

altered by section of the brain stem at this level. Animals successfully operated in this manner exhibit no voluntary movements, but their spinal and medullary reflex mechanisms remain intact. Spinal and medullary reflexes, especially those involved in progression, are readily elicited, in such animals, as soon as the immediate shock of the operation has subsided.

The tonus curves both of the *quadriceps femoris* and *triceps brachii* muscles with intact innervation obtained following section of the brain stem are essentially similar to the tonus curves of these muscles obtained while the intact animal was under light ether anesthesia. Likewise, the tonus curves of these muscles previously deprived of their sympathetic or (in case of the triceps) somatic innervation obtained following section of the brain stem are essentially similar to the corresponding curves obtained while the animal was under light ether anesthesia before section of the brain stem.

The results of the present series of experiments in general corroborate the results of our experiments in tonus measurement previously reported, and afford additional evidence in support of the theory that an important component of the tonus exhibited by skeletal muscles, in the absence of contractile effort, is mediated through the sympathetic nervous system.

¹ Kuntz, A., and Kerper, A. H., *PROC. SOC. EXP. BIOL. AND MED.*, 1925, xxiii, 77; 1926, xxiii, 367; *Am. J. Physiol.*, 1926, lxxvi, 121.

² Magnus, R., *Pflüger's Arch.*, 1916, clxiii, 405.

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The Occurrence of a Physiologically Active Substance in Cultures of the Gas Bacillus.

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Cultures of the gas bacillus which have been enriched with carbohydrate utilizable by the microbe for its energy requirement, contain a substance, possibly substances, which will both induce immediate contracture in isolated guinea pig small intestine im-

mersed in Tyrode solution according to the Trendelenburg technique, and also cause a pronounced, but rather transient, depression of blood pressure in the dog under ether anesthesia upon intravenous injection. The potency of the average 48-hour culture is such that from 0.05 to 0.4 cc. of the fluid medium, freed from bacteria by passage through a Berkefeld filter, will cause such strip of intestine, less than 5 cm. long, preferably from the ileal region, attached to a suitable lever with an arm ratio of 1:9, to record a contracture from 5 to 12 cm. high. Two cubic centimeters of such a filtrate will induce a rather transient drop of some 40 per cent in the blood pressure of a dog weighing about 24 kilos.

The ratio of cultures used to Tyrode solution is from 0.05 to 0.4 cc. of the former to 125 cc. of the latter; and in the dog not greater than 1:1000 of the total blood volume. These effects are elicited by the unaltered, entire, bacteria-free solution which contains much water and other material. The reactive substance is readily washed out from the contracting substance by simply replacing the solution containing it with a fresh Tyrode solution. The actual amount of reactive substance is a very small fraction of the material used for experiment.

The occurrence of the reactive substance is not limited to one or two selected strains of the gas bacillus: some 72 cultures, obtained from the intestinal contents of 41 persons have been studied. Of these, 6 were found to be nearly negative. Quantitative variations were detected among the remaining 66 cultures, but of not great magnitude. The variations in response were, in fact, relatively inconsequential when they were evaluated in terms of the reaction elicited from different pieces of intestines from the same and from different guinea pigs.

None of the bacteria studied thus far, the normal and pathological intestinal group and others, contain demonstrable amounts of this substance. The gas bacillus alone of these contains it, and in relatively large amounts.

The substance which causes the contracture of the guinea pig gut and the transient drop in blood pressure in the dog is produced under quite definite conditions. None appears in the usual cultural mediums from which carbohydrate is excluded, but in media where fermentation is active, the substance is present in considerable—nearly maximal—amount in 48 hours. None is present in the uninoculated mediums.

The substance is not butyric acid, although there is considerable butyric acid produced simultaneously. The butyric acid may be distilled off quantitatively, leaving behind a fluid residuum which contains the substance, apparently increased in potency as the concentration of the mother fluid is increased by the progress of the distillation. Hence, also, it is heat stable. It should be emphasized that the acid distillate from such a concentration, containing much butyric acid, is wholly inert. The chemical properties and identification of this physiologically active, thermostable compound are not as yet fully established.

Effects produced by Berkefeld filtrates of gas bacillus cultures upon pieces of small intestine of guinea pig, suspended in Tyrode Solution I 125 cc. I. Time 6 seconds. Gut thoroughly washed with Tyrode between experiments.

5. 0.4 cc. filtrate milk culture gas bacillus 2xx.
7. 0.4 cc. filtrate plain broth culture gas bacillus 2xx.
8. 0.4 cc. filtrate saccharose broth culture gas bacillus 2xx.

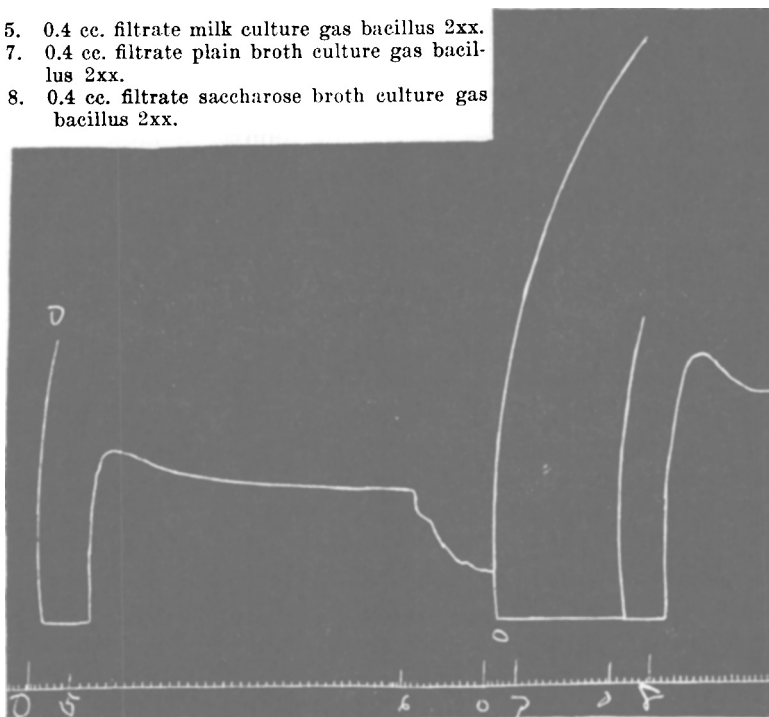


FIG. 1.

At 5, 0.4 cc. filtrate of a 48-hour milk culture added. Note immediate contracture. At 7, 0.4 cc. filtrate of plain broth added. No effect. At 8, 0.4 cc. filtrate of saccharose broth. Immediate contracture. Reactive substance not produced in medium from which utilizable carbohydrate is excluded.

10. 0.4 cc. filtrate milk culture gas bacillus 2xx, neutral to phenolphthalein.
11. 0.4 cc. distillate from 100 cc. of milk culture, gas bacillus 2xx.
12. 1 cc. distillate from 100 cc. of milk culture, gas bacillus 2xx.

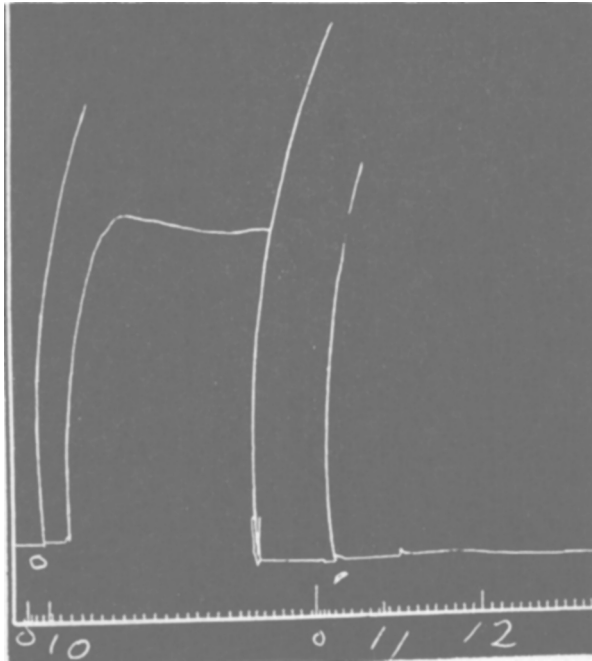


FIG. 2.

At 10, 0.4 cc. filtrate of a 72-hour milk culture of gas bacillus neutral to phenolphthalein is added. Immediate contracture. At 11, 0.4 cc. distillate from 100 cc. of the above milk culture is added. No effect. At 12, 1 cc. of distillate is added. No effect. The reactive substance is not butyric acid and is not volatile.

14. 0.4 cc. boiled filtrate of milk culture, gas bacillus 2xx.
15. 0.1 cc. boiled filtrate of milk culture, gas bacillus 2xx.

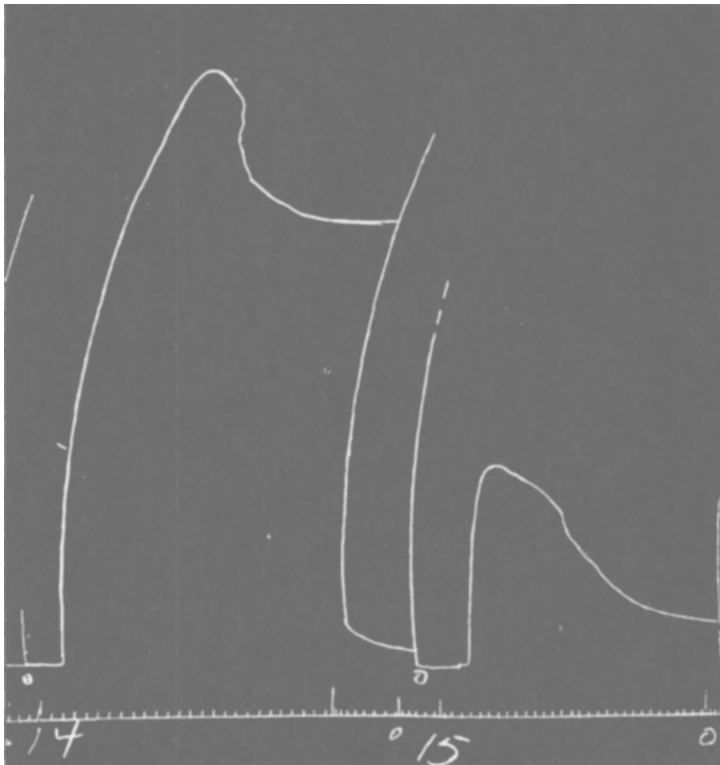


FIG. 3.

At 14, 0.4 cc. of the residual fluid after distillation is added to the Tyrode Solution. I Solution concentrated to $\frac{1}{3}$ the original volume. I Immediate and maximal contracture. The reactive substance is thermostable.