the greatest sensitivity through the bone with the ears open showed the least advantage on closing the external canals. It was also observed that the enhancement in bone transmission due to occlusion of canals becomes less pronounced as the pitch rises, and is most marked in the low part of the tone scale.

2836

Quantitative experimental data on the rôle of the sympathetic innervation in the tonus of the quadriceps femoris muscles.

ALBERT KUNTZ and ALVER H. KERPER.

[*From the St. Louis University School of Medicine, St. Louis, Mo.*]

By the use of Spiegel's method of measuring the tonus of the *quadriceps femoris* in resting animals,[1] tonus curves of this muscle in cats and dogs were obtained before and after elimination of its sympathetic nerve supply, and before and after removal of the cerebellum. In some of the experiments tonus curves of the same muscle were obtained before and after extirpation of the sympathetic trunk in the lumbar region, in others tonus curves of both quadriceps muscles were obtained in animals which had previously been subjected to unilateral extirpation of the lumbar sympathetic trunk. Removal of the cerebellum was commonly carried out after the tonus curves of both quadriceps muscles were obtained in animals which had been previously subjected to unilateral extirpation of the lumbar sympathetic trunk. Then the tonus curves of both muscles were obtained once more.

These tonus curves are essentially the curves of passive extension of the quadriceps muscles. Those obtained for the same muscle before and after elimination of its sympathetic nerve supply are practically identical with the curves obtained for the muscle on the unoperated and operated sides respectively, following unilateral extirpation of the lumbar sympathetic trunk. The time interval between sympathectomy and the measurement of tonus is relatively unimportant.

---

[1] Spiegel, E. A., *Ztschr. f. d. ges. Neur. u. Psych.*, 1923, lxxii, 517.

Curves which may be regarded as typical of a large number obtained in these experiments are illustrated in the accompanying figure (Fig. 1). The curve of extension of the normal quadri-

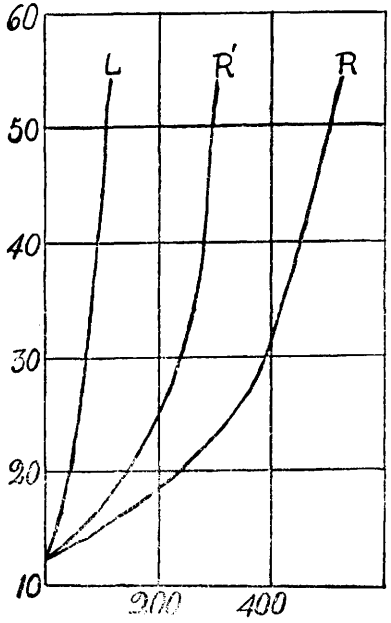

FIGURE 1.

Tonus curves of right and left quadriceps muscles of a cat obtained fourteen days after extirpation of the left lumbar sympathetic trunk. R, curve of normal right quadriceps; L, curve of left quadriceps; R', curve of right quadriceps following removal of the cerebellum. The figures in the vertical series indicate the angle of flexion of the knee; those in the horizontal series indicate the force applied.

ceps (R) rises very slowly at first, and then more rapidly as the angle of flexion of the knee increases. The quadriceps muscle offers greater resistance at the beginning of passive displacement of the leg from a position of rest in which the knee is only slightly flexed than it does from one in which the angle of flexion of the knee is relatively large. This is known as the "brake phenomenon." The curve of extension of the *quadriceps femoris* deprived of its sympathetic nerve supply (L) rises rapidly from the beginning. This indicates less tonus than is exhibited by the normal muscle, and absence of the "brake phenomenon." Following removal of the cerebellum, the curve of extension of the quadriceps with its sympathetic nerve supply intact (R') falls between

the two curves previously obtained, while the curve of extension of the quadriceps deprived of its sympathetic innervation coincides with the one obtained for this muscle when the cerebellum was intact. Obviously, the "brake phenomenon" depends in part on cerebellar impulses which are conveyed to the skeletal muscles through the sympathetic nervous system.

The component of muscle tonus which, as indicated by the curves obtained in these experiments, is mediated through the sympathetic nervous system, includes those elements of tonus which enable the muscle to develop resistance to passive displacement of a limb from a position of rest. These are the elements of tonus which tend to maintain any given posture, once that posture is imposed by voluntary effort or external force. They are closely akin to, perhaps identical with, those elements of tonus on which the "shortening" and "lengthening" reactions depend which Sherrington described and interpreted as the manifestations of plastic tonus.[2] Therefore, the results of these experiments afford quantitative evidence which supports the theory advanced by Langelaan[3] and more recently advocated by Hunter[4] and Royle[5] that plastic tonus in skeletal muscles is mediated through the sympathetic nervous system.

2837

The effect of the administration of thyroxin upon the surface tension of blood.

C. M. WILHELMJ and MOYER S. FLEISHER.

[*From the Department of Bacteriology and Hygiene, St. Louis University School of Medicine, St. Louis, Mo.*]

In a previous communication[1] we have shown that thyroidectomy brings about in the course of nineteen to twenty-two days an increase in the value of the surface tension of the blood of guinea pigs. Since hypothyroidism causes this increase in the surface tension, it was of course of interest to ascertain whether

[2] Sherrington, C. S., *Proc. Roy. Soc.*, 1896, lx.

[3] Langelaan, J. W., *Brain*, 1915, xxxviii, 235.

[4] Hunter, J. I., *Brain*, 1924, xlvii, 261.

[5] Royle, N. D., *Brain*, 1924, xlvii, 275.

[1] Wilhelmj and Fisher, PROC. SOC. EXP. BIOL. AND MED., 1925, xxii, 478.