjects were used. The action potentials were picked up by modified pore electrodes¹ which were inserted into the body of the muscle to be investigated. The active electrodes were insulated from all but a small area of the interior of the muscle, allowing fair isolation of antagonistic muscles. The amplified action potentials were photographed in a Westinghouse multi-element oscillograph. Action potentials could be simultaneously photographed from 2 different sources, usually the biceps and triceps brachii of the right arm.

A simple reaction time set-up was used. The subject was instructed to extend his forearm as quickly as possible following the disappearance of the glow of a low wattage neon bulb. The arm was supported horizontally on a rest allowing free movement about the elbow. The photographs included markers showing arm movement, time in 10 sigma intervals and a marker showing when the subject was given the ready signal and the stimulus. Reaction times were read to the first action potentials after the stimulus and to the first arm movement. The records show an average of about 58 sigma lapse between the first large action potential changes and the corresponding movement of the forearm. This time is fairly constant, varying in ordinary subjects by not more than ± 8 sigma. There was no evidence of a preliminary tension in either the muscle which was to be used in the response or its antagonist preceding the stimulus and related to the warning signal.

¹ Adrian, E. D., and Bronk, D. W., *J. Physiol.*, 1929, **67**, 119.

Almost invariably action potentials in the reacting muscle were accompanied by corresponding ones in its antagonist. These antagonistic potentials might or might not correspond in time with the start of the reaction though it was usually within 10 sigma of being the same.

Wholly unexpectedly about 40% of all the records had an early volley of small discharges which appeared in as little as 25 sigma following the stimulus. The records from 3 of the subjects showed none of these early discharges and those from the remainder showed varying numbers, never, however, 100%. These early discharges, which were not accompanied by gross movement of the arm, occurred from 110 to 160 sigma earlier than the arm movement of the response. In the responding muscle they become larger, which augmentation was followed in 58 sigma (as above) by the first arm movement. These pre-response discharges were found in not only the responding muscle but also in its antagonist, in the triceps and biceps brachii of the contralateral arm which did not grossly move at all, and in the homolateral gastrocnemius. They are therefore quite widespread in their appearance.

No complete theory can as yet be formulated in explanation of these pre-response discharges. The times of their appearance correspond roughly to the times for simple reflexes. It is possible that they originate in lower levels neurologically and so point to another relationship of the voluntary to the involuntary reaction. Further investigation is necessary in order to formulate more clearly the possibilities.

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Solubility of Calcium Oxalate and Uric Acid in Solutions of Urea.

GRACE MEDES.

From the Department of Medicine, University Hospital, Minneapolis, Minnesota.

The high solubility of calcium oxalate and uric acid in urine has frequently been ascribed to the action of the colloids of urine.^{1,2} Urea also is known to increase the solubility of a number of compounds. As the unsaturated amide of carbonic acid it combines with acids to

¹ Joly, J. S., *Stone and Calcarous Diseases of the Urinary Organs*, St. Louis, 1929.

² Pauli and Semac, *Biochem. Z.*, 1909, **17**, 235.