

Muscle Fibers - An In Depth Analysis Part 3



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Introduction

I will begin this particular subject with a very blunt and straight forward statement. You will not, and cannot reach your genetic potential without building up your Mitochondrial density. In fact, I do not believe that you can even come close! Now that I have your attention, lets get to business!

From this article and my writings on the anatomy of a muscle, you understand what Mitochondria is. Let me clarify however what effect these organs have on our body's composition.

Mitochondrial Density = An Increase In - Fat Burning, Muscle Mass, & Your Ability To Train

1. 95 percent of the ATP used for muscular contractions is produced in these organelles. The statement made here sheds light on countless aspects involved in training! Simply put, the more Mitochondria your muscles contain, the greater endurance for the criterion task will be! This allows you to stimulate your muscle fibers in a much greater fashion, then your lesser conditioned counterpart. The greater the stimulation, the greater your growth will be! Also as you recall, between sets our muscle's energy stores must be replenished. You will recover as quickly as your mitochondrial density will allow! This translates to a greater ability to maintain intensity throughout the workout. Too many out of shape bodybuilders conk out after one set of squats, or one compound movement. If you can't go the distance, then you have lost the battle!
2. Efficiency at converting stored energy - In essence Mitochondria is responsible for converting stored energy(or available energy) into useable energy. The more you have of this gem, the higher your ability to burn off stores will be. This translates to an enhanced ability to burn fat! Think of these organelles as fireplaces or our muscles " cellular furnaces. " The larger its capacity is, the more it can burn! How many times have you heard the statement, " I was born with a difficulty to burn fat "

or " I store fat easily. " Increase your cellular furnaces and you will not only use energy more efficiently(use it instead of store it due to lack of efficiency), but you will also increase your ability to burn off stored fat! Another example would be a construction job. If you are in charge of building a house and on the plot of land next to you another person has been put in charge of building the same size house. Who will construct it quicker? The person with 100 men, or the person with 50? Exactly, the person with 100! Its the same principle, you need to increase the amount of men working for you!

That is the positive side of such an adaptation. The negative however, is the complete opposite. If you neglect to condition your muscles they will not use energy efficiently, you will store fat more readily and not have as much ability to train.

3. Supports Hypertrophy - As I discussed earlier today, ATP is the human body's perfect energy currency! In fact essentially all cells run off of it! The process of repairing a muscle is also fueled through this mechanism! If you do not have sufficient Mitochondrial density, you will reach a point in which muscular growth becomes an impossibility! This is why I stated that you will never even come close to reaching your genetic potential if you did not seriously train for density in this area! Literally, your muscles will get to a point in which hypertrophy cannot be supported any longer and even maintained! You see muscle is constantly being repaired and maintained. Even when I stand up tiny tears occur in these cells. The more muscle you have the more energy it takes to just maintain it. Eventually(and when I say this, it happens sooner than most realize!) maintaining the mass becomes a massive job, let alone building it up. The answer: Well you already know it! Build up your mitochondrial density!!! Not only will you continue to grow, but you will grow faster, because you are supplying your body with energy quicker and more efficiency to accomplish the difficult task of building a muscle up! Again, you have two choices

A. Ignore this area of training and expect to run into a plateau. And do not expect to reach your genetic potential.

B. Increase your bodies ability to produce ATP and enhance your short term and long term ability to gain mass!

The choice is yours!

4. Mass Factor & Density In The Muscles Cytoplasm! - While building up your body's ability to produce energy(mitochondria) you will also increase your ability to store energy in the cells cytoplasm or sarcoplasm (see anatomy of a muscle). Again, this translates to more energy in the weight room, and more energy to build mass. Training is no different for both of these aspects of bodybuilding. Furthermore, mitochondria and all the elements that will be built up with it in the sarcoplasm will contribute to the overall size of a muscle fiber! Not only will you enhance hypertrophy in the contractile proteins within the muscle, but also enhance it through multiplying Mitochondria!

How To Train For Mitochondrial Density!

And now ladies and gentlemen, for your delight and enjoyment I present the key to Mitochondrial density!

And that key is to force a muscle fiber to adapt to a higher supply of ATP! I know what your thinking, that's obvious! But it turns out scientists have been conducting university and lab research on the subject for decades and have just recently developed sound interpretations for accomplishing this in an optimal fashion.

The most traditional way to increase density is through cardiovascular type training. And most of the first tests were done within this activity. You see in the 1950's scientists began to notice that the breast and wing muscles of chickens had few mitochondria, while those of pigeons and mallards contained high densities of these structures. Now, chickens cannot fly, but pigeons and mallards are some of the greatest athletes in the world(hey, they race enormous distances)! This is of course when researchers began to understand the correlation between mitochondria and athletic performance. It spawned series after series of tests! I will discuss the most prominent of these now, so that you can get an optimal grasp on the subject.

At first researchers believed that mitochondria could be increased through the manipulation of specific hormones. It turns out that a high dose of t-3 increased mitochondria to a solid extent. But supplementing with this could have hazardous effects. It does however, exemplify the need to maintain a healthy thyroid gland. This of course is done, by a high meal frequency and by lowering stress(see [13 weeks to burning fat](#)).

Afterwards they began searching in the best place. That is, how training effects the density of these organelles. A man named John Holloszy, of the Washington University School of Medicine in St. Louis began running tests on how cardio effected mitochondrial density. His data ended out showing that the longer you run, the more mitochondria you would add to the muscles. In fact he had runners train at different intervals, from 10 minutes all the way up to two hours. It turns out two hours was most effective! The problem with Holloszy's results is that the intensity was low for each participant. Also the test did not look at individual muscle fibers(I, IIA, IIB) and see how much density was increased in each(15). Tests such as this paved the way to better athletic performance, but again they lacked seriously! In fact it is these tests that have led coaches today to stress long distance runs for their athletes.

Enter modern day experimentation! A man named Gary Dudley (State University of New York at Syracuse) came on the scene and decided to test not only lengths of time, but also different intensities and finally how they effected all three of the muscle fiber types mentioned above!! His finding were stupendous! He showed that higher intensity / shorter duration cardio vascular work increased mitochondria much more effectively than low intensity / long duration exercises(16). Here is an overview of his findings!

Fast Twitch IIB " Glycolytic Fibers " - 10 minutes of fast running (at close to 100% VO₂max) (simply means running as quickly as possible for 10 minutes) produced the absolute greatest results in these muscle fibers as far as mitochondrial density is concerned.

Fast Twitch IIA " Oxidative Fibers " - 10 minute all out cardio did the same thing for IIA fibers!

Slow Twitch I " Oxidative Fibers " - Slow twitch were another story however. 10 minute runs did increase slow twitch. But optimal results were found in the 27 minute range at at 85% VO2max. In other words a very brisk half hour session of cardio. Increases were actually more in the 60 minute range with easy going intensity, but comparatively speaking 27 minutes was essentially just as effective! And gave you more bang for your buck!

When dieting, this shows that it would prove very useful to get a few high intensity 10 minute runs in, and one or two 25 minute ones as well. Even if you do not like cardio, doing one high intensity 10 minute run and one intense half an hour run a week would not amount to much work, but would go a long way in increasing mitochondrial density. If you could alternate and do it up to 4 times a week, that would be all the better.

note: In addition, cardio would increase insulin sensitivity and vascularity.

The other way to increase density in this area is through weight training. Essentially you would need to have your muscles adapt to higher endurance activities. As far as a repetition range is concerned, I would suggest the following:

Fast Twitch IIB " Glycolytic Fibers " - These are our power fibers, so working out in the 8-15 repetition range will most certainly develop mitochondrial density here.

Fast Twitch IIA " Oxidative Fibers " - Working out in the 12-25 repetition range will work for these.

Slow Twitch I " Density is best accomplished in the 50 and up range. I would not recommend going past 100 reps.

Shocking Methods - Anything that doubles the duration of a set will increase density. Therefore you should be inclined to use strip sets and especially supersets! I feel that supersets are by far the most productive method of increasing mitochondrial density! And tri-sets can even increase it further! Here is a trick! Try supersetting opposite parts and immediately after the second exercise go back to the first exercise, this will have allowed some of the fibers to recover and force them to develop more mitochondrial density. Lets say I am supersetting back and chest. I would start out with dumbbell bench presses, go to lat pull downs without rest, then immediately go back to the dumbbell bench followed by pull downs! I guarantee your density will double in no time!

Rest Time - Remember, your body replaces its energy stores between sets. By occasionally cutting down on rest time you will force your body to become more efficient at producing ATP! Normally I recommend the following rest times, for optimal recovery.

3-5 reps = 3-5 minutes
6-8 reps - 3 minutes
9-12 reps - 1-3 minutes
13-15 reps - 1 minute
15 -25 - 30 seconds to 1 minute
everything above is the same

Try cutting these times in half for a month! You will see fantastic results!

I also recommend the rest pause method. Try performing a set, resting 15-30 seconds and then continuing it. This again cuts down on rest time, thereby increasing adaptation within energy producing and storing mechanisms!

Overview:

1. Higher repetitions increase mitochondrial density
2. Shocking Methods that force the muscle fibers to continue their sets causes the need for a greater energy source.
3. Intense Cardio Work Dramatically improves this aspect of bodybuilding as well.
4. And finally manipulate your resting periods. This will also cause an increase in contractile protein hypertrophy!

Conclusion

We have covered a tremendous amount of Information in this 3 part series! You now have a great understanding of exactly what fuels and powers a workout routine. Most importantly however, you know how to manipulate these vital aspects of bodybuilding to achieve maximum growth!

If you will excuse me, I have to go destroy every muscle fiber in my entire back complex!

Sincerely

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