tions and then rapidly fatigues at the base line. This type of fatigue curve is due to the failure of contraction and is to be sharply distinguished from the fatigue contracture of normal and phosphate muscle, where the fatigue shows itself as a failure of relaxation. A point of special interest is that shortly after fatigue is complete the muscle begins to shorten. This shortening continues after cessation of the stimulus and the muscle rapidly goes into rigor. The lifting power of the fluoride muscle is not impaired at first as was shown by tracings made with 50 gm. loads.

A 1% solution of sodium bicarbonate injected intraperitoneally into the frog alters the fatigue curve in much the same manner as phosphate. These observations are of interest in connection with the retention of phosphate in parathyroid tetany[2] and the development of tetany in normal individuals when alkalosis is produced by prolonged rapid and deep respirations.[3]

Sodium oxylate which is known to precipitate calcium in the blood stream[4] as well as *in vitro* and which might be expected to cause rigidity does not have this effect. Fatigue contracture develops just as slowly as in normal muscle. Calcium chloride, even when administered in quantities sufficient to prostrate the frog does not alter the fatigue curve from normal.

4197

Effect of Electric Currents on the Arteries.

R. H. JAFFÉ, D. WILLIS AND A. BACHEM.

From the Department of Pathology, University of Illinois.

In a series of experiments the effect of electric currents of low tension (110 to 220 volts) on the femoral artery of the dog has been tested. These currents do not cause any anatomical changes if the blood is circulating freely. Combination of the passage of the current with a stopping of the circulation at a point distal to the electrodes leads to a complete destruction of the muscle fibres of the media, while the elastic fibres retain their specific staining properties but lose their elasticity. It is suggested that the heat that is liberated in the vessel wall produces this effect. The circu-

[2] Herring, W., and Kuhnan, J., *Endocrinology*, 1927, xi, 80.

[3] Grant, S. B., *Arch. Int. Med.*, 1922, xxx, 355; *Am. J. Physiol.*, lxvi, 274.

[4] Vines, H. W. C., *Endocrinology*, 1927, xi, 290.

lating blood prevents the overheating of the wall. Hence, no changes result in the experiments in which there is no interference with the free circulation. Added proof to this explanation is the fact that a slight searing of the vessel with a hot wire leads to almost identical changes.

The vessels with the media practically gone become much dilated but they do not rupture. After several months the media has been replaced by a dense hyaline connective tissue with a scanty elastic network. No muscle fibres can be detected. The intima is thickened and also the adventitia has increased much in thickness and density.

4198

Comparison Between Morphine and Feeding as Agents in Production of Conditioned Salivary Response.

NATHANIEL KLEITMAN.

From the Department of Physiology, The University of Chicago.

In a quantitative study of the conditioned salivation in the dog developed through daily injections of morphine[1] it was found that the flow of saliva was unusually copious. Thus the total quantity of saliva secreted conditionally by a 12 to 14 kilo dog would run as high as 400 cc. in one hour. The conditioned stimulus in this case consisted in placing the dog in a stand where it remained for a definite period of time (usually 30 minutes), before receiving a subcutaneous injection of morphine. In the work of Pavlov and others[2] where food or acid was employed as an unconditioned stimulus, the "delay" between the beginning of the action of the conditioned stimulus and the application of the unconditioned stimulus was a matter of 2 to 3 minutes or even less. This suggested the possibility that the long "delay" employed in the case of the morphine-produced response might be responsible for the large amounts of saliva secreted. To test this, 3 dogs, with fistulae of the submaxillary glands, were placed in a stand for 30 minutes daily, for periods of 22, 27, and 76 days respectively. Each day, at the end of the 30 minutes in the stand, they were fed a meal of ground beef heart. The unconditioned salivary response to feeding was greater than to

[1] Kleitman and Crisler, *Am. J. Physiol.*, 1927, lxxix, 571.

[2] Pavlov, "Conditioned Reflexes," 1927, Oxford University Press, New York.