ORIGINAL ARTICLE

THE POWER-SPEED GENE: ACTN3 R577X

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Abstract

Background: Of the over 25,000 genes in your body, new research has discovered a few specific genes to have a profound positive influence on athletic performance. Some of these genes are endurance genes, while others are speed-strength (power) genes. In particular, the ACTN3 gene is shown in many new studies to be a main driver in muscle mass, strength, power, and speed traits- especially in elite level athletes. NUTROMIC Sports Nutrition's focus is on the influence of various biologically active nutritional substances on various speed-strength genes. MYOSYNC™ is the first nutritional ergogenic to focus on enhancing speed-strength neuromuscular traits which include reaction, starting-power, maximal strength, speed, and speed-strength endurance.

The human body contains over 25,000 different genes which contribute to various human traits. Genes are found in spaghetti-like structures called chromosomes which are located in each of the billions of living cells in your body. Chromosomes come in pairs and there are hundreds, and sometimes thousands, of genes in each chromosome which reside in the cellular nucleus. Each gene has a specific job to do. The DNA in the gene contains the blueprint, or instructions, on how to make a protein. When athletes think of proteins they usually think of skeletal muscle proteins. But there are more types of proteins than just muscle, including the all-important enzymes involved in countless enzymatic reactions which drive your metabolism, as well as the cells that direct our nervous system for thought and movement, our bones, our blood cells, organs, etc. We inherit our genes from our parents. In addition, these genes can be modified during our fetal growth in our mother's womb and also in early childhood. Science has also recently discovered that nutrients in our diet and as dietary supplements can be signaling molecules in gene activation or silencing into adulthood and old age.

Nutrition is considered nutrigenomic, meaning what we eat, or don't eat, can influence how our genes respond. We actually have an opportunity to reprogram our genes. This is good news for athletes. You can reprogram your genes within your nervous system and in your skeletal muscles to respond faster, to be bigger, stronger, more explosive, and faster by consuming certain nutrients. Athletes can influence speed-strength athlete traits including muscle mass, starting strength, power, reaction, fine motor skills, and strength endurance by what they feed their body.

The science of studying specific genes, in particular genes essential to the development of the elite level athlete, is quite new. In just the past five years, research into what key genes are elevated in elite speed-strength (power) athletes has greatly expanded thanks to many international studies. Much of this research has been conducted in Russia because the former Soviet sport system of talent selection, research and development still stands strong today. With a simple swab of the inside of your mouth, sport scientists can measure a variety of specific genes and their variances (known as polymorphisms of SNPs) known to be higher in elite speed-strength athletes.

In the interest of good science I must report that one single gene does not make an elite athlete. In fact, research has shown that a collection of genes likely

contribute to elite athlete performance. In addition, some athletes overcome weaker genetic variances to become champions by grit and determination. In other words, speed-strength genes aren't everything. They're important, but not all inclusive. In a paper by Paulo Gentil he writes "It is estimated that genetic factors may correspond to 44 to 58% of the inter individual variations in muscle strength and lean mass."

And yet there are certain genes that stand out in most all recent research on genes involved in the making of elite speed-strength athletes. One such gene is the alpha-actinin 3 (*ACTN3*) gene. ACTN3 is a protein specific to fast twitch (Type 2) muscle fibers. The type 2 fibers are your explosive fibers while Type 1 fibers are endurance fibers. Everyone is born with a certain ratio of the type 1 and 2 fibers, speed-strength (power) power athletes having more of the Type 2 fibers, and also a variance (polymorphism) in ACTN3 known as R577X.

There are two primary variances of the ACTN3 gene. Also known as an allele. They are the R allele and the X allele. The X allele has what is called a stop condon and this allele "stops" or basically inactivates the ACTN3 action. The R allele allows the ACTN3 gene to perform which is vital to explosive actions in muscles. Each of us has two sets of chromosomes and one allele on each chromosome. If both alleles are the same (homozygous) they would be RR or XX. If they are different (heterozygous) they would be RX. Those athletes with the XX variance would tend to have a higher aerobic capacity and be endurance oriented. Those with the RX variance would fall in the middle; perhaps speed-strength team athletes like American football players, basketball players, and hockey players. Those with the RR variance would have a good chance of being weight throwers, sprinters, Olympic weightlifters, and powerlifters. The R allele occurs more in the top level speed-strength athletes- more RR equaling more elite.

You say you aren't an elite athlete, yet you still want to perform better? While the R allele plays a greater role in elite athlete performance, athletes less than elite through novice level may do well enough with whatever variance they carry.

Numerous research studies on many speed-strength athletes from several laboratories have pointed to ACTN3 as a pivotal driver in explosive force and speed development. This research is being done for different reasons. Some studies use gene testing via a cheek swab to measure various gene variances in an athlete. For example, a swab from the inside of your mouth would grab many of your cells from which the genes could be determined. The RX variance, and in particular the RR variance is a predictor of an athlete being capable of producing greater neuromuscular force (power, speed, reaction), sprint speed, the reprogramming of the metabolic phenotypes of fast twitch muscle fibers, and a greater testosterone level.

ACTN3 will play a role in speed-strength trait enhancement in all athletes and in particular those with the RX or RR alleles. NUTROMIC Sport Nutrition is focused on developing nutritionals with specific nutrigenomic (nutrient influence on genes) actions. MYOSYNC™ is the first of two primary nutritionals targeted towards enhancing various speed-strength gene (ACE, PPARalpha, HIF1alpha, ACTN3 and BDKRB2, and others) variances, with ACTN3 RX and RR alleles being a major contributor to speed-strength athlete performance.

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