

# HOW ANABOLIC STEROIDS WORK

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(1) When it comes to high performance athletes, some seek out an athletic advantage over their competitors through the use of banned substances like anabolic steroids. Other reasons for their use include enhancing physical appearance and treating certain diseases.

(2) Anabolic androgenic steroids (AAS), or anabolic steroids for short, are a class of steroids that mimic the structure and function of natural testosterone. The word anabolic means to “build up” and these steroids help build up muscle. Both testosterone and AAS are also considered androgenic. *Andro* comes from the Greek prefix meaning masculine, and *genic* means to produce. Androgenic hormones cause the development of male sexual features like the increase in body hair and the deepening of the voice.

(3) There are three types of muscle tissues in the body: cardiac muscle, smooth muscle and skeletal muscle. Cardiac muscle is located in the heart and helps the heart contract. Smooth muscle is located in the lining of hollow organs like your stomach and intestines, and in many blood vessels. When smooth muscle contracts, they help move contents forward within the hollow organ. Skeletal muscle is the muscle that surrounds your bones like your biceps and quadriceps. Anabolic steroids target skeletal muscle making it bigger and stronger. Skeletal muscle is composed of millions of muscle cells that are also referred to as muscle fibers or myocytes. Anabolic steroids cause each myocyte to grow larger and this is accomplished in three primary ways.

(4) First, anabolic steroids increase protein synthesis in myocytes to help them increase in size. A skeletal myocyte has the shape of a long tube. This cellular tube contains mostly two proteins called actin and myosin. Anabolic steroids build more actin and myosin which causes the myocyte to enlarge producing bigger muscles.

(5) Second, anabolic steroids prevent muscles from breaking down. Every time muscles are exercised they are put under a lot of strain and this causes a stress hormone called cortisol to



be released. High cortisol levels cause proteolysis. *Proteo* refers to protein, and *lysis* means to break down. More cortisol means more protein damage and a slowdown in the ability to gain muscle mass even when exercising. Anabolic steroids decrease the production of cortisol after a workout which prevents the loss of muscle mass.

(6) Third, anabolic steroids activate satellite cells around the myocytes. A satellite cell is a small cell with one nucleus and very little cytoplasm. When muscles are being exercised or when they are exposed to anabolic steroids, satellite cells go from their usually inactive state to an active one. When active, they are capable of doing remarkable things.

(7) To understand the amazing potential of satellite cells, you have to first understand how a myocyte forms. Unlike most cells, a myocyte contains more than one nucleus. This is because a myocyte forms from the fusion of many smaller cells called myoblasts. A myocyte needs a lot of nuclei because the nuclei direct the synthesis of proteins (like actin and myosin) needed for the myocyte to function. One nucleus isn't enough to keep up with muscle fiber demand.

(8) Activated satellite cells can transform into myoblasts which can then fuse together to form new myocytes. Alternatively, these myoblasts can also add onto existing myocytes to give them more nuclei and allow them to grow bigger. The combination of exercise-induced muscle strain and the addition of anabolic steroids causes a large number of satellite cells to activate and help a muscle rapidly grow in size.

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(9) Like skeletal tissue, cardiac tissue also grows in response to exercise. When anabolic steroids are added, this can cause the cardiac tissue to further enlarge producing a condition called left ventricular hypertrophy (LVH). This means that one of the four chambers of the heart, the left ventricle, has become overly enlarged. This can cause potential cardiovascular problems if the LVH becomes extreme.

(10) Besides its effects on muscles, anabolic steroids can also cause some unwanted side effects. Female users can develop masculine features and a loss of their periods. Men can

experience testicular atrophy, which means that their testicles shrink and they can also suffer from decreased sexual function and infertility. Some men may also develop a condition called gynecomastia, which means that they develop breast tissue when the high levels of testosterone in their body is converted to estradiol, a female sex hormone. A small number of people also report “roid rage” where they experience increased levels of aggressiveness when using anabolic steroids. For preteens and teenagers the use of anabolic steroids holds extra risk because their bodies are still growing. Anabolic steroids can stunt growth.

## Article Questions

- 1) \_\_\_\_\_ means to build, \_\_\_\_\_ means to make something masculine, \_\_\_\_\_ means to break down protein, AAS stand for \_\_\_\_\_. Besides skeletal muscle cells, there are also \_\_\_\_\_ and \_\_\_\_\_ muscle cells in the body.
- 2) What are two other terms for a muscle cell?
- 3) What effect does cortisol have on muscles and what effect do anabolic steroids have on cortisol?
- 4) Why does a skeletal muscle cell have more than one nucleus?
- 5) Describe two ways that activated satellite cells help increase muscle size.
- 6) Describe two negative side effects of anabolic steroids specific to female users.
- 7) Describe two negative side effects of anabolic steroids specific to male users.