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CPK et C_T dans les muscles striés.

Translation from French

CPK and CT in the striated muscles.

Total creatine (C_T, the sum of creatine and phosphorylcreatine) remains constant in the muscle, whatever the rate of stimulation. This contrasts with the important effect of stimulation on the concentrations of glycolysis substrates or oxidations. However, the concentration of C_T is proportional to the maximum isometric force or the rate of production of the heat of maintenance. This suggests that C_T concentration and CPK maximal activity could be closely linked in striated muscle. We have therefore studied the relationship between CPK and C_T in three different cases:

a) *Regeneration*. The muscles are dissected, sliced into 1 mm3 pieces, and isotopically grafted. The day after operation, CPK and C_T decreased to 1 to 3% of control values (homolateral muscles). Then they increase for 240 days, while the muscles regenerate. The muscles become functional again 30 to 60 days after the operation. The CPK increases faster than the C_T: their ratio does not therefore remain constant. Their relationship is described by the power equation:

$$(\text{CPK}) = 10.7\ (C_T)^{1.55} \qquad (1)$$
$$r = 0.99$$

This equation is the same for the three muscles studied: gastrocnemius and rat soleus, frog gastrocnemius. The controls of these three muscles are represented by the same equation.

b) *Phylogeny*. - CPK and C_T were analyzed in the muscles of adult animals: gastrocnemius frog (n = 36), chicken ALD (n = 6) and PLD (n = 6), soleus (N = 48) of rats, soleus (n = 6) and gastrocnemius (n = 6) of mice, paravertebral muscles (n = 24) of dogs and humans (n= 35). Slow muscles have less C_T than fast muscles. However, CPK is not a linear function of C_T, but a power function, exactly described by equation (1) (r = 0.94).

c) *Ontogeny*. - Gastrocnemius and soleus muscles of rats were analyzed from birth to 44 days. The increase in CPK becomes faster than that in C_T 3 days (gastrocnemius) and 6 days (soleus) after birth. For both muscles, (one fast and one slow), CPK is a C_T power function, but it is different from equation (1). It is described by:

$$(CPK) = 1.43\ (C_T)^{2.06} \qquad (2)$$
$$r = 0.98$$

d) Conclusions. - In adult muscles, CPK activity is closely related to the concentration of C_T. Following a powerful disturbance (i.e. slicing), this system remains tightly coupled and regenerates along a trajectory that first passes from a "slow muscle" type to a "fast muscle" type. The activity of the CPK or the concentration of C_T may well therefore reflect the state of modulation of the muscle in differentiation. In the growing muscle however, the trajectory which carries the newborn towards the adult is different, the CPK growing faster, almost with the square of the C_T. The adjustment of the mechanism that ensures the CPK-C_T relationship of the growing muscle is therefore different from that of the adult muscle.