ELECTROMYOSTIMULATION - BASICS, CHANCES AND LIMITS

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Abstract
The changes of charge and its density at the biological membranes is discussed from the point of nonequilibrium thermodynamics. From the fundamental equations (Gibbs 1948) it can be derived that the process of muscular contraction is the result of electrostrictive behavior respectively of the reciprocal piecoelectrical effect. Only the process of restoration of nonequilibrium state of the membranes is an energy-demanding process.
Another point of discussion is the fact that the electrical current conducting structures of the muscle fibers are build like small tubes (tubules, cisterns and sarcoplasmatic reticulum). The idea to build such structures could be that they act as waveguides which are able to transfer much higher wave frequencies than hitherto assumed. According to this new basics, the skeletal muscle fibers must be able to respond to stimulation with electrical impulses of much higher frequencies than is generally believed. Since the 1980s it has been proved, that indeed the muscle fibers of animals and men can respond to electrical impulses with frequencies in the order of magnitude of 10^5 and 10^6 impulses per second. The advantage of the application of such small and high frequent electrical signals applied to the muscular membrane systems is discussed and compared to the effects of broader impulses with lower frequencies.

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