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Real World Superpowers: How Super Athletes Come to Be

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Real World Superpowers

How Super Athletes Come to Be

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Imagine running your first marathon, 26.2 miles of sweat, muscle cramps, and, yes, probably tears. Imagine the throb of your thighs and calves as you hit 20 miles, your body ready to collapse beneath you. Now, imagine doing that again every single day for 50 days, running one marathon in each state. Welcome to the life of Dean Karnazes, super athlete.

However, there is one big difference between your marathon and Karnazes'. All of the pain mentioned above? He doesn't feel it. There's a fair chance that you do.

Karnazes, 54, is what some people call a "super athlete." He possesses the extraordinary ability to run forever, barring the need for basic bodily functions like eating and sleeping (although he has been known to sleep-run in the past). Karnazes has completed a 200-mile race 11 times, and he has run 350 miles in 8 hours and 44 minutes without stopping for any sleep. This can't be normal, right?

Right. While preparing for his 50-marathons-in-50-days stunt, Karnazes realized his abilities were a small bit different from most people's. The ultrarunner consulted with a team of specialists at a performance center in Colorado in 2006 to find out how he was able to run so long without any sign of muscle fatigue.

First, the team checked Karnazes' aerobic capacity, which is related to the cardiovascular system. The results were impressive, but no more impressive than any other dedicated athlete's.

Next they checked our runner's lactate threshold. Under normal circumstances, a person produces the energy to perform various tasks by using oxygen in a process called aerobic respiration. In aerobic respiration, the sugar glucose is broken down into a substance called pyruvate, releasing energy. The pyruvate then goes through an aerobic, oxygen-requiring pathway. However, when a person runs or does any sort of strenuous physical activity, they cannot take in enough oxygen to make all of the energy they need through aerobic respiration. In other words, the pyruvate is unable to go through the aerobic pathway, so it turns into something called lactic acid (also known as lactate).

If the person continues running, their body keeps making lactic acid. There's no way for the lactic acid to be removed until the person stops doing the strenuous exercise, so it builds up in the active muscles. In an odd twist of events, this lactic acid actually makes it harder for the body to break down glucose, and thus harder for the muscles to make the energy they need to keep running. This is what makes your muscles tired when you run, and this is why most people can't run forever.

The buildup of lactic acid while running was what the performance center specialists were looking for in Karnazes' lactate threshold test. Usually it takes high intensity athletes around fifteen minutes to reach the test's threshold. After an hour of testing Karnazes, the specialists gave up. Karnazes' muscles, amazingly, were not building up lactic acid.

How is this possible? Karnazes still had to be making lactic acid, or else he wouldn't have enough energy to run once his breathing got heavy. Instead, it turns out his body is extremely efficient at getting rid of lactic acid by converting it back to glucose — so efficient that once it is made, there is no time for the lactate to start building up. The way the body clears out lactic acid is through a series of chemical reactions in the muscle cells' mitochondria, the powerhouse of the cells. These reactions are helped along by enzymes, proteins that speed up chemical reactions. Through vigorous training, athletes can increase the capacity of their mitochondria and specific enzymes, but only by a limited amount. On the other hand, it seems that Karnazes was genetically gifted with very large and powerful mitochondria. This, along with vigorous training and a healthful lifestyle, is the secret to his success.

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However, not every super athlete has inherited some abnormal body chemistry. So how do Olympians like Simone Biles, Usain Bolt, and Michael Phelps get to be the best athletes in the world?

Right now, it's not so clear, and many experts disagree about how to build the perfect Olympian. Some argue that practice really does make perfect by changing how the body functions. However, statistical analysis has shown that these differences may not be so significant among the world's top athletes. This is the age old "nature versus nurture" debate in a new light: what has a greater effect on athletic performance, the genetic and epigenetic information we inherit from our parents, or the environmental factors that affect us once we are released into the world?

On the "nature" team, some neuroscientists argue that deliberate practice does increase athletic performance by causing tangible structural changes in the brain. Deliberate practice is practice where the athlete has intense concentration and receives feedback from a coach. The way deliberate practice affects the brain is, over time, by building up neurons' myelin sheaths. Myelin sheaths cover part of the brain's neurons, protecting them and helping them to send faster signals, like insulation on a wire. When practice is deliberate and repetitive, certain neural pathways are used over and over. Just as athletes train muscles to get bigger, working out these neural circuits causes their myelin sheaths to get bigger too.

The building up of the myelin sheaths is one piece of evidence that supports the 10,000-hour rule. This rule, popularized by Malcolm Gladwell in his book *Outliers*, claims that it takes, on average, 10,000 hours to become an expert at something. This includes playing a musical instrument, underwater basket-weaving, or swimming freestyle.

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But some experts strongly disagree with this 10,000-hour rule. A recent study has shown that, in low-level athletes, deliberate practice time only accounts for eighteen percent of performance differences between athletes. In high-level athletes like Olympians, deliberate practice only accounts for one percent of performance differences.

So, if practice only accounts for a small percentage of performance differences, what accounts for the rest of them? In truth, experts aren't too sure right now. Most say generally that it is due to "biological factors." For example, if someone has the potential to grow more muscle or make more efficient mitochondria, then they have an advantage. The problem with this thinking arises when people assume that your genetics determine whether or not you can be an athlete. There is no magic "athlete gene," and scientists are just beginning to understand how genetics and epigenetics build up to the final product of a real person.

Practice might not make perfect, but it certainly won't hurt you. Being born with superhuman abilities to run forever probably wouldn't hurt either, though.