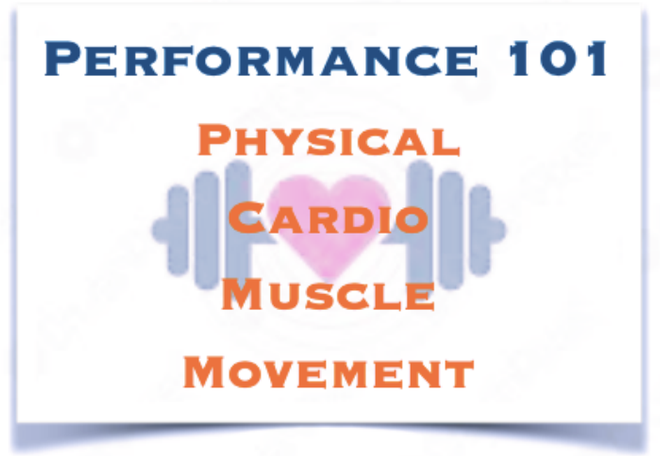
PERFORMANCE 101:
What Limits Muscle Growth



When discussing what Limits Growth we need to discuss 4 Topics: 1) Fiber Number, 2) Fiber Type, 3) Myostatin, and 4) Hormones.

2) Fiber Type

Summary: As mentioned you are limited in muscle growth by the amount of muscle cells you have a birth. You are also limited by the type of muscle cells you have (also known as fibers). You have two types of muscle cells (fibers) Type 1 and Type 2. Research suggest that Type 2 fibers have a greater ability to grow compared to Type 1 muscle cells. You can not change the fiber type. It is another genetic limitation, like the number of muscle fibers that you have. So if you have more of Type 1 fibers you may be limited in how much you can grow. However, both endurance-oriented type 1 (slow twitch) fibers and strength-oriented type 2 (fast twitch) fibers have the ability to hypertrophy. Research shows that the growth capacity of fast twitch fibers is approximately **50% greater than that of slow-twitch fibers**. This could be the reason why power athletes physiques appear to be so much more muscular compared to endurance athletes. There is a difference seen in body builders. Interestingly, bodybuilders display greater type I fiber hypertrophy than powerlifters, presumably as a result of routinely training with higher repetition range Read On!

When discussing what Limits Growth we need to discuss 4 Topics: 1) Fiber Number, 2) Fiber Type, 3) Myostatin, and 4) Hormones.

2) Fiber Type- Fiber Type Number matter when it comes to muscle growth

As mentioned you are limited in muscle growth by the amount of muscle cells you have a birth. You are also limited by the type of muscle cells you have (also known as fibers). You have two types of muscle cells (fibers) Type 1 and Type 2. Research suggest that Type 2 fibers have a greater ability to grow compared to Type 1 muscle cells. You can not change the fiber type. It is another genetic limitation, like the number of muscle fibers that you have. So if you have more of Type 1 fibers you may be limited in how much you can grow. However, both endurance-oriented type 1 (slow twitch) fibers and strength-oriented type II (fast twitch) fibers have the ability to hypertrophy. Research shows that the growth capacity of fast twitch fibers is approximately **50% greater than that of slow-twitch fibers,** although a high degree of inter-individual variability is seen with respect to the extent of hypertrophic adaptation. This could be the reason why power athletes physiques appear to be so much more muscular compared to endurance athletes. The good news, though is that you can build muscle and strength regardless of your muscle fiber type. Based on this information it may be assumed that recruitment of type II fibers should be the main focus of exercise program design for the accretion of muscle mass, given the enhanced rate of hypertrophy in these fibers as compared with type I fibers. Although that may be the case in many forms of training there is a difference seen in body builders. Interestingly, bodybuilders display greater type I fiber hypertrophy than powerlifters, presumably as a result of routinely training with higher repetition ranges (Study). The difference in body builders is one the reasons why the "repetition continuum" is not being fully supported when it comes to building muscle mass. Loading recommendations for resistance training are typically prescribed along what has come to be known as the "repetition continuum", which proposes that the number of repetitions performed at a given magnitude of load will result in specific adaptations. Specifically, the theory postulates that heavy load training optimizes increases maximal strength, moderate load training optimizes increases muscle hypertrophy, and low-load training optimizes increases local muscular endurance. However, despite the widespread acceptance of this theory current research fails to support some of its underlying presumptions (research). Based on the emerging evidence researchers propose a new paradigm whereby muscular adaptations can be obtained, and in some cases optimized, across a wide spectrum of loading zones for increasing muscular hypertrophy. As a matter of principle, there is no ideal "hypertrophy zone." From a practical standpoint, however, a case can be made that moderate loads provide the most efficient means to achieve muscle development given that light load training involves performing many more repetitions compared to the use of heavier loads, which in turn increases the time spent training.

Fiber Type 101: IT IS HIGHLY GENETIC

What are muscle fiber types? They are muscle cells. Some of which are 20–100 µm in diameter and many centimeters long, with the longest fibers being about 12 cm. There are two types of muscle fibers, slow twitch and fast twitch. Slow twitch fibers are oxidative. Meaning that they consume a large concentration of myoglobin (carries oxygen in muscles) and can produce long lasting endurance properties. Fast twitch (type 2) are non-oxidative and are designed for short burst of powerful energy. Red fibers (type 1) are also known as slow-twitch fibers, while white (type 2) are also known as fast-twitch fibers. White, fast twitch fibers can also be broken into two types—2A and 2B, 2A has more aerobic properties. Fast Twitch 2A fibers develop from Type 2B from aerobic training. Red, slow-twitch fibers can contract slowly for a long period of time without fatigue. They are used during aerobic exercises and as such, rely on lots of oxygen and fat to generate energy. White muscles have fewer capillaries, myoglobin, and mitochondria. They are more explosive and powerful but fatiguable, and rely more on carbohydrate for energy and less on oxygen to to do work. Example: An Olympic sprinter, for example, may have around 80% fast-twitch, white fibers, and a good marathoner the reverse. Fiber type propensity may also determine to some extent your ability to run a fast mile and to lift heavy weights with speed and power and to build muscle. You can not change your fiber type from Type 1 to Type 2 but you can change Type 2 from B to A (A is more aerobic) through cardiovascular training. (See more here)

Skeletal Muscle Types

	Twitch Speed	Generation of Force	Fatigue Resistance	Fuel Source
Type I Fibers	Slow	Low	High	Triglycerides
Type IIa Fibers	Fast	High	Medium	Glycogen
Type IIb Fibers	Very Fast	Very High	Low	Glycogen

Type I muscle fibers are needed for long distance.

Type II a and Type II b muscle fibers are needed for power and speed.

Red

- Slow twitch
- Contract slowly
- Contract for longer period of time

White

- Fast twitch
- Contract with greater force
- Only used for short bursts of effort

CAN NOT CHANGE RED TO WHITE

Fiber Type and Body Type

Mesomorphic
Fast
Ectomorphic
Slow

Fiber Type How to Test Type:

There's no easy or reliable way to test your muscle fiber type, you can't significantly change your muscle fiber type, and there's little evidence you should train according to your muscle fiber type. The Counter Movement Jump and the Squat Jump may be used to estimate the dominance of fibre type (possibly). Completing both jumps it is possible to estimate the athlete's leg extensor fibre type to within 5-10% accuracy according to Bosco However, if you do not have access to such testing equipment, simply completing a wall reach vertical jump will tell you if you are endowed with explosive qualities. If you are female and can jump over 46 cm (18 inches) vertically then you are likely to have a high fast twitch fibre composition. For males having a vertical jump height over 53 cm (21 inches) suggests that you have a high fast twitch fibre composition.

Fast twitch estimations for athletes from different sports

Sport	Men (% of fast twitch)	Women (% of fast twitch)
100-200m	48-80%	72-75%
800m	40-64%	25-55%
Shot put	50-88%	45-52%
Distance runners	25-45%	25-50%
Untrained	25-62%	25-72%