Archives Internat. de Physiologie et de Biochimie, 1957, Vol. LXV, fasc. I, p. 149
SOCIÉTÉ BELGE DE PHYSIOLOGIE
Réunion de Gand, 19 janvier 1957

Restitution par l'allongement de la tension tétanique du muscle fatigué, par G. MARÉCHAL (*Laboratoire de Physiologie ; Université de Louvain ; dir. : J. P. Bouckaert*) (1 figure).

Translated from French.

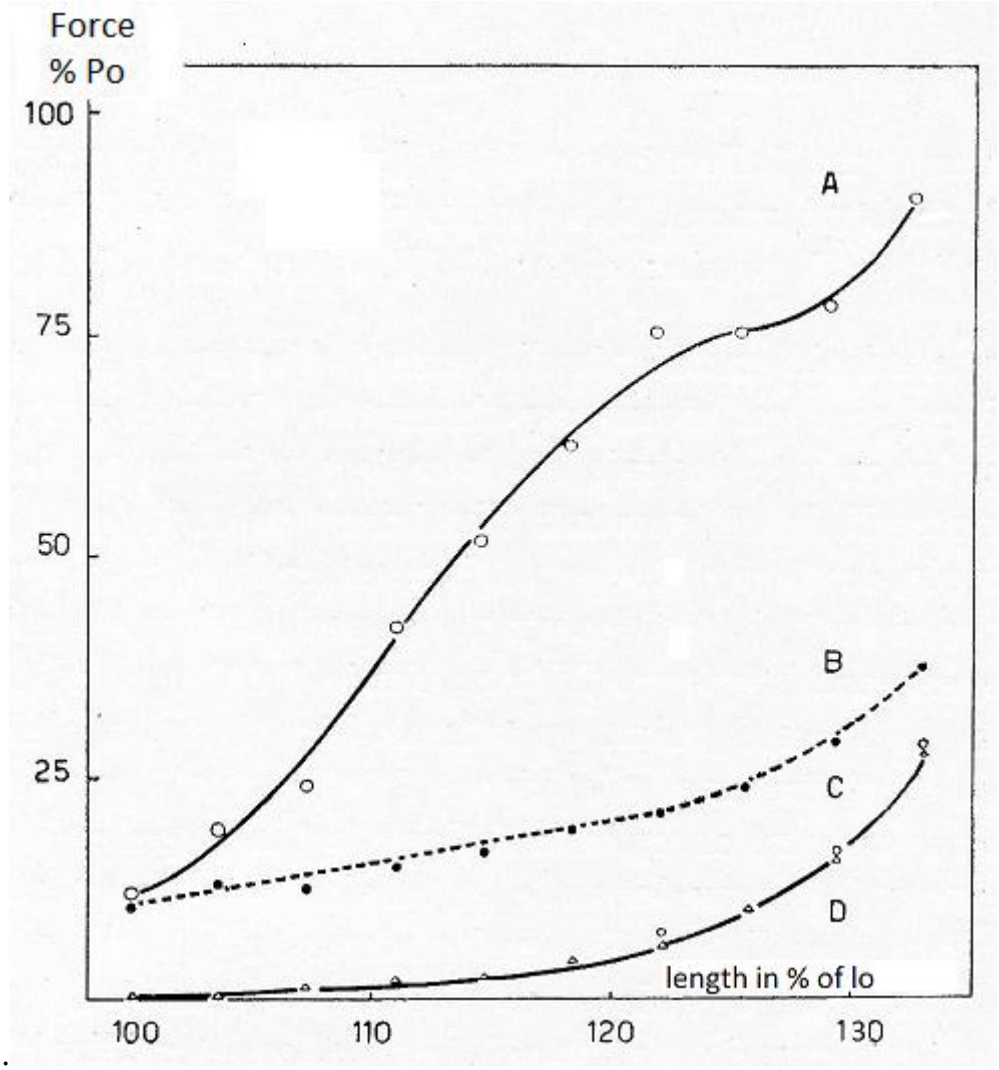
Restoration of fatigued muscle by lengthening of tetanic tension, by G. Maréchal.*(Laboratory of Physiology, University of Louvain; dir. JP Bouckaert)* (1 figure).

A regularly excited isolated muscle develops a tension that decreases more or less rapidly with each contraction. It is demonstrated that one of the reasons for this "fatigue" is the progressive elongation of the elements inside the muscle.

The frog sartorius muscle is fatigued by a series of isometric tetanus (excitation by alternating capacitor discharges, frequency 25 / sec., duration 1 to 3 sec., constant intervals of 1 or 8 min., In richly oxygenated humid atmosphere, temperature about 16 ^{0} C). The length of the muscle, constant during the fatigue test, is the standard length in the body $l_{a,}$ at which the tetanus tension is about its maximum voltage while the resting tension is still low. When the tetanic tension has fallen strongly, and therefore fatigue is great, the muscle is lengthened millimeter by millimeter between each tetanus.

The figure summarizes the results of such an experiment. Muscle, which developed a tension equal to 100% $P_{o,}$ develops barely more than 11.5% P_o after a series of 145 tetanus of 1.6s. Curve A shows the considerable increase in tension when the muscle is stretched to a length of 125%$l_{o:}$ the tension reaches 75% of $P_{o,}$ the starting tension. The increase in the resting tension (curve C) is far from being able to explain the important recovery of the tetanic tension.

This phenomenon does not recur after a second fatigue test. The muscle was returned to its original length and, after standing in Ringer, again developed a tension close to $\mathbf{P_o}$. After a new series of 75 tetanus, the elongation no longer leads to an increase in tension Tetanus decreased by fatigue (curve B), while the resting tension remained practically the same as before (curve D)



The favorable effect of the elongation observed in the first case is not due to localized fatigue of the membrane. It would have been possible to suppose that the membrane, excited at the same place, would deteriorate, and that the stretching would bring better portions of the membrane in contact with the electrodes. But experience has shown that the displacement of the electrodes after fatigue, without modification of the length of the muscle, did not lead to any increase in tetanic tension.

It seems that in order to interpret this phenomenon, at least two components should be admitted to fatigue. The first, a mechanical component, would result from the internal stretching of the muscle under the effect of its own tension, compensated by an equivalent shortening of the contractile mechanism: the stretch would bring it back to its original length. The recovery, however, is not complete, because of the second component, perhaps metabolic. If the muscle is fatigued a second time, or if it is fatigued more rapidly, either by shortening the interval between the tetanus or by lengthening the duration of the tetanus, this second component prevails, and the elongation is unable to restore tetanic tension.