

Of Two Sections of a Cell... *only One uses Oxygen*

Thought Experiment: Can a human run a 40 yard dash without breathing?



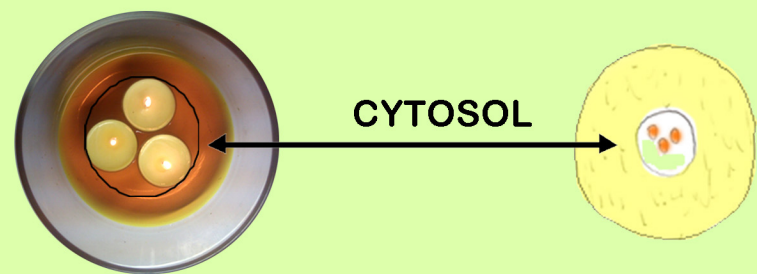
YES.

Many people give no for an answer. But just hold your breath right now, and ask yourself what, if anything prevents you from moving your legs as fast and 'repeatedly furious' as you can.

The answer is, 'nothing'. You can sprint or jump without breathing **because your cells can produce the energy to do it without oxygen.**

THE BIG IDEA:

One section of a cell does not 'breathe' or require oxygen. The **cytosol** - depicted below by the dark yellow colored section in the bowl left, does not require oxygen to produce energy.



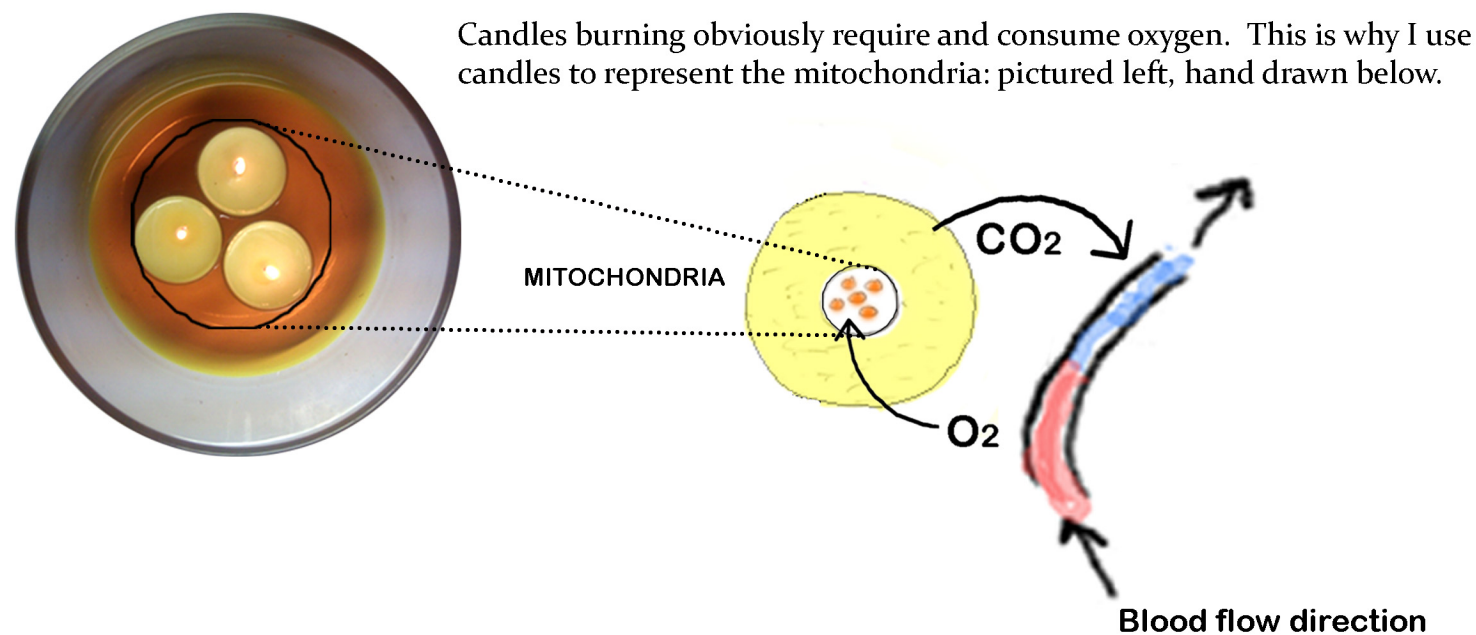
Cytosol is where anaerobic metabolism or glycolysis occurs, i.e. the 'non-oxidative' breakdown of glucose = anaerobic work.

This section of the cell works without oxygen, and gets 'overly acidic' if you work at too high of an intensity level.

Key Points:

1. Only carbohydrate (glucose) can be used in the cytosol to produce energy.
2. This section of your cell 'feeds' the same way anaerobic bacteria do... **ON SUGAR.**
3. Fat cannot burn here.
4. The cytosol is where you use glucose in the greatest quantity, such as when sprinting - which requires glycolysis. Glycolysis explains why you can sprint or leap repeatedly while holding your breath - or more specifically, glycolysis is the process of the cell producing power anaerobically.

CONVERSELY TO THE CYTOSOL, OXYGEN IS UTILIZED ONLY IN THE MITOCHONDRIA



Candles burning obviously require and consume oxygen. This is why I use candles to represent the mitochondria: pictured left, hand drawn below.

Anatomy of Fuel Substrate Utilization

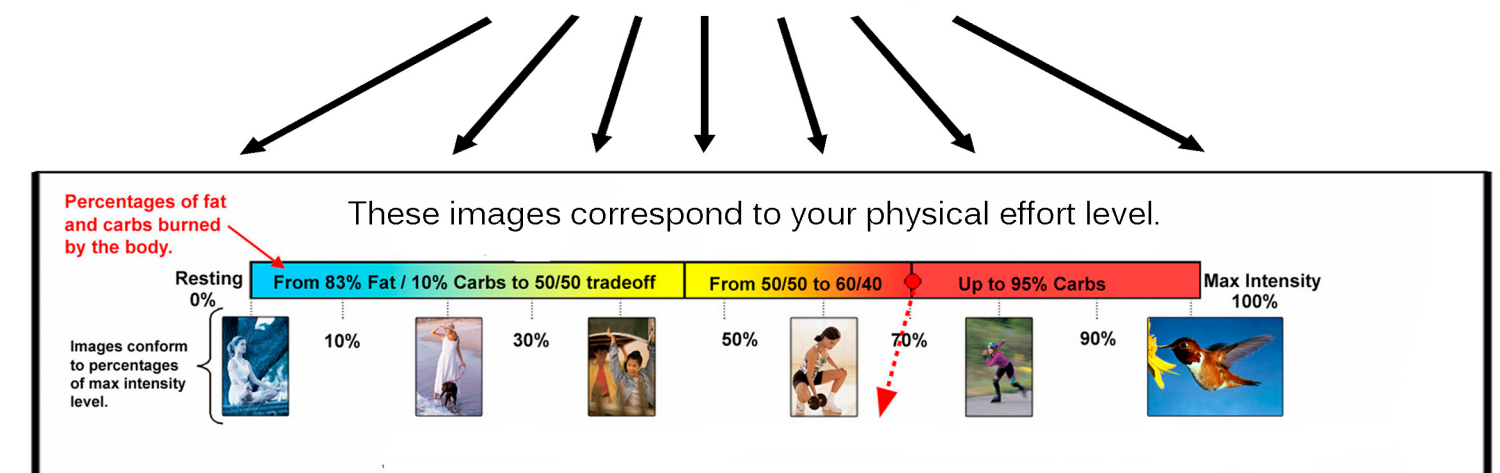
1. Fat burns only here: Mitochondria
2. Only glucose burns here: Cytosol
3. Even though **only glucose is utilized in the cytosol**, glucose itself is not restricted from combusting in the mitochondria. Thus, **glucose may also be burned with fat in the mitochondria aerobically.** Details coming in lessons ahead.

Key Points:

1. Fuel substrate refers to fat and glucose as fuel sources for the cytosol or mitochondria.
2. Oxidative metabolism is equivalent to 'aerobic work done' - or simply, combustion of food stuffs in the mitochondria.
3. Aerobic exercise is simply **aerobic metabolism or respiration speeded up** (equivalent to a locomotive fireman shoveling fuel into the firebox at a faster rate). Aerobic exercise utilizes the mitochondria as a glorified firebox, where it is possible to make a fire bigger. And making a bigger fire generally requires delivering a greater quantity of oxygen and more fuel, sometimes quicker!
4. Aerobic metabolism occurs only in mitochondria and occurs always, **especially at rest.**

QUESTION: How can we know and calculate the amount of fuel substrate used based on what we do physically?

How much Fat? - How many Carbs?..... get utilized?



The next several lessons show how the 'physical rules' of combusting fuel in a cell correspond to any given physical intensity level.

From these rules, we can precisely quantify the both the percentage and amount of fat or glucose utilized by your body at any given intensity level.