

Physiology. — “*On the Action of the Novocain on the Tonus of the Skeletal Muscle*”. By Dr. S. DE BOER. (Communicated by Prof. J. K. A. WERTHEIM SALOMONSON).

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When a subcutaneous injection of 5 or 10 drops of 1 % novocain is administered to a frog, the muscles will soon become entirely atonic. The stimulus-threshold of the N. Ischiadicus is then still unchanged and likewise the sensibility of the skin. According to the hypothesis of ERICH MEYER and L. WEILER this atony is due to intoxication of the accessory nerve-endings of BOEKE. ALMS and also LILJESTRAND and MAGNUS ascribe it to intoxication of the sensibility of the muscle. The experimental investigation of FRANK and his co-workers corroborate MEYER and WEILER's conception.

When FRANK published his experience my inquiry had been in progress for some time. It is known that a small dosis of nicotin applied at the ingress of the nerve, produces a contracture. In order to obtain this effect by acting on the muscle-substance a much larger dosis must be used (LANGLEY). This result is not altered by a previous denervation: five weeks after cutting the N. Ischiadicus I succeeded in evoking contractures in denervated muscles on administration of a subcutaneous injection of a minimal dosis of nicotin.

When I injected into an intact frog first 5 or 10 drops of 1 % novocain subcutaneously, a complete atony of the skeletal muscles ensued after 15 minutes. Subsequently 10 drops of 1 % nicotin were given subcutaneously, which did not engender a trace of a contracture.

In another series of experiments I injected into the muscles of the hind-leg 3 drops of 1 % novocain to 1 cc of NaCl 0.65 %, by which these muscles lost their tonus. I then administered 10 drops of 1 % nicotin subcutaneously; the muscles of three limbs then displayed marked contractures; those of the hind-leg that had been poisoned with novocain remained quite flaccid. Similar experiments were carried out with a foreleg. The result was the same when I injected into the muscles of one of the non-poisoned limbs only 0.65 % NaCl solution.

When the excised rectus abdominis is placed in 40 gr. of NaCl 0.65 % and 1 drop of 1 % nicotin is added, a marked contracture will ensue. This will not take place, however, when first 40 gr. of NaCl 0.65 % + 4 gr. of 1 % novocain is allowed to act on it for 20 minutes.

When allowing this weak nicotin solution to act on the nervous aequator of a gastrocnemius without novocain, a marked contracture will appear, which will not be the case when the solution is made to act on the conical end. In order to achieve a contracture then a much stronger solution is required.

We conclude, therefore, that novocain can obviate contractures originating from the nervous aequator.

After this I used some substances that enhance the tonus, such as calcium-chloride and rhodan-sodium. For each of these I ascertained the weakened solution just yielding a distinct contracture of an excised skeleton-muscle. I then substituted the tenth part of such a solution by 1 % novocain. A frog's muscle was then submerged in it after the muscle had first been attached to a lever and after it had been for 20 minutes in 1 % novocain.

NaCNS yielded similar results to those obtained with nicotin. The contractures occurring after CaCl_2 -poisoning, could not be obviated by a previous intoxication with novocain. Just as large doses of nicotin CaCl_2 would also yield contractures through an action on the tonus-substrate itself.

When in a frog hemisection of the med. oblongata proximal to the exit of the Nervus VIII is performed, there results a typical forced position. The ipsilateral foreleg is bent and adducted. The foreleg on the other side is abducted in a stretched position. The hind-legs display similar positions, but they are less pronounced. The head and the trunk are turned to the side of the lesion. Now when injecting into the muscles of the stretched and abducted foreleg two drops of 1 % novocain to 1 c.c. of NaCl 0.65 %, the stretched position persists (in an uninjured frog such an injection produces a complete atony of the muscles of the foreleg). It appears then that the stretched position is evolved by a tetanic contraction, sustained under the influence of the ordinary cerebro-spinal innervation.

It appears, therefore, that an equally active dosis of novocain leaves the cerebro-spinal innervation intact, while the tonus of the skeletal-muscles is abolished by it. Now since novocain abolishes a muscle-contracture that has been evoked from the nervous aequator (receptive substance), we are justified in concluding that the tonus of the skeletal-muscles is destroyed by novocain through a poisoning of the receptive substance of the tonus-substrate. Moreover it has been proved once more that in the skeletal-muscles two kinds of contractions can be evoked, viz. clonic and tonic contractions.
