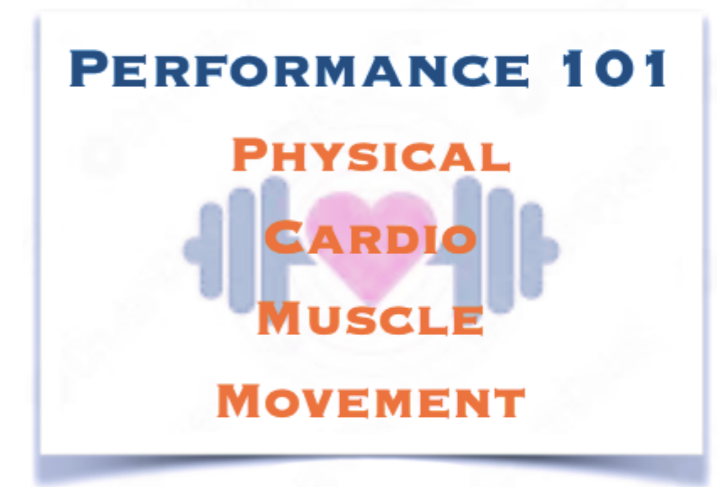


PERFORMANCE 101:

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.

4) Hormones - there is a lot to this !



Summary: Hormones, including testosterone, human growth hormone, and insulin growth factor, play a role in muscle growth and repair and helping to burn fat. The amounts we produce of these hormones are limited to a degree by our genetics and our environment. So we are then limited in terms of muscle growth to a degree by the hormones we produce as well as previously mentioned factors (fiber type and number and myostatin levels). Living a healthy lifestyle aids in the production of these hormones, such as eating a healthy diet, getting enough sleep, and limiting stress. Exercise intensity is also important in aiding production where heavy resistance training to momentary fatigue and high intensity interval training has been shown to increase production. These hormones tend to decrease with age sometimes dramatically. So this is one of the reasons we lose muscle mass as we age. Men have higher amounts than females, although some females can have levels similar to men. Testosterone is arguably the most important hormone for bodybuilding.

Testosterone is the primary sex hormone and anabolic steroid in males, which are produced in the testes, but women produce some at the ovaries. Anabolic steroids, which some people take to gain muscle, is not the same type of testosterone. Testosterone levels in men and women are heritable (~20%) and influenced by the combined effect of many genetic variants and genes as well as the environment. Childhood environment, rather than genetics or ethnicity, is the major factor influencing men's testosterone levels, according to research. Total testosterone levels fall at an average of 1.6% per year after the age of 30 whilst free and bioavailable levels fall by 2%–3% per year in men. Men have 15 times the amount of circulating testosterone than women at any age. Women's testosterone levels also decrease over time, particularly in menopause. Most females can't grow muscle tissue to the same degree since they have lower levels of testosterone. Studies have shown that women with very high testosterone levels develop muscle mass and physical endurance more similar to that of men. They also found that top female athletes were more likely to have higher naturally occurring levels of testosterone and to have polycystic ovary syndrome. To increase and or prevent a decline in testosterone get rest, avoid stress, eat a healthy diet, and weight train. The body produces HGH during the REM cycles of sleep and is stimulated by high-intensity exercise such as heavy strength training, explosive power training, or cardiorespiratory exercise at or above the onset of blood lactate (OBLA, the second ventilatory threshold). Therefore, proper training and rest and recovery can impact muscle building hormones release. According to research the idea that you can or should base entire exercise training programs on trying to manipulate testosterone or growth hormone levels is false. They found that exercise-related testosterone and growth hormone do not play an influential role in building muscle after weightlifting (study). Although this may be the case in the short term (12 weeks) we do not know what happens over years of training. So it is still wise to follow the aforementioned healthy practices to assure healthy hormone levels. Researchers say "While testosterone is definitely anabolic and promotes muscle growth in men and women at high doses, such as those used during steroid abuse, our findings show that naturally occurring levels of testosterone do not influence the rate of muscle protein synthesis." On the other hand, supplementation with anabolic steroids (synthetic testosterone) and other hormones might lead to supraphysiological muscle hypertrophy, especially when different compounds are combined. There is significant health risks with this and it is illegal. [Read On!](#)



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.

4) Hormones

Hormones, including testosterone, human growth hormone, and insulin growth factor, play a role in muscle growth and repair and helping to burn fat. After puberty adults increased testosterone in males and females can lead to improved energy, sharper mental agility, a much stronger sex drive, better sleep, increased muscle tone, emotional stability, and more. Hormones have both short and long-term responses to exercise. In the acute phase immediately post-exercise, testosterone (T), HGH and IGF are produced to repair damaged tissue. Over the long-term, there is an increase in the receptor sites and binding proteins, which allow T, HGH and IGF to be used more effectively for tissue repair and muscle growth. To increase muscle growth, the levels of T, HGH and IGF are produced in response to the amount of mechanical stress created during resistance-training exercises. Moderate to heavy loads performed until momentary fatigue generate high levels of mechanical force, which creates more damage to muscle protein, which signals the production of T, HGH and IGF to repair protein, which results in muscle growth ([see more here](#)), but this increase may not be related to increase in muscle mass (see next page for review). Anabolic steroids are not the same as naturally occurring testosterone. It is a synthetic steroid hormone that resembles testosterone in promoting the growth of muscle. Such hormones are used medicinally to treat some forms of weight loss and (illegally) by some athletes and others to enhance physical performance.

These hormones work by:

- improving how the body processes proteins
- inhibiting the breakdown of protein
- activating satellite cells, which are a type of stem cell that plays a role in muscle development
- stimulating anabolic hormones, which promote muscle growth and protein synthesis
- enhancing tissue growth

Strength and resistance training can help the body:

- release growth hormone from the pituitary gland
- stimulate testosterone release
- improve the sensitivity of the muscles to testosterone

Testosterone is responsible for muscle protein re-synthesis and the repair of muscle proteins damaged by exercise, and plays a significant role in helping grow skeletal muscle. Testosterone is arguably the most important hormone for bodybuilding. Testosterone is an androgen. An “androgen” is defined as a “male” sex hormone because it promotes the development and maintenance of male sex characteristics. Testosterone is a hormone that your gonads (sex organs) mainly produce. More specifically, the testicles in people assigned male at birth and the ovaries in people assigned female at birth produce testosterone. Men have 15 times the amount of circulating testosterone than women at any age. Testosterone works with specific receptor sites and is produced in response to exercise that damages muscle proteins. For both men and women, testosterone plays a key role in the development and maintenance of muscle mass, strength, energy levels, and bone density. After age 30, most men begin to experience a gradual decline in testosterone. Total testosterone levels fall at an average of 1.6% per year whilst free and bioavailable levels fall by 2%–3% per year in men. Women's testosterone levels also decrease over time, particularly in menopause. Women who have had the ovaries surgically removed or damaged from chemotherapy can also experience low testosterone, which is produced in part in the ovaries. Most females can't grow muscle tissue to the same degree since they have lower levels of testosterone. Studies have shown that women with very high testosterone levels develop muscle mass and physical endurance more similar to that of men. They also found that top female athletes were more likely to have higher naturally occurring levels of testosterone and to have polycystic ovary syndrome. To increase and or prevent a decline in testosterone get rest, avoid stress, eat a healthy diet, and weight train. Men and women produce the same kind of testosterone hormone. Interestingly, though, female bodies convert testosterone and other androgens into female sex hormones. How to increase testosterone naturally see [Website](#), [Website 2](#). More Details: Testosterone can stimulate growth hormone responses in the pituitary, which enhances cellular amino acid uptake and protein synthesis in skeletal muscle. In addition, testosterone can increase the presence of neurotransmitters at the fiber site, which can help to activate tissue growth. As a steroid hormone, testosterone can interact with nuclear receptors on the DNA, resulting in protein synthesis. Testosterone may also have some type of regulatory effect on satellite cells.

HGH: Resistance exercise stimulates the release of growth hormone from the anterior pituitary gland, with released levels being very dependent on exercise intensity. Growth hormone helps to trigger fat metabolism for energy use in the muscle growth process as well stimulating the uptake and incorporation of amino acids into protein in skeletal muscle. The body produces HGH during the REM cycles of sleep and is stimulated by high-intensity exercise such as heavy strength training, explosive power training, or cardiorespiratory exercise at or above the onset of blood lactate (OBLA, the second ventilatory threshold). Therefore, proper training and rest and recovery can impact GH release. Secretion of growth hormone decreases with age, and many changes of aging resemble abnormalities seen in younger people with growth hormone deficiency: reduced strength and energy, increased body fat (especially around the abdomen) and psychological changes. Growth hormone and IGF-1 levels peak during puberty, then gradually decline after the age of 30. How to increase GH naturally see [Website](#).

INTERESTING: Resistance training (RT) has also been shown to induce significant endogenous hormonal (testosterone (T), GH, IGF-1) elevations. Therefore, some bodybuilders employ RT protocols designed to elevate hormonal levels in order to maximize anabolic responses. An interesting [review](#) though suggest that acute RT-induced hormonal elevations **seem not to be directly correlated** with muscle growth. On the other hand, supplementation with anabolic steroids (synthetic testosterone) and other hormones might lead to supraphysiological muscle hypertrophy, especially when different compounds are combined.