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J. BERGMANS et G. MARÉCHAL — **Rapport entre potentiel d'action et tension du muscle strié** (*Laboratoire de Physiologie, Université de Louvain, Directeur : J. P. Bouckaert*) (1 figure).

Translated from French.

Relationship between action potential and striated muscle tension

(Laboratory of Physiology, University of Louvain, Director: J. P. Bouckaerl)

The isometric tension (force par unit muscle cross-section) of a curarized frog sartorius evolves into two distinct phases during a long tetanus (MARÉCHAL and AUBERT, 1958). The extracellular action potential AP (belly-tendon derivation), present ratios with the tension very different according to the phase in question. During the first, the tension decreases little, whereas the AP decreases by 50%; during the second, the tension which decreases rapidly decreases proportionally to the AP (see Fig.1).

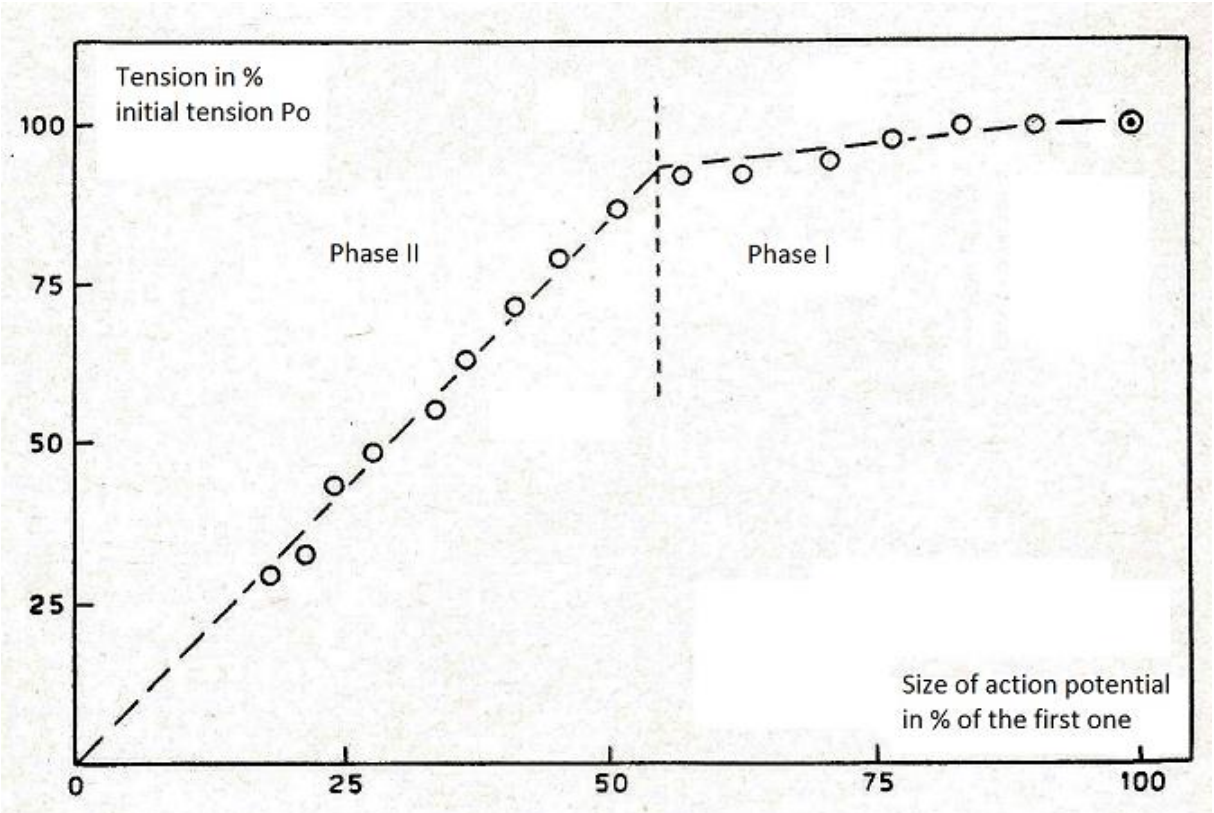

FIG. 1.

The intracellular PA measured with a microelectrode certainly decreases during the first phase of tetanus (BERGMANS, 1959); the decrease in the extracellular AP must reflect a real decrease in the AP of each fiber and not result exclusively from a desynchronization which remains minimal in our traces nor from a decrease in extracellular resistance. The tension is independent of the amplitude of the AP during the first phase of the tetanus, but not during the second phase. This fact suggests that the depolarization of the membrane causes a complete activation of the contractile mechanism when it exceeds a certain amplitude, a certain threshold. During the first phase, the APs of all fibers exceed their thresholds very broadly, and the tetanic tension remains practically constant, despite the decrease in AP. But if tetanization continues, a number of APs no longer reach their respective thresholds; This number may be a complicated function of the time of detection, but since it is sufficient, the observed fatigue will depend only on the number of effective APs, and consequently the tension-AP relationship will be linear, as observed during the second phase of tetanus.

At the beginning of a fatigue test (tetanus 8 sec at 15 min intervals) the maximum tetanus tension decreased little, but the correlative extracellular AP decreased rapidly. When this AP drops to about half the value it had in the first tetanus, the maximum tension decreases in proportion to the corresponding AP. The ratio between maximum tension and AP during a series of tetani closely resembles the ratio between voltage and AP over the same tetanus. The dissociation between the evolutions of maximum tension and AP at the beginning of the fatigue test also suggests the existence of the threshold we have postulated.

It should be added that during a series of shocks we did not observe the persistence of the AP with the disappearance of the mechanical response described by VON BRÜCKE (1908) and SCHAEFER (1936).

In conclusion, the muscular fatigue which occurs as a result of prolonged tetanization seems to originate at the level of the membrane, in a deficiency of the electrical processes which would become powerless to excite again the contractile mechanism.

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