

Cellular Mechanisms of Muscle Fatigue

Nerves detect internal and external environments

>Ie; Acidity, cramping, burning, inflammation

Body makes automatic changes to maintain homeostasis

Acidosis (7-7.35)

Alkalosis (7.45-7.8)

Nociceptors sense pH based off an increase of protons

Rhabdomyolysis

>Breakdown on skeletal muscle

>Myoglobin/creatinin released into the bloodstream and kidneys aren't able to filter

>H⁺ ions, changing pH and causing pain

Who gets blamed? — Byproduct of anaerobic metabolism (No)

Glycolysis

>Pyruvate byproduct

-Krebs or lactate

>At the end of TCA: 2 CO and 3 H⁺

>Pyruvate going through TCA yields 7 H⁺ ions

DOMS (Delayed-onset muscle soreness)

What also causes fatigue?

ATP:ADP

Phosphate

Magnesium

ROS

Inflammation

Carb availability

Causes

1. # of calcium released from SR

2. How sensitive muscle is to Ca⁺

3. How much for the cross-bridge are capable of generating

4. Central fatigue (CNS)

Increasing METS, increases rate of energy.. and it can be overwhelmed and deplete ATP levels

Type I fibers aren't going to use ATP as quickly

As more ATP is hydrolyzed, more ADP is build up

-Calcium, SR is affected, pump function

-Rigor mortis, prolonged time-course of contraction

Recap:

-Cross-bridge cycling needs ATP (Myosin ATPase)

-Sodium-potassium pump have ATPases too; resting membrane potential of the cell

might be altered in the presence of diminished availability of ATP

-Time-course of cross-bridge cycling might be affect by elevated levels

-SR becomes leaky and calcium pump function can be impaired in the presence of too much ATP

-ADP can outcompete ATP for RyR doorman jobs, affecting overall quality

-Cerebral uptake of ammonia might influence neurotransmitter function and incite 'central fatigue'