

# Fuel of champions

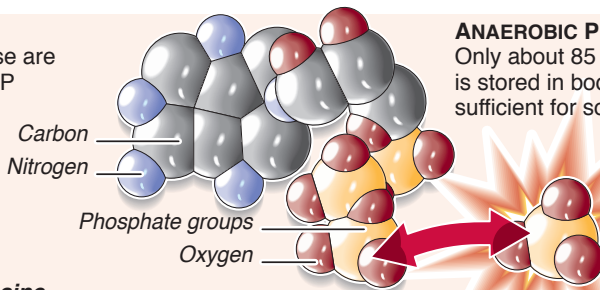
The force that powers champions comes from the breakdown of an energy molecule – **adenosine triphosphate**, or **ATP** – that allows muscles to contract. Sprinters rely on the anaerobic system – metabolism of ATP in the absence of oxygen – to sustain the cells' energy needs, while distance-runners use an aerobic, oxygen-dependent metabolism to produce a steady flow of energy



## AEROBIC RESPIRATION

Oxygen, fats and glucose are used to manufacture ATP

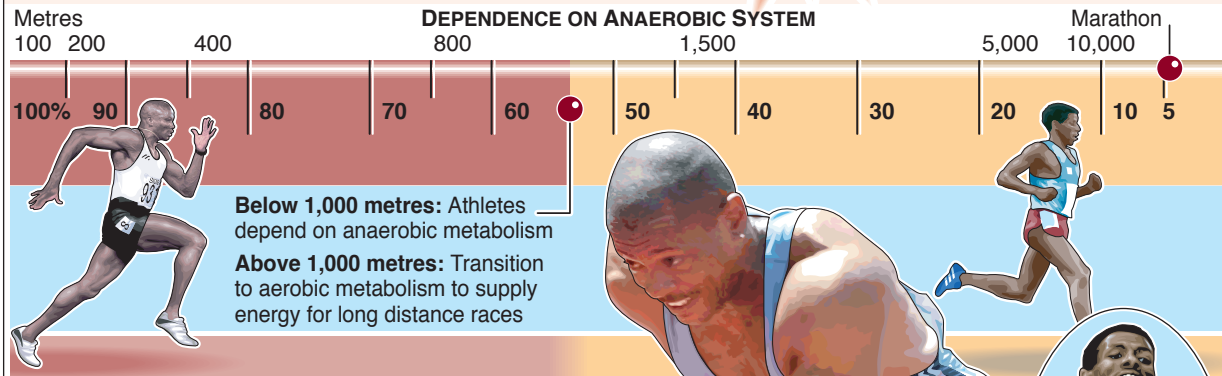
Breaking chemical bond holding one of three phosphate groups releases energy to power muscle contraction, and by-product **adenosine diphosphate (ADP)**



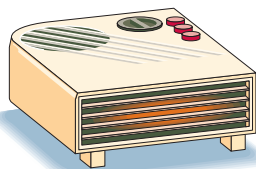
## ANAEROBIC PRODUCTION:

Only about 85 grams of ATP is stored in body's muscle cells at any one time, sufficient for some 5 seconds of intense activity

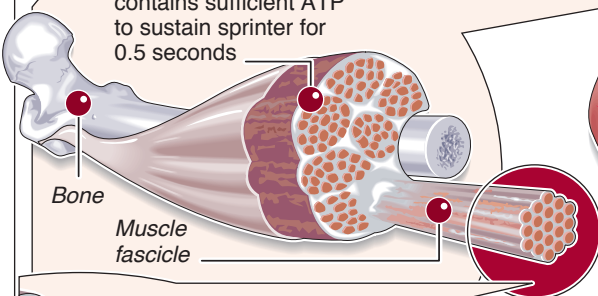
Like recharging a battery, limited supplies of **creatine phosphate** within cell rapidly convert ADP back into ATP. This supplies energy for additional 3-4 seconds, but generates lactic acid which can cause cramps



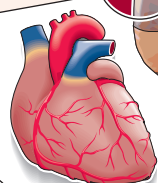
**100 METRES:** ATP stores provide 85% of energy needed to cover distance. This energy could power a one kilowatt electric heater for 28 seconds. Remaining 15% of energy comes from aerobic breakdown of body's sugar stores



**Muscle bundle:** Each kilogram of leg muscle contains sufficient ATP to sustain sprinter for 0.5 seconds

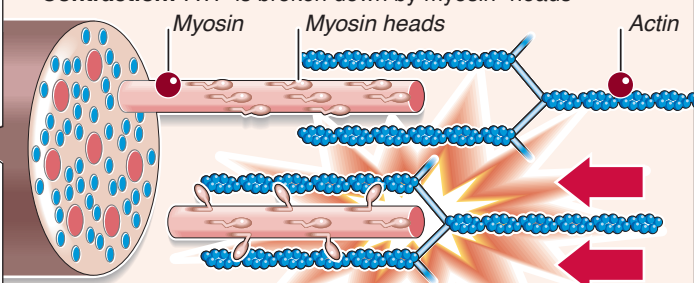


**HEART RATE:** Increases to 165 beats per minute – ATP powers heart to pump 5.5 litres of blood around body during race



**START:** Reaction time to starting pistol less than 0.2 seconds

**Contraction:** ATP is broken down by myosin "heads"



Proteins – **myosin** and **actin** – group themselves into interleafed filaments inside cell. Fast acting filaments reach peak force in just 0.03 seconds

Energy released by ATP molecule increases overlap of protein filaments – forcing muscle to shorten dramatically