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Sources of the Energy Produced during a Single Isometric Tetanus

Frog sartorius muscles tetanized for 12 sec at 20°C in N₂ split 15.4 ± 1.0 μmol phosphorylcreatine/g blotted weight, and 0.22 ± 0.19 μmol ATP/g; ADP and AMP concentrations did not change; lactate production amounted to 2.02 ± 0.14 $\mu\text{mol/g}$; α -glycerophosphate increased by 0.89 ± 0.10 $\mu\text{mol/g}$ and fructose 1,6-diphosphate increased by 1.14 ± 0.15 $\mu\text{mol/g}$ ($n=18$). These reactions should produce together a heat which is evaluated to 190 mcal/g. However the observed heat production was much larger, 322 ± 13 mcal/g ($n=9$). Similar discrepancies were obtained for muscles in oxygen, or for muscles poisoned with iodoacetate. It is concluded that a large fraction of the heat produced during a long single tetanus is accounted for neither by phosphorylcreatine (PC) or ATP breakdown, nor by glycolytic or oxidative reactions.

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