The Biology of Running

Some biological and physical facts can help explain how we are actually able to run!

Fueling: To fuel any effort, the body can burn either sugar or fat. The average person has a bit over 1,000 calories of sugar stored as glycogen in the muscles and the liver, which is enough to run at least 10 miles. But even the skinniest person has over 35,000 calories stored as fat, which is how endurance athletes can keep going and going! Sugar is "easier" to burn for fast energy, but we all are burning both sugar and fat at all times. We can train our bodies to burn fat at a higher rate, by increasing our aerobic (slow, steady, long) exercise and reducing our intake of carbs. This can be useful for long distance running, since it is hard to take in enough calories without upsetting our stomachs.

Hydration: When we run, we sweat and lose water and electrolytes. While we burn our internal fuel to create CO2 and water, it is not enough to make up for even mildly strenuous exercise. Recent research has shown that moderate dehydration during strenuous exercise is not usually harmful (as long as you re-hydrate immediately afterwards), but if you are going to be exercising longer than an hour, you probably want to be taking in fluids. Adding a quarter teaspoon of salt and a quarter teaspoon of baking soda to a quart of water will also help replace your electrolytes, and the salt actually helps the water move through your stomach more efficiently.

Mechanics: While running is basically a series of 1-legged shallow squats, performed as we are falling forward, there is a lot more going on! At peak impact, the force on your body is about 2.5 times your body weight when running! It would be very hard to lift or squat with this much weight, but isometrically holding this much weight (on your shoulders, while standing erect) is not as hard. When you run, you are basically tightening up your core at the moment of peak impact, and allowing the downward forces to bounce you back up, using your ligaments and muscles as a spring (called "elastic recoil"). Energy is also stored in your spine as it twists when your opposite arms and legs move in different directions, and this energy is released as the spine bounces back, helping to drive your next leg forward (called the "Windlass Mechanism"). When you realize this, it might help you relax and stop trying so hard to reach out and pull yourself along using your quads and hamstrings. Ideally, your glutes and calves should be doing most of the work, adding enough energy back into your stride to make up for what is lost to the ground and muscles absorbing some of the shock. Turn your body into a pogo stick, not a bag of rice!

Physiology: There are several factors that influence your running efficiency:

- Power & Stability- You need strength and power in your fast-twitch muscles to propel yourself forward, which comes with time and training. You also need strength in your slow-twitch core muscles to stabilize yourself during movement and minimize loss of energy to wobbling.
- Aerobic Capacity- As you get in better shape, your muscle cells grow more mitochondria (power generators) and capillaries (that deliver fuel and oxygen to your muscles), making it easier on your heart and lungs to run at a faster and for longer periods of time. Aerobic capacity has been shown to increase fastest by doing long, slow exercise (80% of your total volume)
- Lactate Threshold- As you get in better shape, you burn your fuel more efficiently at higher levels of exertion, building up less lactic acid in your muscles for the same intensity of exercise. That said, you can also train your brain to tolerate higher levels of lactic acid "burn", and increase your ability to run harder for longer periods of time.

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