GRAND TETON GUIDE no. 4

AN AMATEUR'S REVIEW OF BACKPACKING TOPICS
FOR THE
2008
T254 EXPEDITION TO GRAND TETONS / YELLOWSTONE

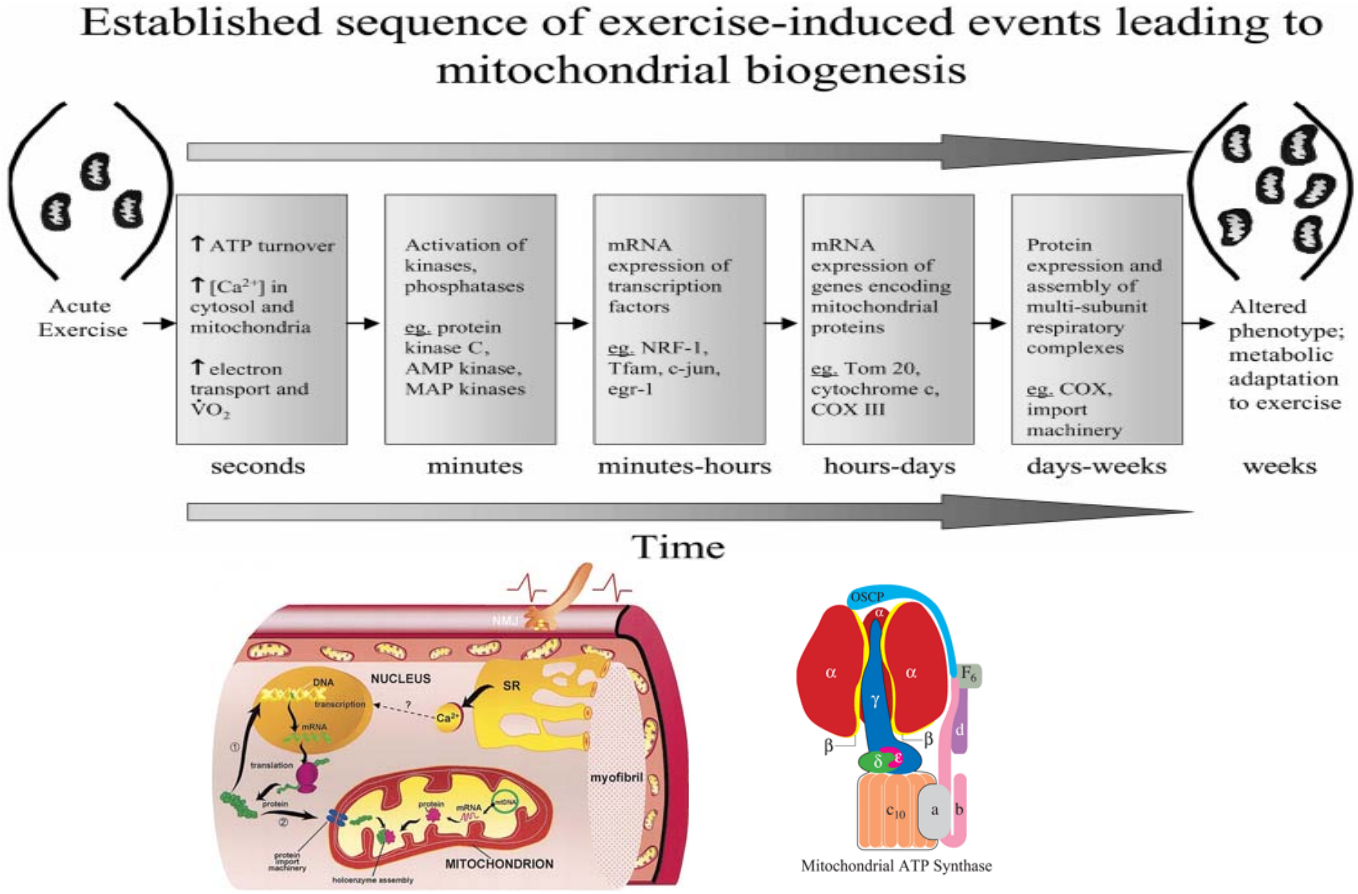
EXERCISE CONDITIONING : AN ADVENTURE BEFORE THE ADVENTURE

Just after dawn - four weeks from now - a contingent of T254 scouts and adult leaders will step onto trails and begin their ascent of the mountainous terrain of the Teton Range. Sheer topography dictates that gravity will be a presence with each stride for the entire four days of this backcountry adventure.

Our ability to move depends on the coordinated development of tension to do work against inertia, friction, and gravitational acceleration. The specialized cells that perform this work are organized as skeletal muscles. Packed into each skeletal muscle cell are thousands of membrane-enclosed metabolic power stations - mitochondria - that function to produce millions of ATP molecules per second. ATP is the cell's ultimate energy currency and is the fuel consumed in many locations in the cell (producing ADP as a recyclable byproduct). ATP powers the engine of the sliding actin-myosin interaction that is the basis of muscle contraction-and-relaxation necessary for motion. Delivery of glucose and triglyceride breakdown products (pyruvate and fatty acids) from the cell cytoplasm to the mitochondrial surface is the only significant participation of the cell at large in energy metabolism. Mitochondria are the oxidation furnaces that do all the heavy lifting of cellular energy supply. (The oxidative reactions, however, occur incrementally and produce relatively little heat; electron transport and generation of a proton (H^+) gradient across the inner mitochondrial membrane is the actual potential energy source used for conversion of ADP back into ATP.)

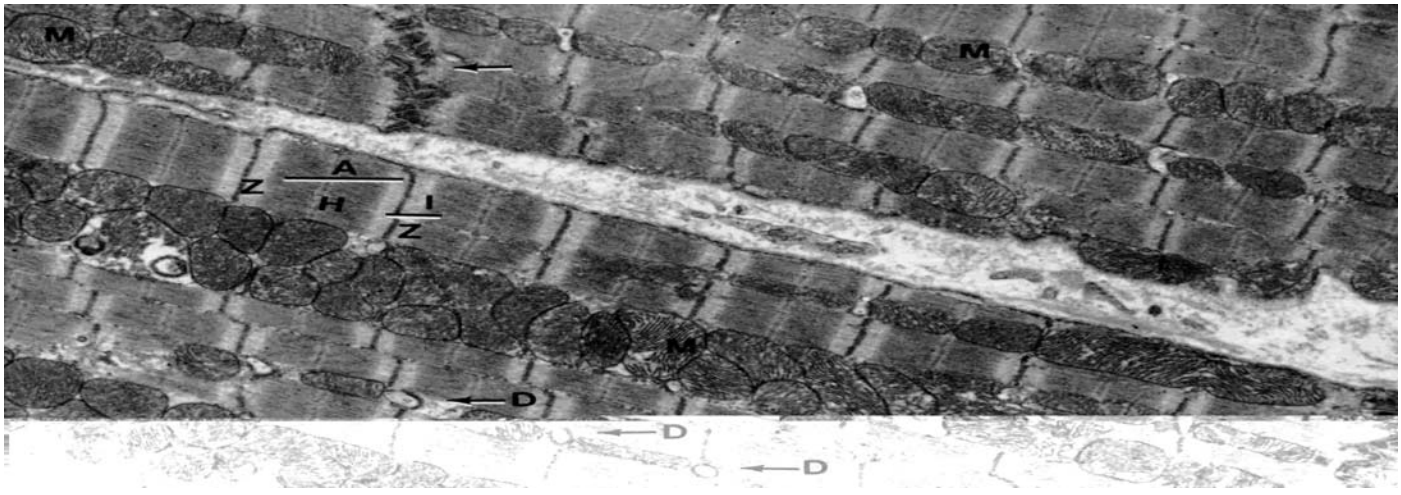
Without an abundance of mitochondrial activity in the cell, however, pyruvate and fatty acids accumulate, lactic acid is formed, and muscle activity is inhibited. How then to increase the number and activity of your mitochondria in the time remaining, given the challenge that lies ahead? The answer is to implement a routine of conditioning exercise *now*, 30 minutes or so in duration, at least 4 days a week.

In reaction to such a stimulus, muscle cell mitochondria have an unusual response: they begin to divide and replicate themselves. Interestingly, they do this by using their own circular, single-stranded DNA as a replication template, acting similarly to prokaryotic cells (bacteria) in this regard.



Mitochondrial ATP Synthase

It is well known that endurance training, employing an appropriate duration per day, frequency per week, and submaximal intensity per exercise bout, can produce an increase in mitochondrial content, usually ranging from 50 to 100% within a 6 wk period. This directly results in improved endurance performance, largely independent of the much smaller training-induced changes in maximal oxygen consumption. ***J Appl Physiol* 90: 1137–1157, 2001**



I encourage all those preparing for the T254 Expedition to Grand Tetons / Yellowstone to intensify training *today* to ensure themselves adequate mitochondria for this adventure.

BE PREPARED.