and to rennin. Trypsin was tested by the casein method of Gross and the rennin was determined by the method of Blum and Fuld with slight modifications which will not be discussed here. Both ferments were shaken at room temperature, and at 33°C.; also the influence upon the results of different rates of shaking and of changes in other conditions were investigated. We shall, however, state here only that the destructive effect of shaking upon trypsin and rennin is, as for pepsin, distinctly increased by increasing the rate of shaking and by increasing the temperature at which the shaking is carried on. There is a pronounced difference in the resistance to shaking between pepsin and trypsin under the conditions thus far studied, the latter being more readily affected. The destructibility of rennin runs practically parallel with that of pepsin.

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The influence of sodium and calcium upon direct and indirect muscle irritability and their mutual antagonistic actions.

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By the researches of Kühne, Biedermann, Ringer, Loeb, and many others, it is established that solutions of sodium chloride cause rhythmical movements of the muscles of the frog, and that the addition of a small quantity of calcium will stop them. By the researches of Locke, Carslaw, Cushing, Poljakoff and Overton, it is further established that solutions of sodium chloride abolish indirect irritability, and that the addition of a small dose of calcium restores it. There has been very little work done on the *primary* effect of calcium upon the direct and indirect irritability of the skeletal muscles of the frog and there are practically no researches on the action of sodium upon the primary effects of calcium.

In our experiments, sodium and calcium chlorides were employed in M/10 solutions and were introduced by infusion through the abdominal aorta according to the method described by Cushing.[1] The graphic records were obtained from the gastro-

[1] Cushing: *American Jour. of Physiol.*, 1902, vi, 77.

cnemius and the sciatic plexus was stimulated at about one minute intervals by two consecutive shocks (make and break) from an induction current.

In agreement with the above mentioned statements, we found that sodium chloride reduces indirect (curare-like action) and reduces moderately also direct (Poljakoff) irritability. Both are promptly restored by the addition of a small dose of calcium. As a new fact we may mention that the irritability is more readily abolished in cooled frogs.

Although calcium *restores* indirect irritability when abolished by sodium, it *abolishes* indirect irritability when injected primarily. The dose necessary is considerably smaller than that of sodium for the same effect. Again, the indirect irritability thus abolished by primary infusion of calcium can be restored by sodium of which, however, a larger dose is required than of calcium in a secondary injection for a similar purpose.

Calcium also reduces or abolishes direct irritability, which again can be restored by sodium. The loss of indirect and direct irritability by calcium is not exactly parallel. Cooling seems to favor the effects also of calcium.

In these experiments neither sodium nor calcium exclusively increased or decreased the irritability. Both depressed in primary infusion and were mutually antagonistic in secondary infusions.

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The effects of local applications of chloride and sulphate of magnesium upon the centers in the medulla compared with those of sodium chloride.

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The three salts were applied in molecular solutions to the exposed medulla oblongata of rabbits. Both salts of magnesium abolished sooner or later all the functions depending upon the centers located in the medulla, the average time until a complete effect took place being fifteen minutes. Respiration stopped and