

AN ATHLETE'S PERFECT TWITCH

(1) Which sport is perfect for you? You might like sports or you might not. You might love playing sports but not be amazing at any of them. You might dislike sports, avoid them like the plague, and never know that you could be the star player of a team. No one doubts that effort, practice and proper training at any sport helps all athletes improve, but some people are lucky enough to have been born with a genetic advantage that makes it easier for them to become high performing athletes.



(2) Some of the major factors that influence athletic performance are body morphology (e.g. height and body composition), endurance (how long you can physically perform before tiring), strength, injury susceptibility (how likely you are to get injured) and how well a person responds to training. These factors are determined by varying amounts of genetic and environmental influences. For example, height, is almost 80% determined by genetic factors. Some athletic careers have been cut short when athletes have not grown tall enough (e.g. basketball players) or when some athletes have grown too tall (e.g. gymnasts). Aerobic endurance is 50% genetically determined and strength is 30% to 80% genetically determined depending on the muscle group and type of contraction.

(3) When it comes to skeletal muscles, everyone has three types of muscle fibers: slow twitch fibers, fast twitch A fibers and fast twitch B fibers. However, the proportion and distribution of these fibers in each individual differs and this has a large influence on the type of sport at which a person will most likely excel. These three fibers differ in their endurance and ability to produce power.

(4) Slow twitch fibers are muscle fibers that contract slowly, but can keep contracting without fatigue for a long period of time. They contain numerous mitochondria to produce a lot of ATP aerobically and their main fuel source is triglycerides (a type of fat). Slow twitch muscle fibers aren't just for athletics, they are used in our everyday lives. They are found in the muscles responsible for holding our bodies upright to maintain posture when standing or sitting. They are found in your

neck which holds your head erect for the entire day without fatiguing. For athletics, slow twitch fibers are the type that long distance runners or cyclists would use to perform their endurance sport. Imagine running a 42 km (26 mile) marathon or cycling 200 km (124 miles) of a stage of the Tour de France. Only slow twitch muscles can provide the sustained effort needed to complete such long distances.

(5) The other two types of muscle fibers are fast twitch fibers and can be broken down into fast twitch A and fast twitch B types. Fast twitch B are the muscle fibers which can be considered the opposite to slow twitch fibers. Unlike slow twitch fibers, fast twitch B fibers contract the fastest but they also get tired the quickest. They have very little mitochondria and can only be used for very short term anaerobic activities that require a big burst of explosive power like sprinting or jumping. Fast twitch B muscle fibers use glycogen and creatine phosphate for fuel instead of triglycerides. Fast twitch A muscle fibers are a hybrid of slow twitch and fast twitch B muscle fibers. Their contraction speed is in between the speed of the other two fibers and their tendency to fatigue is intermediate.

(6) How ATP is created and broken down plays a big role in the difference between how slow twitch and fast twitch B fibers respond. Slow twitch muscles create ATP quickly, but break it down slowly. The constant creation of ATP gives slow twitch muscles greater endurance, but the slow break down of ATP doesn't allow for a large generation of force during contractions. Fast twitch B fibers are the opposite. Once they make ATP, they can break

AN ATHLETE’S PERFECT TWITCH

it down very quickly to create powerful forces during contractions, but they are very slow at rebuilding their ATP supplies once the ATP is used up. This is why they fatigue easily.

(7) When it comes to sprinting or running a marathon, many of the same muscles are used. The calf muscle, for instance, is important for both sports so the calf muscle has to have a mixture of both slow and fast twitch muscle fibers. What separates a world champion marathon runner from a world champion sprinter is the the ratio of fast vs. slow twitch muscle fibers. The marathon runner will have a greater proportion of slow twitch muscle

fibers and the sprinter will have a larger proportion of fast twitch muscle fibers.

(8) We are all born with a specific proportion of slow and fast twitch muscle fibers and this can’t be changed, however, what can be changed is how efficient these fibers are and how large the fibers become. With more endurance training, more slow twitch fibers will be recruited quickly when they are called to action. Not only that, but the fibers will hypertrophy, meaning they will grow larger. The same gains are seen with fast twitch fibers when training is focused on strength and power exercises.

Article Questions

1) List the some of the factors that influence athletic performance.

2) Fill out the chart below to summarize the differences between slow twitch and fast twitch B muscle fiber types.

Fiber	Speed of Contractions	Fatigue and Endurance	Force Generated	ATP Synthesis	ATP Breakdown	Best for Which Sport
Slow Twitch						
Fast Twitch B						

3) A doctor tells you that you were born with more slow twitch fibers than fast twitch fibers and that it would better if you joined the cross country running team instead of track and field for sprinting. You have always wanted to be a sprinter. What can you do to make up for your lower ratio of fast twitch to slow twitch muscle fibers? How will what you do increase your sprinting performance?