

Are Olympians built differently?

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Throughout the 2024 Olympic Games in Paris, Team U.S. continues to bring home the gold. While we celebrate their success, we can't help but wonder—could I do that?

We talked to doctoral fellow Benjamin Burke, who works in the lab of

John J. McCarthy, Ph.D., in the department of physiology at the University of Kentucky College of Medicine. The lab focuses on the cellular and molecular mechanisms underlying the regulation of skeletal muscle mass in response to exercise, aging and disuse.

What distinguishes Olympians from regular people?

There are many factors that distinguish [elite athletes](#) from the rest of us. Unfortunately for recruiters, the interplay between such factors can get quite complex. To name a few, there are muscular, neural, neuromuscular, cardiovascular, respiratory, skeletal, biomechanical, anthropometric and endocrine components that influence an individual's athletic ability.

In addition to these physical factors, there are very important psychological (e.g. motivation, discipline) and environmental (e.g., training, nutrition, culture) considerations which are crucial to an athlete's success, not to mention opportunity.

Long story short, some people have the mind to succeed at a given sport, some have the body, and some have the opportunity, but elite athletes have it all.

From a muscular perspective, how does the body of a swimmer differ from, say, a rugby player, cyclist or gymnast?

Our muscles are incredibly plastic, meaning they have an amazing ability to adapt to their environment. A common example of this is how our muscles get bigger and stronger over time if we consistently lift weights—but that's only a broad view of what is taking place.

Our main muscle cells, called [muscle fibers](#), can alter their gene expression in response to stimuli (e.g., exercise, bedrest), resulting in changes in metabolism, protein content, force production, etc. In other words, the work which your [muscle cells](#) are capable of performing will change depending on the stressors placed on them. If you add this up, you get differences in the overall capabilities of the entire muscle.

Olympians spend years intensely training so that their muscles are extremely fine-tuned for their sport. Depending on what is required by their respective event, their muscles may be able to metabolize certain nutrients more efficiently, produce more force, or actualize very delicate movements with extreme precision.

We can't forget the genetic side of this story. While elite athletes take advantage of the plasticity of muscle to finely tune their skills, we are all innately predisposed to favor certain muscle architectures. By nature, one individual may have muscles which are more suited to running a world-record marathon, while another is geared towards lifting a world-record clean-and-jerk.

However, the genetically and environmentally induced differences in muscle architecture are not "one size fits all." Muscle fibers have specific categorizations based on their metabolic and contractile characteristics. In humans, our main categorizations are type I, type IIa, and type IIx muscle fibers. One fiber type may metabolize fatty acids more effectively, while the other may produce force more effectively.

Fiber type composition may drastically differ between athletes that compete in a sport which requires extreme endurance (i.e., marathon runner) and those whose sport requires incredible power (i.e., weightlifting). These differences can arise even within the same basic sport. For instance, the musculature between a track and field athlete running the 5,000 m versus the 100 m, a hockey goalie versus a center,

or a track versus road cyclist may all differ dramatically.

Are their abilities a product of training, or are they just built in a way that gives them a competitive edge?

This is the age-old question, nature versus nurture. We've already alluded to this, but in the case of performance, it's both nature and nurture that make an athlete elite. You can take an average person and train them like a machine, but if they don't have the genetics for it, they won't succeed at an elite level. There are, of course, exceptions to this, but there is a reason that sprinters, throwers, swimmers, gymnasts, etc. have very specific body types.

On the other hand, you can have an individual who innately has all the physical gifts needed for success at a given event, but if they never hone their craft with the right training, exercise, nutrition, etc., they'll never showcase their skills on the big stage.

From a muscular perspective, certain people are genetically predisposed to favor certain sports over others. This can be due to their innate fiber-type composition, the place their muscles attach to their bones via tendons, how well their muscles are able to adapt to exercise, and plenty of other factors.

Conversely, various modes of training can alter the collective makeup of our muscles, causing muscle fibers to behave differently, change strength, alter flexibility, etc. At the end of the day, it requires both a genetic predisposition and lots of training to succeed at the highest level.

An important consideration which is often overlooked is injury prevention and rehabilitation. We often attribute an individual's athletic success to genetic giftings or ruthless training regimens, but often

overlook health as a crucial factor in sports performance.

There are plenty of athletes with immense ability whose careers were prematurely ended because of injuries. Had these athletes had the proper preventative care or rehabilitation, they may have had a better chance to succeed at their sport. Therefore, such injury prevention and/or rehabilitation is an example of how we can "nurture" athletic ability.

How often and for how long would someone have to train to be able to compete at that level?

The typical answer is years, if not decades. In general, this is true; it takes years of dedicated effort to master a sport. Elite athletes eat, sleep and breathe their sports. However, it's not that simple. Take, for example, Tara Lipinski. She competed for the U.S. figure skating team, winning a gold medal in 1998 at 15 years of age.

Some Olympic athletes had been training for longer than she had been alive, yet she held the title of Olympic champion while her peers were figuring out how to survive sophomore year in high school. Therefore, while it takes years upon years for most elite athletes to develop their craft, some individuals have what it takes from incredibly young ages.

Aside from muscles, what other factors set Olympians apart from non-athletes?

Aside from the physical aspects, we often talk about the psychological side of sport (e.g., drive, fortitude). We may even discuss the neural skills it takes to be an elite athlete (e.g., reaction time, intelligence, etc.). We speak of the "intangibles" that young prospects have, their "killer instinct" or insatiable desire to win.

However, we often forget the intersection between the physical and the mental. The mindset of elite athletes isn't always something that has intangible effects but can quite literally change their physical bodies. This happens over time, as with training, but can also happen in an instant.

Let's take Eddie Hall, former World's Strongest Man. In 2016, Hall broke the deadlift world record, lifting a staggering 500kg or 1,102lbs. Up until that day, the heaviest he had lifted in competition was 463kg. He reportedly failed to lift 480kg in training leading up to the event. However, when he took the stage, he shattered the record by 35kg! How could he perform such an incredible feat of strength, having never come close before?

The battle was won in his mind. Hall worked with a hypnotist and psychiatrist to mentally prepare for the lift. To him, it was a life-or-death moment on that stage, and his body functioned differently as a result, performing a feat no one thought was possible.

We've all heard stories of a person lifting a car off a relative or other astounding exploits. The reality is, each one of us is capable of inconceivable physical accomplishments, but we have safety mechanisms in place to prevent us from pushing ourselves too far.

It may be that elite athletes are built differently, have the right environment, do the right training, or it may simply be that they believe they can do what no one else can. While it's likely a combination of all these factors, Olympic athletes have nevertheless figured out a way to maximize their performance in unbelievable ways, and it certainly makes for some top-notch entertainment every four years.

Provided by University of Kentucky

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