7 Ways Your DNA Affects Your Athletic Performance

Whether you're a weekend warrior or play at a professional level, odds are you are always searching for a new way to improve your performance and give yourself a competitive edge. Over a series of decades, sports science research has broadened our understanding of how the human body reacts to exercise, training, and recovery, but applying that information to our body's own specific needs has always been a guessing game of trial and error. Thanks to recent advancements in genetic science, we now know that the way an individual's body performs is highly affected by that person's unique genetic profile, ushering in a new era of customized, healthy performance enhancing solutions.

Most people are aware that our genes determine things like our eye and hair color, and whether or not we have dimples. But our genes also reveal many things about our health, including how our bodies perform athletically. By analyzing these particular genetic markers, it is then possible to develop an athletic performance program that is designed for a person's unique genetic profile. This process — collecting and analyzing DNA, and developing recommendations based on what it reveals — is what GxPerform does, and it has the potential to change some long-held beliefs about athletic performance. So, let's take a deeper look at these seven components and the particular genetic markers that influence them.

Your genes determine:

1. **If your body is more inclined to power or endurance sports**
2. **How well your body responds to cardiovascular training**
3. **Your potential level of strength**
4. **The potential capacity of blood volume in your heartbeat**
5. **Your potential testosterone levels**
6. **How effectively your body utilizes protein in your diet**
7. **How prone you are to muscle and bone injuries**

1

Your genes determine if your body is more inclined to power or endurance sports.

Specific Genes Analyzed: ACTN3, AGT, IL-6, NOS3, ACE, FTO, IGF1, GNB3, IL6-174

These genes have been shown to have significant associations with a person's endurance and/or power potential, or how likely you are to have a positive response to aerobic endurance and/or power training, which in turn may help determine the activities at which you will be most successful. A meta-analysis of 35 articles published between 2008 and 2016 that analyzed the DNA of 19,852 people identified nine genetic variations that have significant associations with being a power athlete. Other research has found that a specific allele of the ACE gene is heavily represented in endurance athletes like elite long-distance cyclists and is beneficial for endurance, rather than power-related sports.

Knowledge of your genetic makeup can help you hone your training for the optimum outcome. In a study published in Biology of Sport, researchers tested the power and endurance levels of 28 athletes from different sports and 39 soccer players. All the athletes underwent genetic testing and then were assigned to a training protocol that either matched their DNA analysis or did not match their DNA analysis. After 8 weeks, they retested the athletes' aerobic fitness and explosive power. Those who were in the DNA-matched training group performed significantly better than those who were not.

2

Your genes determine how well your body responds to cardiovascular training.

Specific Genes Analyzed: AMPD1, APOE

These genes have been shown to have significant associations with a person's cardiovascular fitness response to moderate-to-high intensity exercise. VO2 Max is generally considered the best indicator of aerobic fitness and endurance potential. Factors that impact it are how strong and efficient your heart is, how well-developed your capillary system is to deliver blood into your muscles, and the size and number of the energy-producing furnaces known as mitochondria in your muscle cells. All of these factors—and in turn your VO2 Max—improve with moderate-to-high intensity training. People who are active will have a higher VO2 Max than their sedentary peers. It is also influenced by your size, gender and, because it naturally diminishes overtime, age.

V02 Max is generally considered the best indicator of aerobic fitness and endurance potential.

How much you can improve your VO2 Max depends upon myriad factors, including your current fitness level and the intensity of your training. Research finds that sedentary people who start training at about 75 percent of their max for at least 30 minutes 3 times a week can increase their VO2 Max an average of 15 to 20 percent over six months, but the range of response is large. Some people make enormous gains, while others make very few. The reason, we now know, is in your genes.

3

Your genes determine your potential level of strength.

Specific Genes Analyzed: TGFA, POLD3, ERP27, HOXB3, GLIS1, PEX14, LRPPRC, MGMT, SYT1, HLA, GBF1, KANSL1, SLC8A1, ACTG1, DEC1, IGFS9B

These genes have been shown to have significant associations with a person's grip strength, which in turn may help determine how successful you will be in activities requiring muscular strength and muscular endurance. Handgrip strength is not just about a firm handshake. It reveals a lot about your intrinsic muscular strength and fitness and may, when weak, also indicate an increased risk in fractures. So, it's important not only for successful performance in many activities such as racquet and ball sports, resistance training, and off-road cycling, but also for general vitality and health.

Research has found that handgrip strength is strongly correlated to muscular power and endurance. In one study, significant correlations were found between grip strength and performance in tests of muscular strength and endurance including sit-ups, push-ups, leg extension, and leg press. Grip strength is also highly heritable. A large-scale genome-wide association study including a combined sample of 195,180 men and women identified 16 SNPs associated with grip strength. A number of these are also associated with genes that are implicated in the structure and function of muscle fibers, which helps explain why grip strength is a good indicator of intrinsic overall muscular strength. The study also confirmed that these genetic determinants of muscle strength were linked to fracture risk, likely because low muscle strength increases risk of falling.

4

Your genes determine the potential capacity of blood volume in your heartbeat.

Specific Gene Analyzed: KIF5B

This gene has been shown to have significant associations with a person's exercise stroke volume response. There are two ways for your heart to get more oxygen-rich blood to your exercising muscles: pump faster (heart rate response) and pump out a greater volume of blood with every beat. The latter is your stroke volume response, the amount of blood ejected per beat from your left ventricle, as measured in ml/beat.

Stroke volume increases as your exercise intensity rises. How much your stroke volume improves with exercise is also largely hereditary. The HERITAGE Family Study of 483 men and women from 99 nuclear families found that after 20 weeks of endurance training, the average increase in stroke volume during steady state aerobic exercise (60% of VO2 Max) was 3.9 ml/beat. But there was a large range of stroke volume response among individuals, ranging from a decrease of 41 ml/beat to an increase of 45 ml/beat. Variations in the KIF5B SNP were strongly associated with stroke volume response to exercise, explaining nearly 30 percent of the variance.

5

Your genes determine your potential testosterone levels.

Specific Gene Analyzed: SHBG

This gene has been shown to have significant associations with testosterone levels in men, which in turn may impact your stamina, body composition, strength, mood, and ability to make and maintain lean muscle mass. Testosterone is a steroid hormone that is secreted by the testes and adrenal glands. It is instrumental in determining muscle size, strength, and function and also plays a role in maintaining lower levels of body fat. Low testosterone levels (defined as less than 300 ng/dl) not only hinder your ability to make gains in the gym, but also can be harmful to your health, as it's been associated with heart disease, metabolic syndrome, type II diabetes, osteoporosis, muscle loss, and increased mortality risk. Testosterone gradually declines after age 40 (a phenomenon sometimes referred to as "andropause"). Being overweight also lowers testosterone, as does smoking and excess alcohol consumption.

Testosterone levels are also largely hereditary. Studies in male twins indicate that genetic factors account for about 65 percent of the variation in serum testosterone. A recent genome-wide association study that included a combined sample of 14,429 men identified genotypes that were associated with serum testosterone levels. One specific genetic variation was associated with a 6.5-fold higher risk of having low serum testosterone, or a 30 percent prevalence of low testosterone in men with that genotype compared to only a 4.6 percent prevalence of low testosterone among men with a more favorable genotype for serum testosterone levels.

6

Your genes determine how effectively your body utilizes protein in your diet.

Specific Gene Analyzed: FTO

As an athlete, you need more protein than the average person.

This gene has consistently been shown to be associated with body fat mass and BMI. As an athlete, you need more protein than the average person, as protein is required for muscle growth and repair after training, workouts, and competing. Many active people also rely on a heavy protein intake to shed and maintain weight, with a large contingency adopting protein-centric eating plans like the Paleo diet in hopes to maximize lean body tissue and minimize fat. How well that approach works may be largely dependent on your DNA.

One large study found that people with a specific FTO variant had more successful weight loss and shed more body fat, particularly high-risk abdominal fat, if they ate a moderate-to-high protein diet (25-30% of total daily calories) compared to a lower protein diet (15-20% of total daily calories), regardless of the percentage of their that came from fat and carbohydrates. However, they also lost more non-fat mass — which includes muscle — with the weight loss, even though they were eating a higher protein diet and exercising.

7

Your genes determine how prone you are to muscle and bone injuries.

Specific Genes Analyzed: SPTBN1, MEPE, SLC25A13, MBL2/DKK1, LRP5, C18orf19

The genes and their associated SNPs in this category have been shown to have significant associations with a person's bone mineral density and risk of fracture. Strong bones are essential for good health and longevity as well as to support your active lifestyle and avoid injuries like stress fractures and breaks. Throughout your life, your body is constantly breaking down old bone (in a process called resorption) and laying down new bone. You reach peak bone density at about age 30, after which you may start breaking down bone faster than you make it. If this loss remains unchecked, you can end up with dangerously thin bones that increase your risk of fracture. Because of hormonal reasons and the fact that they have thinner bones to begin with, women are at particular risk for thinning bones and osteoporosis (a disease where bones are porous and prone to breaks), especially after menopause.

Twins and family research reveals that up to 85 percent of the variance in bone mineral density (BMD) is determined by genetics. The largest meta-analysis of 17 genome-wide association studies found that certain genetic scores were highly associated with BMD and fracture risk. The only way to know for certain that you have healthy or low BMD is to have a bone density test, called a dual energy x-ray absorptiometry or DXA scan, which measures bone density in your hip and spine. Other screenings, such as the kinds that measure bone density in your lower arm wrist, finger, or heel, also can identify thinning bones.

Conclusion:

As you can see, athletic performance starts from within — it's unique to your specific genotype. It doesn't mean that the hours you have already dedicated to your training, your diet and any supplements you consume, or the lifestyle changes you've embraced haven't helped get you to where you are today, but genetic science does suggest that your strength and performance can be enhanced based upon your proper understanding of your specific genotype. The only way to know how much of an impact your DNA can have on your performance is by testing it. GxPerform can help — when you purchase GxPerform, our groundbreaking, science-based athletic performance solution, you will get a comprehensive report detailing your genotype in the seven traits listed above — and 8 more! The report also provides a set of recommendations that will help you achieve your athletic performance goals, based exclusively on your genetic results.

Today, it is possible to understand and act upon the competitive edge our bodies naturally give us. Let GxPerform chart it for you.