HST Faq E-Book

By Bryan Haycock a.o.

1. Rep Speeds

Basically, during the 15's the reps should start out slow and then speed up as you feel the burn begin to kill your strength. After all, the whole point is to flush the muscle with lactic acid.
During the 10's you should go slower when the weight is light. That way it will still be difficult to complete the set. As the weight gets heavier simply increase the tempo to ensure that you complete the set. BE careful not to get too sloppy though. It will do little good to use momentum to move the weight during the 10s.

The first week of 5's should be slow on the way down but still pretty explosive on the way up. Then as the weight nears your 5 rep max you will have no real control over how fast you move the weight. It will generally go slow simply because it is so heavy.

During negatives you should lower the weight in about 2-3 seconds. This may seem too quick to most traditionalists. Research has shown that if you go too slow during negatives you don't get the same growth stimulus. It begins to resemble the effect of isometrics if you go too slow. This is one reason why the old principle of "time under tension" isn't so simple as just time. The action of the muscle while under load is very important when trying to produce a specific effect.

2. Warm-ups

Begin with a general warm-up – stationary bike, treadmill or similar for 5 mins at low-moderate intensity – just enough to break a sweat. Then do some light, dynamic stretching – arm rotations and similar.

Continue to:
Specific warm-ups for first exercise of major muscle groups (legs, chest, back)
15s don't really require warm-ups.
10s - 1 set 5 reps @ 70% of working weight on main exercises. Later exercises for same or auxiliary muscle groups don't require warm-ups unless you feel you need it.
5s - 1 set 5 reps @ 50% of working weight
1 set 3 reps @ 70% of working weight
1 set 2-3 reps @ 80% of working weight
1 set 1 rep @ 90% of working weight (optional)

Although it looks like a lot, it is low-volume compared to those that use 20+reps on their warm-up sets. The warm-up only serves to increase the core- and local temperature, thus elevating various enzymes and activating the neural system, thus making the muscles work more efficiently. Don’t make the warm-ups into a workout of its own. The above should at most require 15 minutes.

The reps should be easy, producing more of an "active stretch" than a strength challenge. You will find that when you train a body part more frequently, it requires less warm up to feel ready to perform.

3. Rest between sets

The Rest between sets is determined by the amount of time required to regain sufficient strength to successfully achieve the minimum effective Volume. There is not much to it, and you will not see any dramatic results by varying rest periods (within reason, of course)

Overall, rest periods should be around 1.5-2 minutes.

When moving from one body part to the next try to alternate between opposing or antagonistic body parts – commonly known as antagonistic pairing. E.g. 1 set of chest, rest, 1 set of back, rest, one set of chest, rest, 1 set of back, rest etc. This way your chest, shoulders, and tris can rest while you hit your back and bis. After a while you will find your aerobic capacity going up as this closely resembles sort of a power circuit.

You may shorten rest periods on 15s to attain the lactic acid effect - on the order of 30-60 seconds.

Increase rest periods as you get into the heavier, neural ranges - on 5s and negs you will most likely find it necessary to rest on the order of 2-5 minutes between sets.

Also, shorten rest periods earlier in the workout when you are fresh - then progressively increase rest periods as fatigue accumulates towards the end of the workout.

4. Bryan's Routine – Example of AM/PM split

Squat
Leg Ext
Leg Curl
Straight leg calf raise
Chins (wide and narrow)
Dips
Rows (wide and narrow)
Incline Bench
Lateral raises
Rear delt work (dumbbells)
Dumbbell press
Tri Ext
Curls of all kinds

I'll do some crunches too. As well as stationary bike and once in a while I will jog a bit.

Sometimes I will split things up into AM and PM workouts. If I miss the PM I will simply do it the next day. I don't use a training partner so I only do negatives on Chins, Dips, curls, tri Ext, and rear delt work. I usually do 2 sets of 2 exercises for back. I don't go terribly heavy on Squats and Bench. I guess 25 years has taken a bit of a toll on this less-than-genetically-ideal body. In fact, on squats I will start with 20 reps.

Here's my AM/PM split.

AM
Squat
Incline Bench
T-bar row (supported)
Calf (straight leg)
Lateral raises
Bent over laterals
EZ curls
Tri extensions

PM
Leg curl
Leg extension
Military press (lowering no further than top of head)
Chins
Dips
Lateral raises
Lying rear delt raises (lie on bench on your side)
DB curl
Tri extension
Calf raise

I warm up on the bike for at least 6 minutes with a lot of resistance (break a sweat). I do 2 "work sets" after an adequate warm-up on each exercise. On off days I do cardio for 20 minutes twice per day, while I'm dieting anyway.

5. Training Frequency

Also read the Planning Your Training Frequency (http://www.hypertrophy-specific.com/hst_artcls_trainingfreq.html) article.

The reason HST calls for more frequent training is because the acute anabolic effects of training, such as increased protein synthesis, muscle-specific IGF-1 expression, and other factors involved in modulation of short term protein synthesis, only last for 36-48 hours. There is also mounting evidence of a "summation" effect by exercising while levels of these signals and responses are elevated, as should be expected.

This does not mean that the structural repairs to the tissue have been completed. Research has demonstrated that you can train a muscle before it is fully recovered structurally and not inhibit its ability to continue to recover. So, HST uses this evidence and calls for repeated loading (training) every 48 hours or so to keep the anabolic activity of the muscle high, while trying to stay slightly ahead of the structural recovery curve by constantly increasing the load each workout. Staying ahead of the structural recovery curve is really key to elicit real growth in a person who has lifted for quite a while. Of course, injuries can develop over time if care isn't taken to take time to heal, and prepare the tendons for repeated heavy bouts of lifting (SD and 15s serve this purpose in HST).

"Recovery" can refer to several different things.

1) "Recovery" can refer to the structural repair process of fixing the micro trauma. The damaged proteins can takes several days to be repaired and all evidence of damage removed. Even at the end of seven days after significant muscle damage from eccentric muscle actions, you may still see some small fibers regenerating.

2) Strength - this can be acute recovery as in the necessary time to rest between sets. Or it can mean the days that it usually takes to regain baseline strength after muscle damaging exercise.

So the trick is to have the CNS "recover" just in time to hit the muscle again as the acute anabolic effects are wearing off. That way you can stay anabolic more of the time. Training once every 7 days will still allow you to grow, it just takes longer for the gains to accumulate. Training more frequently is more efficient if your goal is just to get bigger

To understand, you have to consider the total volume over time. A week is easiest to consider, so, over the course of a week, it is the total volume that is important. So 9 total sets for chest can be done in one workout or in several workouts. Both will stimulate growth. However, you will be anabolic more of the time if you can actually create that stimulus more often. In the case of HST, 3 times as often. There is a physiological benefit (acute anabolic effects of training) in doing 9 sets as 3 sets X 3 workouts, as opposed to 9 sets all at once - and then nothing for the next 7 days.

6. The HST Books

Much of it is written already. However, I need to release a version of HST that anybody can pick up and understand as well as apply to their own training without too much difficulty.

My love, of course, is for the science and those guys/girls who are also looking for more detailed answers. Most of these individuals are usually trainers. The HST for professionals will be just that. A book for professionals. People who dedicate their lives in some way or another to practicing and researching exercise science. Personal trainers, open minded coaches, and of course bodybuilders who manage their own training.

This group will not only want to know what HST has to offer, but they will also form their own opinions based on their backgrounds in exercise physiology. This group will sift through the info to find the really juicy stuff they haven't read or heard about before. Some will reject it if it threatens their authority, others will be glad they found it and add it to their already wide array of knowledge and experience. Unfortunately, science on that level specific to bodybuilding only has appeal to a very limited audience. Even the really hardcore guys just say, "shut up and lift dude!”

The biggest audience is the group that just wants to get in shape. HST can serve them very well, but they first have to hear about it on a very simple level... no ribosome’s, no translation, no mitogen activated protein kinases either. Just plain language that leaves very little to be misunderstood. On top of that, they will need basic info on nutrition and supplementation. This population’s goal is to see results, not be given a lesson on physiology. They usually don't really care about how it works. They just want to be told what to do and to keep it simple.

7. Does DC method/EDT/GVT/SS/IART/HIT work?

7.1. EDT

I love Charles so don't take anything I say as a criticism about his person.

He is incorrect. "Work" does have something to do with hypertrophy, but only as far as peak tension (not intensity or effort) achieved and the duration of that tension (not to be confused with sets with less weight due to fatigue).

You are pushing the limits of your strength-endurance by trying to increase the number of reps with a fixed load within a given amount of time. The %1RM relative to your level of conditioning at the time will determine how effective those sets will be for growth.

Once the muscle adapts to using (lifting & lowering) your 12 RM, you will stop growing. However, if you continue to stress its metabolic/oxidative capacity, it should increase its ability to resist fatigue with the 12RM load. In other words, once you have stopped growing, you might continue to get better at lifting your 12Rm while exhausted as long as you make lifting your 12RM more exhausting over time by reducing the rest periods.

So the method will work as long as you can continue to increase the weight.

7.2. GVT

A lot of people ask me, "If HST is the best way to train, why do guys claim they made gains using other routines?" I tell them that any routine that incorporates some principle(s) that is known to be necessary for hypertrophy is going to produce some level of change to their muscle. This is common sense. The same goes for a routine that I hear mentioned now and again called German Volume Training (GVT).

GVT is a high-volume light-weight training system that focuses mainly on "strength-endurance" or fatigue. GVT, though specific to increasing short-term endurance, can produce some hypertrophy in as much as it adheres to any of the known principles of hypertrophy.

Let's go over some hypertrophy-specific principles and see how GVT stacks up.

For simplicity, I am going to quote Charles Poliquin. He did not invent GVT, so I don't want to give the impression that I am in any way critiquing Charles. I'm only critiquing the method. I'm just quoting Charles because he did a good job summarizing the method. His comments will appear in *italics*.

The Goal of GVT

As to people's question about whether GVT is hypertrophy-specific, we must take a look at the goal of GVT. The clearly stated goal of GVT is to complete 10 sets of 10 reps without reducing the weight. So right from the beginning we see that the goal of anyone using GVT is not hypertrophy, but endurance of strength in the 10 rep range.

The Principle of Specificity

IF GVT adheres to the principle of "Specificity", GVT will have to stick with high volume and significantly light weights in order to condition your body to be able to perform 10 sets of 10 reps without reducing the weight load. And this is in fact what GVT does. *"You want to begin with a weight you could lift for 20 reps to failure if you had to. For most people, on most exercises, that would represent 60% of their 1RM load."*

So rather than using "load" or "muscle tension" which is a principle specific to hypertrophy, GVT uses fatigue to increase the "difficulty" of lifting a light weight, thereby making it "feel" heavy. Inducing fatigue is a principle specific to endurance.

The Principle of Progressive Load

GVT does use the principle of progressive load however. According to Poliquin, *"Once you're able to do 10 sets of 10 with constant rest intervals, increase the weight on the bar by 4% to 5%, and repeat the process."* So although GVT does not incorporate heavy weights, it does increase the light weights from time to time. Unfortunately, because of the use of fatigue as GVT's primary stimulus, the muscle is at the mercy of the nervous system. Unless you get stronger, which is a known neurological mechanism, the muscle will never be subjected to an increase in tension, and thus will not experience a hypertrophy-specific stimulus.

The Principle of Training Frequency

Due to the significant demands placed on the central nervous system (CNS) a GVT workout can't be completed but every 5 days. *"Because this is such an intense program, it'll take you longer to recover one training session every four to five days per body part is plenty."* Now the consequences of too infrequent training are not all or none. It is a matter of degrees. Sure, it's not ideal for hypertrophy to train once every 5 days. But it works just fine for CNS recovery, and considering the goal of GVT, which is strength-endurance, it makes perfect sense.

The Principle of Adaptation (resistance to the stimulus)

GVT training in its pure form does not take this factor into consideration. Nor has any training routine until the time of HST. Without Strategic Deconditioning, continued gains in size come glacially slow, or stop all together. After all, adaptation is the body's way of preventing any externally applied stimulus or environment from affecting the body. Homeostasis must be maintained if the body is to survive. So, over time, any stimulus grows weaker and weaker until it no longer elicits a response from the body unless that stimulus is increased in magnitude, or it is removed for a time to allow the body to "un-adapt" and become sensitive to that stimulus once again.

All right, I think it is pretty clear that GVT is not "specific" to hypertrophy. However, it does utilize one principle of hypertrophy, namely progressive load, and thus will induce some hypertrophy if an individual is just beginning or is sufficiently deconditioned.

7.3. IART

Brian Johnston feels you should train a muscle according to its "rate of fatigue". I feel a muscle's rate of fatigue is irrelevant to "hypertrophy". I argue that it is load, rather than fatigue, that is the prime stimulus for hypertrophy. Otherwise, wouldn't marathon runners have hypertrophied muscle? What about distance swimmers?

Training programs based on fatigue are strength-endurance specific, not hypertrophy-specific. Never mind all the research showing load and microtrauma as the primary stimulus for hypertrophy. Not to mention the studies showing that fatigue actually reduces microtrauma.
Keep in mind that IART is heavily influenced by Arthur Jones. Arthur Jones isn't "into" physiology, or science. He is into "common sense" and stress. I, on the other hand, am into science and the mechanisms of muscle fiber hypertrophy.

7.4. HIT or HD

To understand any comparisons to HIT or HD use the following definitions:

Intensity = percentage of voluntary strength. In HIT terms it is equal to "perceived effort".

Maximum capability - maximum voluntary strength

HST does not equal HIT. Except perhaps that they both have an H and a T in their acronyms.

- HIT's measuring stick is based on strength (performance).
- HST's measuring stick is based on growth (size).

- HIT is based on how hard it feels to lift a weight.
- HST is based on progressively loading the tissue.

- HIT's goal is fatigue.
- HST's goal is hypertrophy.

- HIT is based on a philosophy of stress.
- HST is based on the physiology of muscle cells.

- HIT came from the imagination of Mr. Jones.
- HST came from the research of dozens of independent researchers.

Understand that it is not necessary to train at 100% voluntary strength levels to stimulate "growth". This is one fundamental difference between Hypertrophy-Specific Training (HST) and HIT. HST is designed only to stimulate growth. Strength of course will increase as well during HST training but this is not the primary goal of the method. It isn't necessary to push against a weight that won't move (due to load or fatigue) to induce the necessary strain to muscle that leads to growth.

After years of training I realized that I would never get any bigger training the way I was unless I could get stronger, but I couldn't get any stronger until I got bigger. I had to discover a way to get bigger without getting stronger first. The HST method allows a person to get bigger before they get stronger. Accomplishing this is dependent on frequent loading (hitting same muscle at least 3 times per week), rapid progression in loading (mandatory increase in weight every workout), and Strategic Deconditioning (a week or so completely off to allow the muscle to become vulnerable to the training stimulus).

HIT training takes this "deconditioning" too far. They think the muscle is "recovering" when it is actually past recovery and beginning to decondition thus allowing the stimulus to work the next time the muscle is trained. Unfortunately, the rate of growth is greatly dependant on the frequency of the stimulus. So with HST you hit a muscle at least 3 times as often as with HIT, and growth is greatly accelerated.

7.5. DC/Doggcrapp method

DC's suggestions betray his strength training background. Methods based on fatigue/exhaustion (training to failure and rest/pause stuff) are really methods of increasing strength.

So in essence, he is shifting the emphasis towards strength gains. There is absolutely nothing wrong with that if that is your goal. All you have to do is induce more fatigue, and train less frequently.

Using a variety of exercise won't protect your tendons from injury. Using the same exercises doesn't increase your risk of injury either. Otherwise all Olympic lifters would be injured all the time. The variety thing is more an influence of BB mags. Although, if boredom is an issue, switch things up all your want, just make sure that the muscle is experiencing the same relative tension and demands across different exercises.

DC (I don't know him personally) is only one of many variations of HST that you will see in the near future. Especially from more experienced lifters. Why? Because HST is true (so to speak). It isn't based on "tradition", a "style", "Russian secrets", or even an "opinion". HST is based on the way muscles actually grow in response to training. As a result, there will be a gradual yet natural shift of bodybuilding training styles towards HST.

8. Responses to criticism of HST

I think it is important for people who criticize HST for being "too simple" or, as they incorrectly perceive, "nothing new", to understand that just as the physiology behind strength is complicated, the physiology behind muscle hypertrophy, which is the foundation of HST, is also complicated.

HST is not a "guess" like all the previous muscle building programs. It is a method based on the physiology of muscle growth.

You can't simply read one study and come to the conclusion that HST is the "big picture". It has taken me personally over a decade of reading the kind of research [posted in the studies section] before I was able to put together HST with any degree of confidence. The studies listed are a great cross section of the “current” state of understanding about how muscles “know” how to hypertrophy in response to mechanical stimuli. However, in order to understand it, a person has to have some background in the several fields of study that have gotten us this far. I have been working hard to get the book done. I know I keep saying that but its true. Trying to keep all of this running is more complicated than it might look. If I drop one of the balls I’m juggling I’ll have to drop all this and go to work for the highest bidder.

You also have to know how to investigate. I’m not saying anyone here doesn’t, I’m just saying that you can’t just set out to find the holy grail of training. Believe me, I’ve tried. It doesn’t exist. At least not in one place. Instead, the answers are widely interspersed through a wide range of research coming at things from greatly different angles. Not only that, but you will find some research that is seemingly unaware of other pertinent research simply because the fields of origin are far removed from each other.

In short, you have to break down the process of training for muscle hypertrophy (the big canvas) into two parts. The first part is the "means" by which we are able to apply the mechanical stimuli, namely weight lifting. The second part is the point of interest or, muscle cell itself.

Weight lifting is composed of the following (just examples):
Different movements of the body
Different positions of the body during movement
Different planes of motion of the limbs
Different speeds of movement
Different kinds of muscle contractions
Eccentric
Concentric
Static
Differing numbers of repetitions
Differing amounts of tension
Differing amounts of fatigue
Differing durations of rest
Different frequencies of training bouts

The muscle cell is composed of the following (just examples):
Structure
Connective tissue
Membrane characteristics
Cytoskeletal Proteins
Contractile proteins
IMPs
Receptors
Function
Motor Neurons
Motor Units
Sliding filaments
Z-lines
Etc
Metabolism
Glycolytic
Lipolytic
Aminoacid oxidation
ATP/CP
Genetics
Mechanisms of injury
Mechanical Strain
Oxidative stress
Optimal length
Mechanisms of repair
Anabolism
Proteolysis
Immune response
Fibrous tissue
Myogenic stem cells
Paracrine and autocrine
Mechanotransduction
Signaling molecules
MAPKs
Calcenurin

HSPs
Nutrition effects
High/low calorie
Protein
Carbs
Fat
Supplements
Endocrine effects
Testosterone
GH
IGF-1
Leptin
Myostatin
Etc.

I think you can begin to see the complexity of research that went into HST as well as HSN. From the list above I think you can see why people choose to stick with training issues rather that physiology. It's just so complex that it's easier just to argue about sets and reps. Or even just to revel over how "hard" a routine is...Now I'm not complaining, I love this stuff almost as much as I love growing. But still, I can't give you an answer in a nutshell. Even the HST book will be a short hand version of the state of the art of building muscle.

Anyone who argues with these principles after understanding them correctly is in error. That is a strong statement but it is true. These are principles that we "know" from research and experience. The data from this research is not theoretically based. It is based on identification, measurements, and direct microscopic observation. All future research will show us is more genetic detail, NOT that we were wrong on some sort of fundamental basis. So, anyone can with confidence apply these principles to their training and successfully induce muscular hypertrophy.

If anyone should attempt to apply these principles and not experience some degree of muscle growth, it is not because the principles are wrong, it is because the application of the principles was flawed. Once again, another strong statement, but it is true. For example, just because you plant a garden and water it does not mean you will successfully grow prize-winning vegetables. Does this mean that your garden acted by some other mysterious agricultural principles other than those based on water, sunlight and soil? Of course not! We "know" the principles of growing plants. Where we fail, is in our application of those known principles.

The application is where the details lie. Issues such as how much, how many, how fast, when and where to name a few.

Whether it be growing plants, or growing muscle, you are dealing with a moving target. Because plants are alive, or put another way, because plants are biological systems, the best application of agricultural principles to grow vegetables will change as conditions change. The same is true for the application of the principles of hypertrophy or muscle growth. The application will change as conditions change. All the while, being careful to stay faithful to the underlying "known" principles.

8.1. HST is nothing new, this stuff has been around for decades

The knowledge of sets, reps and rest has, but the science to explain how these factors work hasn't. That has been the problem. That is the reason so many "different" training programs exist today. If everyone knew how a muscle physiologically adapts to training we wouldn't be discussing it here today. Just because people are experimenting with different combinations of sets reps and rest does not mean they had some sort of crystal ball that told them about science that had yet to be performed.

So I'm not disagreeing with you that the concepts of sets reps and rest have been around for decades, but the necessary insight into cellular physiology that would allow people to start narrowing down there focus and methods has not been available until the last 8 years or so.

You don't have to know how muscle cells respond to different stimuli in order to have a good workout or even make good progress, but eventually you do have to know someone who does so that you can consult with them about how to make continued progress. Otherwise, when people plateau, they simply wander from one program to the next, not knowing why the last one started working, or even why the new one might or might not work. Keep in mind I'm talking about the natural guys.

So simply “doing” it “regularly and progressively” is what everybody in the world who wants to be big is already doing. As you say, those are not new concepts. But is all their “doing” getting them where they want to be? If not, that’s when they might want to start “reading and talking”, and I don't mean the mags on the news stands. Over the last 24 years or so that I have been “doing” bodybuilding, I have had to read an awful lot to understand why a person who has been training so long does not simply continue to grow and grow even though he is training “regularly” and to the best of his ability “progressively” as well. At that point do you simply accept the fact that you are as big as you are ever going to get? If you are passionate about bodybuilding that answer will never do. So you go on searching, reading, and, when you have something you feel is worth saying, you talk about it with other passionate people.

Sure, this kind of scientific discussion isn’t for everyone. But anybody who is really passionate about their hobby or profession will eventually find themselves reading about it, and talking about what they know with other people who share their passion. At least that has been my experience.

Finally, please remember my motives for sharing HST over the last few years. I want to help people who want to grow. I am a bodybuilder myself. I am always trying to add muscle. The more the better. Because of unique circumstances in my life, I have collected a great deal of information about how muscles grow in response to training, food, and drugs. It has helped me tremendously. And, you reap what you sow, so, I thought I would sow and let the universe workout the rest.

Truth be told, without the people doing research on muscle physiology, there would be no HST. They deserve all the credit and will be given it in the book. I always try to reference my writing to ensure proper credit goes to those making the discoveries in their respective fields. Including references of where I get my information is how I do my best to stay honest. I'm just a messenger, one of several that I could mention.

I was just trying to make a point about the differences between doing something haphazardly (e.g. taking a break), and doing something deliberately and accurately based an understanding of how it will effect muscle growth (e.g. SD).

I am well aware of earlier theories about training the entire body each workout. They were still grasping in the dark though. They didn't have the research that we have to day to refine the method. Nor did they understand how muscle grows on a molecular level in response to mechanical loading, so they couldn't make precise decisions about putting it all together.

8.2. Bah...you can grow just fine adding 1-2lbs per week. Lots of bodybuilders and power lifters have done it before.

HST proposes that you can grow faster. Muscle tissue adapts much faster than people realize. Significant growth can occur in 12-14 days. You don't necessarily need 12-14 months. Slowly increasing the poundage's as your strength levels permit is fine, but I feel you can increase the rate of hypertrophy by working around the tissue's natural tendency to become resistance and likewise more sensitive to the loading stimulus with the proper application of SD. In addition, proponents of HST feel that understanding the physiology behind the loading stimulus and the tissue's physiological response is important when trying to train as effectively and efficiently as possible. To some this is a bunch of scientific gobbledygook. They say, "Just shut your mouth, train heavy, and eat big!" Believe me, I have, for more than 20 years (and boy am I tired). Then, to the relief of some and as a threat to others, research has surfaced that sheds new light on ways of taking out the guess work, and really adjusting lifting methods to be more specific to the desired result…both for strength or hypertrophy. (Yes, there is even strength research being ignored by existing dynasties) That's where HST came from. If there was no new research, there would not have been and could not have been any HST.

There are many methods of weight lifting, but they are not of equal value. I feel, the merits of HST to build size fast makes it anything but "just another method".

I hope people understand that I too have gone through all the methods that others have, while trying to find the best way to grow. I feel as if sometimes people think I just popped up out of nowhere claiming to have invented weight lifting. This couldn't be further from the truth.

Not only that, but I'm not here to point out the flaws in previous methods and/or beliefs. Nor am I here to try to make people feel stupid or somehow duped because they have established their own beliefs and practices based on what they felt was the truth. I'm here to invite people to consider new information, new research, and a new perspective based on that new information.

I am a positive person, and I know that HST can be a positive thing to happen to bodybuilders helping them reach their goals.

8.3. I want to tweak HST to fit into my own beliefs and how I'm used to training

Why do people tweak and change things? Well, when done haphazardly it is usually because they have no faith in the underlying principles. This almost never leads to progress, only constant tinkering and frustration. Without adequate knowledge of the principles, and faith in their effectiveness, their expectations will never be realized and their "locus of control" will move ever outwards, blaming everything but themselves for their lack of progress.

In contrast, when people tweak and change their program based on changing conditions, they almost always experience success and they gain valuable experience in the process. Their locus of control will move inwards and they will grow ever more effective at adjusting their training as conditions dictate to keep the gains coming.

If you find yourself lacking faith in your training program, you will most likely fail to reach your goals. You must first prepare yourself. Take it upon yourself to gain the required knowledge of the principles of muscle growth to believe in what you decide to do. Look up the studies and compare the traditional methods to what the research tells you. Ask questions of people who seem to have faith in what they are doing. Find out whether they are doing it because they were told to do it, or because they know it is the right way to do it. And of course, ponder your own experience and try to make sense of past periods of growth and past periods of stagnation.

Even if you decide not to use HST, by learning the principles you will come to realize why any other program worked or didn't work. You can break down other programs and see how they apply the principles of hypertrophy. In as much as they apply any given principle effectively, it will produce some results. In as much as they fall short on any given principle, the program will fall short of being ideal for muscle growth.

Nearly every program ever devised before HST incorporated one or more of the principles of muscle growth. That is why people have experienced gains while using them.

Keep in mind that when you are presenting information that requires "application" by many thousands of people with an infinite variety of backgrounds and experience, you have to decide on the most general, yet accurate way of presenting that information. It is a compromise, utility for detail. That is why there is some variation in the way each person utilizes the principles of hypertrophy in their own training, while at the same time keeping true to those principles. If they stay true to the principles, they will grow.

8.4. So how is HST different from other training programs?

This is a very good question and one that deserves to be answered, without simply zealously defending the premise that is being questioned. This makes for a very bad circular argument that can be VERY frustrating for people with skeptical, though honest, questions.

First, let's start with what isn't different about HST compared with previous training programs. The length of this list is what has raised this question in the first place, and justifiably so. Let's begin with the "concepts" and then follow with the "methods".

Pre-existing Scientific **Concepts** of Weight Training Found in HST:

- Stimulus Leads to Adaptation (cause and effect)
- Specific Adaptation to Implied Demands (SAID) or simply "Specificity"
- Progressive Resistance
- Some relationship between Time and Tension
- Diminishing Returns

Pre-existing **Methods** of Weight Training Found in HST:

- Traditional Weight Lifting Movements both compound and isolation (squat, bench, curls, etc)
- Training the whole body 3 times per week
- Altering weight loads used over time
- Altering the number of repetitions used over time
- Doing eccentric reps (negatives)

There has never been a weight training program that did not incorporate or mention most of these **Concepts**, and at least some of these **Methods**. Entire books (big books) have been written to explore these concepts and teach these methods. Whenever research was required, like for a textbook, you would find "strength and conditioning" research sited to support the validity of the concepts and virtues of each particular training method. The studies used "strength" and other "performance indicators" as a measure of whether the concept and/or method were valid.

This has been perfectly sufficient for nearly everybody including trainers, teachers, professors, coaches and athletes, who have ever lifted a weight. For those who needed more, they simply explored other methods for steadily increasing body mass - I'm referring specifically to hormones.

The exploration of the hypertrophic effects of hormones began in the 50s and has continued unabated every since. Today, a competitive bodybuilder considers himself conservative if he only uses 1 gram of Testosterone per week. Lest I digress, we are not including the effects of androgens and other drugs in this discussion. That is a different issue with concepts and methods specific to the pharmacology and endocrinology of hormones and muscle tissue.

Now let's consider the concepts and/or principles or beliefs of traditional weight training that HST refutes. These are the concepts that the new research refutes most specifically.

Pre-existing *Concepts* that HST **Refutes**:

• A muscle must be fully recovered before you should train it again.
• You should not train a muscle that is sore (DOMS, not injury).
• You must never train a muscle on consecutive days. (i.e. train the same muscle everyday)
• The concept of "Overtraining" in general as it applies to bodybuilding.
• You must train with maximum "intensity" to elicit significant muscle growth.
• You should not use eccentric training on a "frequent" basis.
• You must change your exercise selection regularly in order to "confuse the muscle" into continued growth.
• You must hit a muscle at every angle in order to adequately train it.
• Muscle Fatigue is the primary indicator of having triggered the growth signal
• You must effectively isolate a muscle in order to train it effectively.
• You can train a muscle in such as way as to change its natural shape.

Pre-existing *Methods* and/or practices that HST **Refutes**:

• Training a muscle no more than once or twice per week.
• Training less frequently as your "intensity" increases.
• Adding weight only when you can complete a certain number of additional reps at that weight. (This is a fundamental difference!
• Training to failure every set and/or workout (If you don't how would you know if you can perform additional reps at that weight yet?)
• Forced reps
• Performing several "obligatory" exercises per body part per workout
• Performing multiple exhaustive sets per exercise
• Changing exercises to "confuse" the muscle.

The above erroneous concepts/beliefs and the methods/practices they engender are the cause of all the confusion and different training programs out their today. Most all of it stems from bodybuilding magazines fabricating these concepts and practices to address their ongoing need for new content each month, and to conceal the use of drugs required to attain the level of mass flaunted by the sponsored models. By limiting your study of muscle growth to these magazines you will be ever learning, and never able to come to the knowledge of the truth. But that is an issue to be addressed elsewhere.

Now, there is one traditional concept with its associated methods and practices that often make HST appear to be like previous programs. That is the concept of "periodization".

We will only briefly discuss the topic of periodization, as only a brief treatise will be sufficient to show the differences between periodization and HST. For more detailed discussions of periodization you are advised to read "Super Training: Special Strength Training for Sporting Excellence" by Siff & Verkhoshansky, "Special Strength Training" by Verkhoshansky, "Fundamentals of Sport Training" by Matveyev and "Science and Practice of Strength Training" by Zatsiorski.

Traditional concepts of periodization are based on methods used to manipulate intensity (i.e. work and/or load), volume and frequency in order to manage CNS fatigue and adaptability in athletes. To date, the art of periodization has entered the mathematical age and significant progress is being made in modeling systems designed to predict CNS fatigue and changes in the individual's fitness level. (1, 2, 3). Once an individual familiarizes him or herself with the true concept of periodization, they will immediately see the difference between Strategic Deconditioning and Periodization for strength training.

For example, here are a few differences between SD and Periodization:

• SD is used to decrease fitness level (A.K.A. conditioning).
• Periodization is used to increase fitness level.

• SD is used to increase the micro trauma associated with training.
• Periodization is used to decrease the trauma associated with training.

• SD is used to reduce work capacity.
• Periodization is used to increase work capacity.

• SD is applied irrespective of the need for "rest".
• Periodization according to the need for rest.

• SD is not based on "peaking" performance.
• Periodization's sole purpose is to allow the athlete to peak on a specific date.

So, when people ask, "What's different about HST?", tell them plenty! And its those differences that make HST superior to any other bodybuilding training method existing today.

9. Negatives/eccentrics

Note: If you are unable to do negatives on some or all exercises, you simply use your 5RM (the load you used in your 6th and last workout of the 5s block with) for another 2 weeks. I.e. the load should be kept constant for the last 2 weeks of your HST cycle. If you have gained a lot of strength, you may increment the load further for a couple of workouts - but avoid going to failure.

Eccentric lifts, or sometimes called "negatives", are when you use more weight than you can lift. Eccentric reps/negatives should be done in a controlled fashion. Aim for a lowering cadence of 2-4 seconds. Negatives begin AFTER the last 5-rep week. This is where Hypertrophy Specific Training differs from traditional routines. Never fear, if volume is kept low and training frequency kept high, you will experience breakthrough growth.

If you train alone, there are many exercises you can't do negatives on simply because you would need a partner to help you lift the weight first. If you do train alone - or if you feel any particular strains or aches - I would suggest that you just continue using your 5 rep max for each exercise for an additional 2 weeks after finishing the first 2 week block of 5s. You should see good results using your 5 rep max for an additional 2 weeks.

Exercises suited for negatives if training alone are any unilateral exercise using dumbbells, machines, or cables - aiding the concentric by using both hands or legs. On other exercises like dips and chins you can do the concentric by pushing yourself up with your feet.

There are two approaches to the progression.

- Select a load which is approximately your 2-rep max and do 1-2 concentric+3-4 eccentric reps for all 6 workouts of this phase. This is the easiest way and should be followed for your first try with the program.

- After your last workout of 5s, continue the progressive increments for each workout until you can no longer control the weight on the descent for 2-4 seconds. You may also vary the concentric:eccentric rep number ratio. E.g. for the first workouts in the negatives microcycle, you may do 3-4 regular concentric/eccentric reps+1-2 eccentric-only reps. On the last workouts of negatives you may do 5 eccentric-only reps. This is for more advanced lifters, as the injury potential would be greater from the heavier loads that will be lifted.

- Blade

For HST, you are adding negatives at the end of the 5s. So how long does it take you to lower the weight when you are repping out the last workout of 5s? Don't forget that the point of doing "negatives" in HST is to continue to increase the load while keeping the volume the same (number of reps and sets). If you are using a reasonable weight progression I doubt that you are going to have all that much control over how fast the weight lowers. When I'm doing heavy 5s I lower the weight the best I can just in order not to hurt myself.

I'm not counting in my head or anything. If I am, then I haven't really reached my 5RM yet. When you are at your 5RM it should be heavy... So, when I start my negatives it doesn't all of a sudden get lighter. It should be heavier than the 5s were. That being the case, let the weight "stretch" the contracted muscle. Its not about fatigue or fighting gravity. It's about stretching a muscle that is contracted. The harder you contract it the more weight it will require to stretch it. Simple as that. How fast you stretch it usually comes naturally to most lifters.

Why? Because it is about the same speed as they have done all their other reps. Simply lower it in a controlled fashion.

From a physiology point of view, lower a heavy weight too fast and you get golgi-tendon organ interference. The golgi will actually block muscle contraction to prevent tearing, and you aren't really making the muscle engage properly.

Go too slow and the muscle is just fine, but the CNS is, in a manner of speaking, burning through its fuel so fast you can see the gauge moving. It becomes a test of isometric-strength endurance. This will make you better at doing really slow negatives, but it won't necessarily make the muscle bigger at that point.
Methods of primary interest to the serious bodybuilder are negatives, loaded stretching (contrary to popular belief, this method does not require consuming alcoholic beverages prior to stretching) and concentrated loading microcycles. Let us briefly go over these methods and the terms used to describe them.

"Negatives" is a bodybuilding term used to describe the eccentric portion of a movement or exercise. In research you will sometimes see it referred to as "active lengthening". This means stretching a muscle to increase its length while under voluntary contraction to resist the stretch. The result of this eccentric action is an increase in tissue micro damage and an increase in eccentric strength.

Negatives are known to be responsible for the infamous delayed onset muscle soreness (DOMS) that so many of us sadistically strive to achieve. The increase in eccentric strength is a result of neurological adaptations facilitating motor unit coordination during eccentric contractions. As bodybuilders, all we are interested in is the microtrauma.

As mentioned on numerous occasions, we must have micro trauma in order to allow growth factors to "leak out" into the interstitial space, and thus to activate satellite cells. These satellite cells then donate myo-nuclei which help to produce additional contractile and structural proteins.

Certainly I would not recommend negatives unless there were some evidence indicating there usefulness. Type II fibers are favorably activated by the muscle during eccentric contractions as compared to type I fibers. Type II fibers are those that contribute the majority of growth produced by bodybuilding type training. The stimuli from eccentric loading and concentric loading are similar except that the proportions of the stimuli from eccentric loading are different in some very important ways.

First, the load that is placed on the muscle during an eccentric movement is not distributed over as many fibers as during a concentric movement (Ebbeling, 1989). When measuring EMG activity, or the electrical activity in the muscle, Ebbeling found that it is lower during negative work at both maximal and sub maximal intensities. This suggests that relatively few fibers are recruited to produce large forces. Therefore, under comparable workloads, eccentric actions produce greater tension per cross-sectional area of active muscle than concentric contractions. In other words, lowering the weight produces more load per fiber than lifting it!

Does increasing the load per fiber as seen in eccentric contractions lead to increases in fiber diameter or simply put, GROWTH?

Hortobagyi (Hortobagyi, 1996) found dramatic differences between subjects performing isokinetic concentric contractions as compared to isokinetic eccentric contractions. Muscle strength, fiber size, and surface EMG activity of the quadriceps were compared after 36 sessions (12 weeks) of maximal isokinetic concentric or eccentric leg extensions.

Eccentric training increased eccentric strength 3.5 times more (pre/post 46%) than concentric training increased concentric strength (pre/post 13%). Eccentric training increased concentric strength and concentric training increased eccentric strength by about the same magnitude (5 and 10%, respectively). Eccentric training increased EMG activity seven times more during eccentric testing (pre/post 86%) than concentric training increased EMG activity during concentric testing (pre/post 12%). Eccentric training increased the EMG activity measured during concentric tests and concentric training increased the EMG activity measured during eccentric tests by about the same magnitude (8 and 11%, respectively).

Type I muscle fiber percentages did not change significantly, but type IIa fibers increased and type IIb fibers decreased significantly in both training groups. Type I fiber areas did not change significantly, but type II fiber area **increased approximately 10 times more** in the eccentric than in the concentric group.

It was concluded by these authors that adaptations to training with maximal eccentric contractions are specific to eccentric muscle actions that are associated with greater neural adaptation and muscle hypertrophy than concentric exercise. It is the specificity of this type of exercise that gives it questionable value to performance athletes.

There has been a lot of controversy surrounding the optimal amount to weight that should be used during eccentric work. Rather than argue who is right and who is wrong, just remember that if a movement is too fast, say 1 second or less, not enough fibers will be participating to get good growth. If the movement is too slow, you begin to do quasi-isometric movements that fail to induce sufficient micro trauma. You may be asking, "How much weight should I use?". That question is answered by the amount of time it should take you to perform the eccentric rep. If it is too heavy you wont be able to slow the weight down sufficiently, if the weight is too light you will find yourself "lowering" the weight even though you could stop the weight from falling.

Eccentric movements should be performed with the help of a spotter whenever possible. I make no claim that eccentric reps should only be performed sparingly. There is no evidence that I have seen that would contraindicate the frequent use of negatives in a "bodybuilding" routine. If you are a performance athlete you should focus on muscle movements that most closely represent those used in your sport. There are not many sports that require heavy eccentric contractions more than skilled concentric contractions so excessive eccentric work would thus be contraindicated.

10. Supplements

10.1. Creatine

There is so much research showing the benefits of using the stuff it is almost as valuable as protein as far as supplements go.

It enhances the energy "state" of the cell, it enhances glycogen storage, it enhances protein synthesis, it prevents protein catabolism, it stabilizes the muscle cell membrane (allowing higher faster recovery) and enhances cell volume (hydration state), it increases the number of myonuclei donated by satellite cells when fusing with myofibers - thus increasing the muscle's growth potential (refer to Basics of HST thread).

Why wouldn't anybody use it? There is now research looking at 5 years of chronic use indicating it is safe.

It is true that the creatine transporter down regulates itself, but not to the point that no creatine is taken up. If you use 0.03 grams per kilogram (3-5 grams) per day, you will always be loaded and reap the benefits that creatine provides.

Please keep in mind that creatine was originally marketed to increase your strength dramatically and put 7-10 pounds on you over night (Feels like Deca! Ya, sure it does Bill). This simply isn't going to happen for most people.

Creatine use will however do a lot to optimize your body's ability to adapt to training. That's what a person should use it for. And, it does produce measurable results. Measurable in the lab and in the real world. You just have to be patient, and know what your looking for.

Creatine is taken up into cells by the creatine transporter. It is a sodium (Na+) dependant transporter. It is estimated that 2Na+ are transported with each Cr molecule.

The transporter is saturable. Meaning, it can only go so fast no matter how much creatine is present around the cell.

The creatine transporter is NOT directly affected by glucose, insulin, or caffeine. However, when insulin reaches very high levels, it has been shown to increase the amount of creatine that is taken up into cells. There is no evidence that it increases the total amount that the cell can hold.

Caffeine does not inhibit the uptake of creatine into cells.

There is no evidence that "low blood sugar"/hypoglycemia will be affected by creatine supplementation.

1) Creatine uptake into muscle tissue is limited by the activity of the creatine transporter.
2) The creatine transporter is "down-regulated" as the level of creatine inside the muscle cell increases.
3) Creatine only has an effect on muscle cell physiology once it is already inside the cell. Creatine in the blood does nothing for performance...it must be inside the cell.
4) If you load creatine during 5 days (20gm/day), the amount of creatine excreted in the urine goes up DRAMATICALLY by the 3rd day because the muscle cells lose the ability to take in creatine because their transporters are being down regulated.
5) Creatine uptake appears to be either sodium dependant, or highly regulated by sodium transport. Insulin (from carbs) increases sodium uptake into cells, this is why carbs have been shown to increase creatine uptake.
6) Exercise increases creatine uptake. If you take some creatine and sit on a stationary bike and only peddle with one leg, the leg you peddle with will take up more creatine than the leg that is not peddling. (Hint: take you creatine pre-workout)
7) Different forms of creatine do not affect creatine uptake. This is because creatine uptake is limited by the creatine itself, not by its form at the time of ingestion. Once the muscle cell is filled up, it won't take any more. Don't let anybody charge you for any special forms of creatine. Monohydrate works as good as any.
8) Creatine supplementation will result in approximately a 20% increase in phosphocreatine at best.
9) Some people will have a greater response to creatine if their meat intake was low before. Vegetarians respond beautifully to the stuff.

Once creatine stores are full in muscle tissue, it doesn't matter whether you take 5 grams or 10 grams, the muscle won't take in any more because it down regulates the creatine transporters until no more creatine can be taken in. Insulin or no insulin, if there are no transporters, no

creatine is being taken up into muscle tissue. It is simply being broken down into creatinine and peed out.

Its hard to say what is optimal. All I can say, is that if you "load" you fill up muscles faster than if you don't. However, in the end, you will still end up with as much creatine in muscle if you don't load, but it will take anywhere from 3-4 weeks to do so. Is faster better? Don't know.

We also know that if creatine is floating around during exercise, it will be taken up much better than when you take it at rest.

We also know that insulin, because of its effects on sodium retention, also "facilitates" creatine entry into cells.

So, putting it all together, whether you load or not, make sure to take creatine before exercise. And, it might further help to take it with something that will increase insulin levels, like a preworkout MRP.

There have been no studies to answer the question about creatine cycling. When considering the effects of creatine, I would guess that cycling would not be particularly beneficial, compared to just taking it all the time. Just my opinion though.

And, there is yet any research to clearly define the time frame for cycling creatine.

A person is still justified asking whether creatine really needs to be cycled or not. However, I stumbled across a study the other day that measured intramuscular levels of creatine after loading. They found that levels were slightly higher for the first weeks or so after loading, but then slowly began to decline. So, if there is a particular event where you want as much creatine as possible in the muscle, you may want to go off for 30 days, and then load the week leading up to the event.

For bodybuilding...we just don't know if there is any real benefit to either rapid loading or cycling it.

I always take my creatine before training and have never had any cramping or even an upset stomach from it.

The strength increases seen with creatine supplementation are more a result of fatigue resistance, rather than an increase in neural drive.

The energy requirements of short duration, high intensity exercise are met primarily through the recycling of ATP and phosphocreatine (PC). Despite the relative importance of this system to performance, relatively little definitive research has been done to elucidate whether this system undergoes significant adaptation. The research which exists suggests that phosphagen and related enzyme adaptations are affected specifically by the type, duration and structure of resistance training.

Your muscles/body loses creatine everyday at a rate of about 0.03 grams/kg bodyweight/day. So the creatine that is stored in your muscles doesn't just stay there, it is slowly lost at pretty much a constant rate.

Creatine monohydrate supplementation has been shown to increase creatine-phosphate by about 20%. This is significant and affects the creatine phosphate energy shuttle (which is responsible supplying ATP for protein synthesis).

So, creatine probably wont directly increase your one rep max, but it can increase the number of reps you can get with your 10 rep max. Make sense? Add the creatine to your pre-workout protein drink.

"Twitching" is often caused by Ca++ dysregulation in the muscle cell. The sarcoplasmic reticulum is struggling to sequester all the calcium ions floating around. As this occurs, the calcium ions will cause the fibers to twitch. This can sometimes show up after a change in caffeine intake, along with heavy training. Caffeine is a Ca++ channel agonist.

This will not hurt your gains, in fact, I have suspected in the past that this will actually lead to muscle hypertrophy through the activation of calcineurin.

Anyway, you may try using creatine. It helps the muscle fibers relax by making ATP more readily available (when ATP is not available the fibers go into rigor). IF the twitching is driving you crazy, try creatine. If your not quite crazy yet, you can skip the creatine and know that at least the twitching might help those fibers grow. Using the creatine will not "prevent" hypertrophy of course because the real stimulus for hypertrophy occurred during your last workout.

Tachyphylaxis does not really apply to creatine supplementation in a classical sense. Creatine doesn't really "push" any physiological system, like say, ephedrine or caffeine. Creatine and the response to oral intake are reduced by decreasing the number and activity of creatine transporters. But this isn't really how the term tachyphylaxis is generally used.

I don't mean to sound preachy, but...I was told by several people in the industry that unless I did something to my creatine to make it fancy, I would never be able to sell it. They said it needed bells and whistles. I told them, "Why would I make a product that I wouldn't buy myself?" And they would say, "That's different, you know a lot more about this stuff than they do." Well, I didn't do anything fancy to my creatine. I only made sure it was the purest that could be bought and provided the research to support its use, as well as the research to show how best to use it for gains. I didn't fabricate any of the research either. It was done by institutions that have nothing to gain from creatine sales.

I can tell you that creatine from certain German companies is of high quality. However, the Chinese have actually cleaned up their act and have now begun to produce high quality creatine as well. This comes after pressure from large supplement companies for their creatine to meet other companies' standards of purity.

There is also a US company that sells equally high quality creatine as the Germans. Remember, there is no secret to producing pure creatine. If one company decides to ensure that their raw creatine is pure, it will be just as good as any other company that is producing pure creatine. So, pure is pure, regardless of where it comes from.

Keep in mind that high quality (pure) creatine costs more than cheap impure creatine. So there is always a temptation for companies who don't really know or care "who they are as a company" to just go for the cheap stuff without regard for quality.

10.2. What Bryan uses

I use (in order of priority):

1) Protein powders
2) Creatine
3) EFAs (fish oil)
4) 1/2 multi vit/mineral per day

When I can afford it, I'll use:
CLA

HMB (well suited for HST, but less useful with traditional training methods)

Ipriflavone or methoxy-7 (for the effects on calcium and tendons, not muscle) I don't take it (when I take it) for its purported effects on muscle, but because it has been demonstrated to reduce collagen protein breakdown. Ipriflavone also increases calcium uptake from the gut. Those are the only two reasons I use it. As for toxicity, it has been shown to affect the immune system to a non-significant degree. For those concerned about this effect they should not take it.

EFA before CLA Just because CLA is more expensive

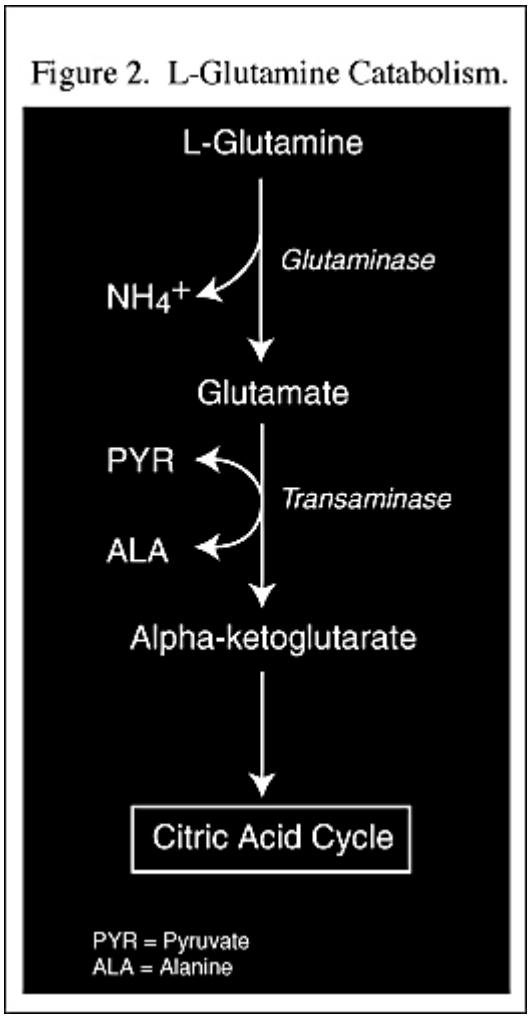
Also, CLA can't exactly "replace" EPA as far as nutritional needs go. But it does do the same job on fat cells (through PPARs).

10.3. Glutamine

Here are the reasons to take glutamine.

1) Immune support. Supplemental use of glutamine, either in oral, enteral, or parenteral form, increases intestinal villous height, stimulates gut mucosal cellular proliferation, and maintains mucosal integrity. It also prevents intestinal hyperpermeability and bacterial translocation, which may be involved in sepsis and the development of multiple organ failure. One study reported that athletes reported fewer incidences of upper respiratory tract infections while supplementing with glutamine (2 grams) after they ran.

2) Gastrointestinal support. 70-80% of orally administered glutamine is absorbed into the cells of your GI tract. It remains there and is metabolized by those cells without ever reaching the blood stream (image). In sicknesses such as sepsis it has been shown to help improve survival because of improved GI tract function.



That's pretty much it.

There is no real benefit for someone looking to build bigger muscles. That 10% of dietary glutamine that gets past the GI tract is taken up by the liver where it is converted into sugar (gluconeogenesis) and stored as glycogen in the liver.

Don't let in-vitro research fool you into thinking oral glutamine will have an effect on a healthy individuals muscle mass. Yes, glutamine does regulate protein synthesis to a certain extent under some situations. However, you can't make it happen by taking it orally. Don't let ads with some pro-bodybuilder holding a bottle of glutamine fool you. Even if that pro-bodybuilder is taking it...it isn't doing anything for him either.

Here are a couple good "in-vivo" research studies to start with:

1. Candow DG, Chilibeck PD, Burke DG, Davison KS, Smith-Palmer T. Effect of glutamine supplementation combined with resistance training in young adults. Eur J Appl Physiol. 2001 Dec;86(2):142-9.

2. Antonio J, Sanders MS, Kalman D, Woodgate D, Street C. The effects of high-dose glutamine ingestion on weightlifting performance. J Strength Cond Res. 2002 Feb;16(1):157-60.

Keep in mind that if you are eating protein powders, especially any thing with whey in it, you are getting plenty of glutamine. The question of glutamines worth in the newsletter centered on its effect on building mass and/or strength, not anything to do with the gastrointestinal track.

In short, only 47-50% of orally administered glutamine can be expected to make it past the liver and other organs, into the blood stream. And only about 10% can be expected to reach extracellular spaces.[Bowtell JL, Gelly K, Jackman ML, Patel A, Simeoni M, Rennie MJ. Effect of oral glutamine on whole body carbohydrate storage during recovery from exhaustive exercise. Journal of Applied Physiology. 1999 Jun;86(6):1770-7] Now, this is the main argument against glutamine. 90% of the glutamine you take orally never even makes it to your muscles. This isn't to say it is wasted. Your GI tract loves glutamine from reasons explained earlier. If you are having intestinal problems nothing is better. If you are trying to increase protein synthesis by loading glutamine, it isn't going to work.

10.4. Ephedrine and Caffeine

Ephedrine is a sympathomimetic, which means it acts to increase sympathetic activity. As a sympathomimetic, ephedrine acts to stimulate the sympathetic nervous system. It does this by causing pre-synaptic nerve terminals to release norepinephrine, or what is commonly called noradrenalin (NA), into the synaptic space. It also has the effect of increasing circulating adrenaline (Ad), the body's chief beta-2 agonist. Noradrenalin, once released into the synaptic space, interacts with adrenergic receptors on the surface of adiposities (plain old fat cells). This initiates a sequence of events within the adiposity that increases biolysis.

The process of biolysis is under feedback control which attenuates biolysis at several levels. A couple of the chemicals involved in attenuating the effectiveness of ephedrine are phosphodiesterases and adenosine. As you might expect, these are the chemicals that we will try to minimize with caffeine while using ephedrine as a fat loss agent.

Caffeine is a methylxanthine. Caffeine possesses the ability to inhibit phosphodiesterases within the cell and has even been shown to have the ability to prevent some re-uptake of norepinephrine. Another property of caffeine is adenosine receptor blockade. There is some question as to weather oral caffeine ingestion actually significantly inhibits phosphodiesterases but it does seem to inhibit adenosine action in vivo. Both of these properties make it potentially useful as an adjunct to ephedrine to enhance fat loss.

Caffeine does temporarily decrease insulin sensitivity. So does anything else that is "lipolytic". I have read the study(s).

Exercise was shown to negate (reverse) the effect of the caffeine. This is because of what is called non-insulin dependant glucose uptake.

Anything that stimulates the release of noradrenaline or adrenaline will decrease insulin sensitivity. Even an increase in blood levels of released fatty acids will decrease insulin sensitivity. Its called the glucose fatty acid cycle, or the Randle Cycle. This is because the fat cell's "machinery" is not designed to store and release fuel at the same time. This would be counter productive. The only exception is exercise, where the body wants to release fuel from fat cells at the moment, but increase its ability to take in fuel to replace what it lost from muscle as fast as possible afterwards (or "during" exercise in the case of muscle tissue).

No need to panic about caffeine and insulin sensitivity. Its effects on insulin sensitivity have been known for a long time.

Pointers:
Keep carbs relatively low while using ephedrine. Insulin counter acts the effects of ephedrine and will ultimately hinder fat loss if carbs remain too high. This does not mean you must go on a ketogenic diet. If total calories are low enough carbs become less of an issue. But if you are trying to keep muscle by lowering calories only slightly, the carbs will sabotage ephedrine's action.

Ephedrine and Clenbuterol have two different, yet similar mechanisms of action. Nevertheless, don't use Clenbuterol and ephedrine at the same time, or even in an alternating fashion. Both drugs work through the beta-adrenergic receptor, however, Clenbuterol will shut down beta-receptors within a few weeks. Taking ephedrine at that time will do little for you. Better to use ephedrine from the start of your diet, only switching to Clenbuterol no further than 3 weeks out from the contest.

In order to get the most benefit from ephedrine on muscle loss, adjust your dosing schedule to every 2 hours. This will enhance the duration and consistency of beta-adrenergic activity. Be sure to adjust the amount you take each time in order to maintain the total amount taken over the course of a day. For example, instead of taking 20 mg ephedrine and 200 mg caffeine 3 times daily, take 10 mg ephedrine and 100 mg caffeine 6 times daily.

E/C was never intended to be cycled. Clen was never intended to be used chronically, but instead only as needed.

People often confuse E/C with Clen because they both involve the beta-2 receptors. Clen is a potent specific agonist to the receptor and causes rapid down regulation of the receptor. E/C is NOT a specific agonist, but instead works in a round about way to increase circulating norepinephrine and epinephrine. The caffeine is also an adenosine inhibitor.

It has been demonstrated that E/C actually gets more effective over time. This has been attributed to an increase in thyroid receptors.

E/C is notorious for rebound "hunger" though, so taper off over a long period of time, starting first with the caffeine, then the ephedrine.

For mild appetite control, ephedrine can be used alone with good results.

The Primer will ensure that you get the desired effect from the caffeine/ephedrine. The effects are tied to pathway tyrosine>norep/ep>dopamine.

With or without carbs you will still get the emotional and stimulatory effect of E/C. You just don't get the lipolytic effect as long as the insulin is high from carbs. The effect of insulin on E/C induced lipolysis is significant, but it does not mean that it completely negates the effects of E/C.

If you use E/C too long without food it won't provide that positive sense of "lift". It will only make you feel anxious. Supplementing with additional tyrosine seems to help as well.

The caffeine can also really cause havoc on your stomach. It gives lots of people significant pain (sometimes nausea) after a while of taking it on an empty stomach.

Unfortunately synephrine can't replace ephedrine. They work by different mechanisms and have a different adrenergic agonist profile.

The benefits of E/C while bulking is a nutrient partitioning effect. Your metabolic rate stays greatly elevated and your strength is augmented by the caffeine. You should take E/C every two hours at half dose regardless of what diet you are using.

Precaution should always be used with E/C though. They are both drugs and can have serious side effects in some individuals.

10.5. CLA and EFAs

Try to get 2-6 grams per day of EPA+DHA. The FDA has only approved 2 grams per day because of the ability of omega-3s to thin the blood (reduce clotting). However, if you are not at risk of bleeding abnormalities, anywhere up to 6 grams per day is beneficial. The burping WILL stop if you take them consistently. Takes about a week for the burps to stop.

Keep in mind that omega-3s will be preferentially oxidized (burned for fuel), so a lot of what you supplement on a low carb diet will be burned as energy before it can be stored in fat cells where it does its magic. Whenever possible, take your fish oils after a meal or after carbs. The carb load to the liver will decrease the oxidation of the fatty acids and allow more to pass through into the blood for storage. This is good when it comes to omega-3s and CLA.

CLA can't exactly "replace" EPA as far as nutritional needs go. But it does do the same job on fat cells (through PPARs)

It's going to take about 6-10 grams per day of CLA to notice any effect. If you use CLA while bulking it may help nutrient partitioning. CLA and Omega-3s should be taken "all" the time. They aren't supplements that you take every now and then. It has to be constant so that they can have time to change the environment within the body. This only happens as CLA are incorporated into fat cells. Unfortunately, the CLA is preferentially oxidized as it enters the liver, so you have to take enough to not only let the liver burn some, but also have enough to get into circulation and be deposited into fat cells.

As with EFAs I suggest you take CLA with carbs (or after a meal). The rise in insulin may prevent the immediate oxidation of the CLA, and enhance the delivery of it to subcutaneous fat cells.

The delivery of "fat" to fat cells may not seem like a good idea at first, but CLA and Omega-3s activate PPARs once in fat cells. This is good, and is what leads to the change in body composition over time.

Regular use of CLA will change your "tendency" to gain and lose fat. It will basically make your fat cells act as if you had a genetic predisposition to leanness. The mechanism is pretty interesting.

Here is a bit of info on CLA.

CLA is a naturally occurring fatty acid found primarily in beef and dairy fats. The reason that it is found primarily in beef and dairy products is because CLA is formed from linoleic acid by bacteria in the gut of cows (or herbavors). The cows then absorb the CLA and it becomes incorporated into lipids in the cows, including milk lipids.

How does it work?

CLA increases fat oxidation.
(West, D. B., J. P. DeLany, P. M. Camet, F. Blohm, A. A. Truett, and J. A. Scimeca. Effects of conjugated linoleic acid on body fat and energy metabolism in the mouse. Am. J. Physiol. 275 (Regulatory Integrative Comp. Physiol. 44): R667-R672, 1998)

CLA has been shown to increase certain enzymes responsible for fatty acid beta-oxidation. This means that the body's ability to burn fat goes up significantly with CLA supplementation.

Inhibition of triglyceride uptake into fat cells.
(Park, Y., K. J. Albright, W. Liu, J. M. Storkson, M. E. Cook, and M. W. Pariza. Effect of conjugated linoleic acid on body composition in mice. Lipids 32: 853-858, 1997)

The best way to get fat is to send the fat you eat straight to the fat cell to be stored. This is generally what happens when we eat fat, however CLA supplementation has been shown to decrease the enzyme necessary for fat cells to take up fat and triglycerides from the blood. This fat is then more apt to be taken up by muscle tissue where it can be burned for fuel. In fact, CLA also increases the muscles ability to burn fat as fuel as mentioned previously.

CLA increases insulin sensitivity
(Houseknecht, K. L., J. P. Vanden Heuvel, S. Y. Moya-Camarena, C. P. Portocarrero, L. W. Peck, K. P. Nickel, and M. A. Belury. Dietary conjugated linoleic acid normalizes impaired glucose tolerance in the Zucker diabetic fatty fa/fa rat. Biochem. Biophys. Res. Commun. 244: 678-682, 1998)

The reason CLA has been labeled a "partitioning agent" is because of its ability to shift the flow of nutrients away from fat tissue and towards muscle tissue. So you are starving the fat and feeding your muscle, the end result being an increase or maintenance of muscle and a reduction in fat.

CLA acts to reduce body fat stores by chronically increasing metabolic rate.
(West DB, Blohm FY, Truett AA, DeLany JP. Conjugated linoleic acid persistently increases total energy expenditure in AKR/J mice without increasing uncoupling protein gene expression. J Nutr. 2000 Oct;130(10):2471-7.)

Treatment with CLA chronically increases basal metabolic rate. Over time this elevation leads to significant reductions in fat mass. The exact mechanism by which CLA raises energy expenditure has yet to be elucidated but could act through PPARs.

10.6. HMB

An understanding of HMB is critical if you are to get any benefit from it.

How does HMB affect muscle mass and strength? It isn't through anabolism, and it appears not to be directly through anticatabolic mechanisms either. If you recall the pathway for leucine metabolism, you'll notice that the fate of ingested HMB is mainly as HMG-CoA, a substrate for cholesterol synthesis. It appears that cholesterol synthesis may be a rate-limiting step in membrane repair after intense training. Keep in mind that muscle cells do not use circulating cholesterol for membrane repair. They must manufacture cholesterol from scratch (i.e. through the HMG-CoA pathway).

HMB won't help if you are not training in such a way as to cause microtrauma to the cell membrane. HST however does cause frequent microtrauma and I personally have felt subjective benefits from HMB supplementation. Mostly, a sense of faster recovery and less noticeable "stiffness" in the morning after.

Take it in divided doses evenly spaced. Take at least one dose right before and another right after training. This is to take advantage of blood flow to the muscle.

I DO recommend HMB. It won't do much for guys who have been using the same weight for months without any gains, but for HST it is perfectly suited. It will help keep you lean too.

If you do decide to use it, use it during the entire cycle. 3-4 grams per day is a suitable dosage depending on your weight. If you are over 200 pounds I would recommend 4 grams. HMB's effectiveness does not increase with escalating doses above ~4 grams. Try to split it up throughout the day as much as possible. Make sure to take some right before training when blood flow to muscle is highest.

HMB does not interact with any other supplements so it can be taken with any or all other supplements.

It won't do anything during Strategic Deconditioning so don't take it then.

HMB appears to be converted mostly to beta-hydroxy-beta-methylglutaryl CoA (HMG-CoA). HMG-CoA is then used to make cholesterol within cells. This is important for muscle cells in that they cannot use cholesterol from the blood.

Here is where much of the misunderstanding about HMB comes in. HMB has NOT been shown to directly inhibit protein breakdown, and certainly does not cause protein synthesis. A study done in 1997 looked at the effects of giving lambs high doses of HMB (Br J Nutr. 1997 Jun;77(6):885-96). To their surprise, HMB did not have any effect on protein catabolism or anabolism. In essence, HMB didn't do squat under normal conditions.

So, if you are expecting HMB to "build" muscle you are going to be disappointed. If the "noticeable effect" you are looking for is anabolism, you are going to be disappointed.

However you'll notice that the fate of ingested HMB is mainly to be converted to HMG-CoA, a substrate for cholesterol synthesis. It appears that cholesterol synthesis may be a rate-limiting step in membrane repair after intense training.

HMB significantly decreased the exercise-induced rise in muscle breakdown as measured by urine 3-methylhistidine and CK during the first 2 wk of exercise. In the studies showing an effect of HMB on muscle breakdown, the differences between the HMB group and the placebo group tend to decline over a period of about 3-4 weeks until at about 4-5 weeks there is no difference in the above markers of damage, including 3-MH. This reflects the fact that, if the cholesterol mechanism is true, HMB serves to facilitate rates of growth only when membrane integrity is a limiting factor. This generally occurs during the first two to three weeks of a new or unaccustomed exercise program. After that, muscles become resistant to further damage (repeated bout effect, or rapid training effect) induced by that particular program (loading regimen) and HMB supplementation loses its usefulness.

HST is characterized by a constant increase in load following a period of Strategic Deconditioning. Therefore, when followed with the appropriate frequency, you stay just ahead of the structural recovery curve. This keeps you constantly in a state of muscle damage. This appears to be the only time when HMB is useful.

In traditional routines you use the same weight until you can add more because your strength has increased. I've seen guys use the same weight on their lifts workout after workout for months or even years at a time. Their muscle tissue is tuff as shoe leather and there virtually NO structural damage to the tissue after any workout. They simply walk out of the gym with their butt kicked but with no new muscle to show for it…for months at a time! HMB facilitates "recovery" from frequent heavy bouts of training typical of HST. I have experienced increased exercise tolerance when using it. No I didn't measure anything, I just felt better and stronger with fewer aches and pains.

I haven't even began to talk about the benefits of the calcium in HMB with respect to fat cell metabolism: (J Am Coll Nutr. 2002 Apr;21(2):146S-151S.; FASEB J. 2000 Jun;14(9):1132-8.; FASEB J. 2001 Feb;15(2):291-3.; J Am Coll Nutr. 2001 Oct;20(5 Suppl):428S-435S; discussion 440S-442S.)

10.7. Various

Antioxidants significantly reduced erk1/2 and had no effect on p38...I personally have stopped the high-dose antioxidants. It's true that antioxidants have been shown to decrease the signal for hypertrophy. Will taking an antioxidant after training have a "significant" detrimental effect? I don't know. I'm the type that avoids anything that has been shown to reduce hypertrophy so I only take antioxidants during SD or on the second day of rest (weekend).

Ginseng: If you are buying a product because you want it to increase the amount of muscle and/or strength that you have. Ginseng won't give it to you.

If you are buying ginseng for a spiritual or "back to nature", or "I'm experimenting with Chinese traditions" reason, then once again, do whatever you want. But if you are buying ginseng to get big, save your money.

Green tea has compounds that block COMT. I stopped using as much green tea when I found that they were anti-androgenic. They not only block androgen at the receptor, they also appear to down regulate androgen receptors.
Green tea is basically an anti-endocrine factor. It seems to reduce the effects of all steroid hormones. I don't mean to freak anybody out, it's just that the flavones (especially epigallocatechin gallate) are well known to reduce the actions of endogenous androgens (and estrogens) as well as even lowering testosterone levels themselves.

Anyway, my point is that, you may never see any significant effect of drinking green tea on muscle gains. Then again, we know that it is having an antagonistic effect, however small, in a direction opposite to what we want with respect to testosterone.

Cultures that consume a lot of green tea of also known to have fewer androgenic "manifestations" both normal (body hair, muscle mass, etc) as well as fewer pathologic manifestations (prostate problems, and other cancers associated with steroid hormones).

Fat is a different story. It clearly helps fat loss by altering catecholamine metabolism and probably a few other things.

If **Udo's Choice** is your only source of fat in the diet, it's great. I tend to get some fat of various kinds in the food I eat so the "ideal ratio" of fats in Udo's is no longer ideal when combined with the other fats in my diet. Instead I just want to add some that I may be low in. CLA I take only for its effects on PPARs.

Myostatin inhibitors: Myoblast is a product by Cytodyne. It contains a sulfated sugar extracted from seaweed. This heparin-like extract will bind to the myostatin protein in-vitro (colum). Similar products are being sold by Biotest and Champion Nutrition.

Because this extract was shown to bind to the myostatin protein in-vitro (not published, nor peer reviewed research), it is being sold as a myostatin blocker called CSP3 or Myozap.
What does it do? Nobody knows yet.

Are there any side effects? Nobody really knows yet. It will probably thin the blood if taken in high enough doses.

I used it for 8 weeks...nothing happened accept a bit of stomach upset. Well, actually something interesting did happen. I have a heart murmur (irregular heart beat) and strangely enough, after 8 weeks of the sea weed it went away. Go figure. I did notice a slight effect on my heart rate when I first began taking it (stimulant effect), but that was it. There is evidence of some compounds that have a favorable effect on irregular heart beat, maybe this is a new one.

It didn't make me grow though. Believe me, I understand all the research (had access to unpublished research), so I didn't take it blindly.

The active compound is a sugar molecule with a sulfur group on it, so it is no surprise if none of it even made it past my gut.

Yes, I was using the same material that Biotest has.
If it ever is going to work, the active fraction must be isolated and administered in a way that bypasses the gut. Until then, odds are not very good that you will experience any added muscle growth from using it. However, I am hopeful that supplements based on this mechanism will evolve from these first generation compounds. In all likelihood, you will see other compounds emerge with greater binding affinity and with better absorption properties.

Psyllium Husk is a waste of money - all the research on fat absorbers demonstrates that they don't work.
Forskolin: For people who may be unfamiliar with Forskolin, here is a brief review.

Forskolin is an extract of the roots of the Ayurvedic herb Coleus forskohlii. Forskolin has been shown in-vitro to increase the level of cAMP in cells. Forskolin-induced elevation of cAMP levels in cells leads to blood vessel dilation, inhibition of mast cells (and hence reduction in allergic inflammation), increase in thyroid hormone secretion, and stimulation of fat release from fat cells. Forskolin has other properties as well, including inhibition of the pro-inflammatory substance known as platelet-activating factor (PAF) and inhibition of the spread of cancer cells. Research into coleus's other constituents has been sparse. Keep in mind that Sabinsa is making all of the claims concerning Forskolin's effects on body composition. They have a major interest in bodybuilders using it instead of ephedrine. Not that I mind companies educating customers about a product, but they should use peer-reviewed research that is available to the public to do so.

Forskohlii raises intracellular cAMP plays which plays major role in causing fat breakdown and release from fat stores. Companies are adding Forskohlii to weight loss products in order to appease people who don't want to use ephedrine. What people don't realize is that Forskohlii acts "post receptor" and therefore is less specific than ephedrine. In other words, Forskohlii does not rely on beta-adrenergic receptors to increase cAMP levels. Forskolin acts on ALL cells with adenylate cyclase, not just those sensitive to noradrenalin. For example, forskolin is traditionally used in Ayurvedic medicine to lower blood pressure. Ephedrine on the other hand raises blood pressure. Obviously the effects are not the same, even though each drug eventually leads to increased cAMP levels in various tissues. Therefore, you can't rely on Forskohlii only affecting cells sensitive to adrenergic stimuli.

I haven't heard from anyone who has experienced much from forskolin. The old ephedrine/caffeine combination thus far has no equal, even clen falls short.

Octacosanol is a sugar alcohol made from sugar cane wax, and has nothing to do with IGF-1. It's also present in wheat germ oil. It interferes with cholesterol synthesis which might be good if you have a problem with cholesterol, but it will do nothing for muscle growth. In fact, it might actually hamper it slightly if it interferes with the muscle's ability to produce cholesterol for cellular repair.

There is no medical research to back up their claims. Using wheat germ oil as a "tonic" is as old as the hills but it has no effect whatsoever on muscle growth.

Furthermore, a thorough analysis of studies has not supported the claim that wheat germ oil is an effective performance aid. This evidence was used successfully by the Federal Trade Commission to ban advertising claims that wheat germ could improve endurance, strength, and vigor. So this company simply changed the name they were calling it and said it will grow muscles.

They should be ashamed for making false claims and deceptive advertising.

Saw Palmetto binds and blocks the activity of the androgen receptor as well. This binding is not terribly strong, but it does happen. So saw palmetto is an anti-androgen both because it appears to reduce the activity of 5-alpha reductase but also because it binds the androgen receptor itself.

Theanine is the only thing I have come across that seems to temper the effects of caffeine.

Ipriflavone may really help if you need actual tendon effects. Ipriflavone decreases catabolism of collagen proteins which, over time should help to strengthen tendons/ligaments.

It is important to remember that your problem may not be the strength of your tendons or ligaments, but the length of them. Sometimes injuries can alter the length of ligaments and tendons, causing laxicity (looseness) in the joint. Sometimes this is called subluxation. You can't fix this without surgery to shorten the ligaments.

Scar tissue can also cause pain where a tendon slides against the surface of a joint or bone.

Glucosamine and chondroitin deal primarily with cartilage.

11. Bryan Haycock's interview with T-mag, informative, basic summary of HST

11.1. Part 1

Mr. Hypertrophy
An Interview with Bryan Haycock
by Chris Shugart

Bryan Haycock has been quietly making waves in the bodybuilding community for over 23 years. He's a physiologist who's worked as a writer, editor, and as a consultant for the sports supplement industry. He's built a reputation on applying hard science to all aspects of bodybuilding.

Recently, there's been a buzz about Bryan's new hypertrophy training program, HST. We tracked Bryan down to talk to him about his new program plus a few other things.

Testosterone: Bryan, you come from a pretty diverse educational background. Describe that to us please.

Bryan Haycock: I entered college in 1990 and began my coursework primarily in psychology. Two years later, I considered going to medical school so I added pre-med to my major. Two years after that I added exercise and sport science to the list. I finished my pre-med undergrad work, but finding myself pretty unsatisfied with the pre-med scene I decided to enter graduate school and get a Masters in Exercise Physiology. All the while I continued to take psychology and philosophy classes for my own interests. Finally in 2000 I graduated with a Bachelor in Clinical Psychology and Exercise and Sport Science, and a Masters in Exercise Phys, with a minor in Nutrition.

T: Wow, that's boatload of degrees!

BH: I've got to add something here, though, Chris. What a person actually gets out of their education, no matter what credentials they're awarded with in the end, depends entirely on the individual. Passion and personal dedication determine what you actually learn in school, not grades or degrees. I know lots of people who are prolific in science and exercise physiology and they don't have any formal degrees. They've simply taken it upon themselves to read the publicly available research and study it for themselves.

T: Very true. Now, for those who don't know you, tell us how you've been involved in bodybuilding and supplements over the years.

BH: I've always had a passion for bodybuilding. I got my first weight set when I was eight years old and I've never stopped lifting.

T: Age eight? I think I picked up a really heavy Shogun Warrior toy at age eight, but that's about it. Did you reach a point where you competed, like at twelve or something?

BH: When I turned fifteen I entered my first contest, but I didn't compete again for another five or six years. The stage didn't really do much for me so I cut my competitive career pretty short. I still lifted like a competitive bodybuilder, though, and worked at various gyms as a trainer. I got the usual certifications such as CSCS to get better pay.

Later, thanks to my good friend Millard Baker, I began writing for various bodybuilding mags. From this arose the opportunity to work for a consulting firm called Supplement Facts. My job was to provide scientific substantiation (from the medical journals) for supplement companies' claims about their supplements. Many times there simply wasn't any, so I'd kindly suggest to them that they drop the claim. The FDA has certain regulations on what are called "structure/function claims" that any supplement company must adhere to whenever they make claims about their products. Over time I learned more than anyone should ever know about herbs and their traditional uses! [laughing]

I've continued to write for bodybuilding mags and act as a consultant for other private companies until most recently, when I've devoted all my time to helping people with HST through the Hypertrophy-Specific website.

T: In the last ten years or so, it seems like there's been a shift in bodybuilding. In the "old days" guys learned from other lifters and by trial and error. Then the strength coaches came into the picture armed with flashy studies and unique training programs. But is that what bodybuilders need? I mean, we just want to get big and muscular, so do we need to be following these coaches who work chiefly with gifted athletes on their strength and performance?

BH: You know, that's a great question. I'll admit that I'm biased in favor of "good" science. Watching what others do who've achieved what you want to achieve is a logical first step. However, it has some glaring weaknesses. After all, how many of us only see what they do in the gym or read about what they do in the magazines? There aren't many of us who are invited into their homes to see what they do when they aren't in the gym to help them achieve their freakish size. I've seen many, many people do exactly what they see the big guys do in the gym, yet to their surprise they never seem to achieve the same results.

T: Good point. So what about these athletic performance coaches writing about bodybuilding?

BH: If you think about it, this couldn't possibly be the ideal way to learn about muscle hypertrophy (growth). There's a principle in exercise physiology called S.A.I.D. It stands for Specific Adaptation to Implied Demands. This principle implies that the body will respond in a remarkably specific way to whatever you demand of it. If you challenge its strength, it'll grow stronger. If you challenge its endurance, it'll increase its endurance. Likewise, if you challenge its ability to withstand strain [microtrauma], it grows bigger and more resistant to strain. All adaptation is specific and predictable.

The whole idea of claiming to train pro athletes is, as you said, not indicative of a person's expertise. In fact, all it really indicates is who your friends are. Most all people who train high-profile people are there because they were a friend of a friend of the celebrity or pro-athlete. I'm not saying they don't know what they're doing, either; I'm just agreeing that it doesn't mean they have all the answers just because they work with high profile people.

T: Do you think that steroid usage screwed up what we know about pure hypertrophy training? I mean, when a certain type of training or dieting stalled out, guys would just take steroids. Maybe without the drugs they would've just found a better way to train. Some of these bodybuilders are on so much gear it probably doesn't matter how they train because they'll still get results. Now we have natural, genetically average guys following the training advice of drugged up genetic mutants and there's a lot of frustration out there. What's your opinion on all this?

BH: Boy, where do I start?! I'll try to make this brief but believe me, I have strong feelings about how the education of a bodybuilder got so screwed up along the way. About forty years ago, when the powers that be decided they'd try to make money from bodybuilding, truth took second seat to the pursuit of wealth. In essence, they found that they could use kids' dreams of

looking like a super hero to swindle them out of their money. "If you buy this, you'll look like this guy." The fact that it took hormones to look like the guy in the ad was kept in the strictest confidence. They'd even go so far as to vilify people caught using steroids to maintain the sparkling image of the idols in the magazine ads. "Pot, let me introduce you to kettle."

The powers that be also found out quickly that the bigger the muscles, the more influence the ads had on kids. So the idols in the ads just got bigger and bigger. Over time, there arose a culture of gross misrepresentation and subsequent misinformation in bodybuilding. Using professional bodybuilders to sell supplements and weight equipment is a slippery slope.

Sure, it's inspiring to see your idol in the magazine pages, and it's also very persuasive to hear him or her say that this product or that allowed them to achieve their success. But what happens when people begin to buy the products and the equipment, yet fail to achieve the results promised them by the ads with their idol so prominently placed with the product? I'll tell you. Any one of three things must happen. You either lose the customer because they become disenchanted; you must switch the product presented with the idol; and/or you must explain it away in their method of training (i.e. blame the user). This is where "intensity" came in. If you didn't grow like the ad promised, you simply weren't "man enough" to train with the intensity of the pros.

It wasn't until Dan Duchaine and a friend came out with the Underground Steroid Handbook that people began to realize that pro-bodybuilders look the way they do because they use steroids… lots and lots of steroids. It had nothing to do with supplements or training. When Bill Philips introduced Muscle Media 2000 this realization hit the mainstream.

T: Yep, I think you nailed it. I'm asking questions like that because your program, HST or Hypertrophy-Specific Training, seems to be a return to real, bullshit-free hypertrophy training. Tell us how it all started.

BH: It all started out of frustration, really. I'd been lifting naturally for about twelve years and found myself unable to grow further. It was obvious that the only way to get bigger was to get stronger, but I couldn't get stronger until I got bigger. It was a catch-22. So I began to study all of the methods of traditional training: sets, reps, rest, exercises, diet, periodization, etc.

After I'd put it all into a single picture, I realized that the research we were using to build muscle was never intended to explain muscle growth at all. We as bodybuilders had borrowed it from European strength researchers and coaches and twisted it to conform to our needs. Basically, we interpreted it to say what we wanted it to say. Even worse, we were using outdated research looking at stress and aerobic metabolism to try to grow bigger muscles.

T: Interesting. Give us an example.

BH: One example is the idea of "super compensation. This idea, first described in the mid-50s by a Russian scientist named Yakovlev, was used to explain glycogen replenishment in the liver. It had nothing to do with muscle hypertrophy. The whole concept is just a gross misunderstanding and misapplication of the research and human physiology. Nevertheless, it became the foundation for traditional bodybuilding routines.

About this same time, research looking into the actual mechanisms of muscle growth began to appear. As I compared the research used to justify the training methods of the day, I realized that those studies didn't say anything about how a muscle grew. They only explained how the body stores glycogen, or if it was actual exercise research, it was about how to train a track athlete for the competitive season. Like I said before, they were simply misapplying research from another field.

Anyway, to make a long story short, after comparing all the research, both good and bad, with current methods of training, obvious holes and unnecessary elements in traditional training beliefs became apparent.

T: So, HST is your answer or "fix" to these problems?

BH: Well, it's actually just a logical conclusion from the available information. The only way to discredit HST is to discredit the studies that lead to it. People of course will do this and I might have nothing to say. I believe in what we've observed about muscle cells; others will choose not to. At that point it really isn't an argument about HST's validity; it's an argument about the validity of science and technology.

T: Bryan, if you could, give us a brief rundown of what HST is.

BH: HST is a method of "loading," as opposed to simply "exercising" a muscle in order to make it grow larger. This is done without regard to muscle performance, although most people inevitably get much stronger. Each muscle group is trained at least every 48 hours. The easiest way to do that is to do full-body workouts, three times per week. The 48 hour frequency is based on the time course of changes in muscle-protein synthesis after a workout.

The weight is progressively increased each time you train a given muscle group. This is possible because you don't start using 100% of your max. You work up to it over a two-week period. As the load increases, the reps will drop to accommodate the increasingly heavier weight, until you're eventually using negatives.

The volume (number of sets and exercises) is kept low in order to accommodate the frequency of training. The payoff (i.e. growth) from more frequent training outweighs the payoff from increasing volume. Then there's a week or so of strategic deconditioning. This is done to deal with what's called the "rapid training effect" or sometimes called the "repeated bout effect." Strategic deconditioning is a way of making the muscle more sensitive to the growth stimulus of training, making the muscle more like when you first began training.

Probably the most important elements or principles of HST are progressive load, training frequency tuned to take advantage of post-workout protein synthesis rates, and strategic deconditioning.

T: Frequent training and negatives — sounds like those would lead to overtraining. How does HST get around that? The low volume?

BH: Exactly. Overtraining is a neurological and psychological issue. So, in order to minimize the stress on the CNS, HST tries to minimize "exhaustion." After all, the point of HST is not to increase endurance; it's about getting as big as you can from your efforts in the gym.

T: What kind of feedback are you getting from those who've tried it?

BH: The feedback is very positive from all kinds of people. But this shouldn't surprise anybody if HST is actually based on how muscle cells grow, and not on Bryan Haycock's imagination. I didn't concoct HST. HST is simply an outgrowth of the peer-reviewed research on muscle cells.

T: Would HST work for natural and "enhanced" trainees?

BH: Yes, muscle is muscle. The principles of mechanically induced muscle hypertrophy don't change from person to person or from natural to "enhanced." There are some modifications, though.

It appears that HST's effects on strength are greatly enhanced by steroids. So you end up with guys using insanely heavy weights. This just isn't advisable or necessary. The steroids more than make up for any reduction in load taken for the sake of safety. Guys cycling androgens generally cut out the negatives and sometimes the 5's [reps] and stick with 8's and 10's. The androgens really overcome the need to lift heavy as well as strategic deconditioning. Progressive load and adequate frequency are most important, not to mention diet, but that's a whole other story.

Guys really need to understand what all the anabolic drugs do. The drugs take over the nuclear and protein synthetic machinery of the cell and simply make it start growing and dividing. The more you take, and the more protein you eat, the bigger you'll generally get. Training is necessary, but it's really just used to "coax" the growth, not cause it.

Natural guys don't have the luxury of growing in spite of their training. They're forced to rely on the weight itself to get the muscle to grow. That's why most of the effort is centered around reps of five and even negatives. Without the constant heavy loading of the muscle, it just won't grow.

T: What's the advantage of whole-body workouts? Those are really out of style these days, so to speak.

BH: The advantage doesn't lie in the fact that you're training your whole body all at once. The important thing is to be able to train each muscle group every 48 hours. This generally means three evenly spaced sessions per week. Training each muscle group every 48 hours necessitates training more muscle groups at a time, or going back to the gym more often. Either way works.

T: Some experts have said that whole-body workouts are only for beginners.

BH: This argument is totally unfounded, and is based purely on tradition and the aforementioned misunderstanding and misapplication of inappropriate science.

T: Okay. Given the low volume, some are going to think of HIT when they see this program. What makes it different from HIT? What do you think of HIT overall?

BH: I used HIT-type training principles before I began to analyze muscle-cell research. It should be understood that HIT and Heavy Duty are not based on muscle-cell physiology. HIT and HD are actually based on Selye's GAS (General Adaptation Syndrome) more than anything. Jones and Mentzer loved to talk about philosophy and logic, but seldom ever mentioned a sarcolemma, MAPk, myogenic stem cells, or even such obvious things as intracellular IGF-1. The reasons they chose to ignore such basic principles of muscle cell physiology remain with them.

HST differs methodologically from HIT primarily in the fact that HIT uses extremely infrequent workouts and requires that the lifter always use 100% RM weight loads regardless of the condition of the muscle. Conversely, HST incorporates a training frequency based on the time course of elevated protein synthesis after training, and weight loads sufficient to induce hypertrophy based on the muscle's current condition. These types of things can't be determined without acknowledging how muscle cells respond to loading, so HIT and HD couldn't be expected to incorporate these methods.

My only other problem with HIT is its blind devotion to "intensity." Intensity as described by Jones, is based on perceived effort, and doesn't necessarily measure a set's ability to stimulate growth of the tissue itself. The authors of HIT and HIT-type routines believed fundamentally in GAS, super compensation, and the intensity myth perpetuated by popular muscle magazines in the 80's. All three of these principles are, at best, only indirectly related to muscle growth.

T: One of the things that shocked me about HST is you say to train through soreness. Explain that.

BH: First let me qualify that statement. A person should never train a muscle if there's a risk of injury or they simply feel that it needs more time to recuperate. We all need to use common sense and our own best judgment each and every time we go into the gym or attempt a lift.

Now, my comments about training a muscle while sore come from research showing that muscle tissue is designed to recover from microtrauma even while it's still being traumatized. This is a fundamentally foreign idea to most, if not all, bodybuilders. Heresy! they cry.

Without going into detail, animal studies of overload-induced muscle growth use models that don't remove the load for anywhere from one week to eight weeks. Later studies on humans demonstrated that after eccentric-exercise induced muscle damage, a second workout of eccentric reps didn't hinder the recovery from the first workout.

Now, considering that training only elevates protein synthesis for about 36 hours, and muscle is able to be trained again within 48 hours without negatively effecting recovery, training a muscle every 48 hours becomes a viable and desirable method to maximize the rate of muscle growth. Of course, sometimes some residual soreness will occasionally still be present after the previous workout. From what we now know about how muscles recover, having to train a muscle while still sore from the previous workout doesn't seem so outlandish. It actually makes sense.

T: So, you think most guys trying to gain muscle don't train muscle groups often enough? Most seem to train chest, for example, once every five to seven days.

BH: Well, it's not just a matter of not training often enough; they train with way too high volume per workout. They feel that if they can just completely exhaust the muscle (and themselves), it's got to grow. Unfortunately, the high volume creates such a drain on their CNS that they can't train any sooner than a week or so later. Then the muscle begins to grow for about two days after their workout, but returns to normal and stays that way for the next three to four days before they train again. They never seem to get ahead and they never seem to make any progress.

The whole point of training a muscle more frequently than say, once per week, is to take advantage of the anabolic effects of resistance exercise. The anabolic effects, if we consider that to mean elevated rates of protein synthesis in the muscle, only lasts about a day and a half. Then it stops and everything is back to normal. If you go on to wait an entire week before training again, you simply won't grow as fast as you could. Training too infrequently is like taking two steps forward and one step back.

T: What about training to failure? Does HST use failure?

BH: Clearly, if you're going to continually increase the weight, you're eventually going to be training at failure or your strength limit.

With HST you're probably going to train to failure at least once every two weeks. Generally you'd go from between 75 to 100% of your max in two week cycles. Then at the end, when you've ramped your weights as high as they'll go, you'll be doing sets to failure each workout. How many workouts you'll train to failure depends on whether you're still making progress or not.

Keep in mind that "failure" is an indicator of central fatigue, not muscle strain. If you want to increase your resistance to fatigue, train to failure all the time. If you're only interested in effectively straining the muscle so that it'll get bigger, just focus on that and try to get past feeling like every set has to be a test of your manhood.

All this takes us back to the misguided faith in intensity. Intensity, also known as "training to failure," is simply the scapegoat of the drug lie we talked about earlier. It's a decoy to get people's attention away from the real reason they don't look like a pro bodybuilder no matter how hard they work in the gym.

T: Let's talk more about the importance of strategic deconditioning within HST training. Give us some more info on that.

BH: The muscle will adapt in two ways whenever you lift to get it to grow. It'll increase in size — what we want — and it'll also increase its resistance to the growth stimulus — what we don't want. So in essence, it'll act on the message to grow, but then it'll also reduce the effectiveness of future messages to grow. We see this often in physiological systems of the body. This one happens to be a structural change/resistance, rather than a receptor or enzymatic change as seen in other systems like beta-receptors.

So when you load a muscle you cause what's called the "rapid training effect" or the "repeated-bout effect," two names for the same thing. Either name you choose, it spells plateau. What happens is that there's a rapid growth of connective tissue that reduces the strain transferred to the delicate muscle cells. That strain is required, if you're natural anyway, to activate the cellular pathways that lead to hypertrophy.

The only way to get it to grow, once it's already grown and become resistant to future growth, is to either continue to increase the strength of the stimulus by lifting heavier weight, or try to get the muscle to become more sensitive to the previous stimulus (i.e. the same weight you used before). This is where strategic deconditioning comes in.

The idea of strategic deconditioning is to remove the training stimulus temporarily so that the muscle will actually decondition and become more vulnerable to microtrauma. The trick is to stop lifting long enough to sensitize the muscle, but not so long as to lose too much hard earned muscle.

Many people have stumbled onto this principle accidentally when they've been forced to take a layoff for whatever reason. When they get back into the gym they experience rapid growth and generally new levels of muscularity. This is because the layoff made their muscle sensitive to the stimulus of lifting, but this time they started with more muscle than before because of their previous training. I guess you could call that "haphazard deconditioning." [laughing]

T: Okay, I'm intrigued. Would you consider writing an article for Testosterone readers and giving them a basic HST program to follow?

BH: I'd love to, Chris.

11.2. Part 2

Recently, there's been a buzz about Bryan's new training program called Hypertrophy-Specific Training or HST. According to Bryan, most weight-training programs are based not on principles of muscle growth, but on the outdated and misapplied research of European strength researchers and coaches. In other words, most programs you see today aren't really geared toward what most of us are after: big muscles.

Bryan dug into the relevant research, applied what he found to the real world, and came up with a program designed not to increase strength or improve athletic performance (although there is an overlap, of course), but to simply cause muscular growth.

Several core T-mag staffers have taken a look at the program and opinions are mixed. However, we all agree that HST is damned interesting and worth trying, so we asked Bryan to come up with an introductory HST program just for T-mag readers. Check it out, and if you want, give it a fair try and let us know how it worked for you.

Hypertrophy-Specific Training is a training method designed specifically to cause muscle hypertrophy (growth). Although significant increases in strength are often experienced while using HST, the program is not centered around strength gains.

HST is based on principles of muscle growth that have been demonstrated in recent research. In light of current published research, it would be incorrect to say "we don't know how muscle grows in response to training." Yes, we do! The whole point of HST is to present the body of research that explains how hypertrophy occurs and the method of training that we can derive from this research.

As we go over these hypertrophy principles, you'll notice that you'll already be familiar with several of them. This should come as no surprise. After all, though our understanding of muscle growth has expanded, our tools in the gym remain the same. When all that we know about how muscle cells grow is laid out on the table, a picture begins to emerge. HST, I believe, is that picture.

You might be thinking all this sounds a bit presumptuous, or at least pretty cocky. Well, the principles of hypertrophy were gathered, a method was tailored accordingly, and the results speak for themselves. What's most interesting is that much of the positive HST feedback comes from people who've made serious gains even after years of training. Guys training naturally usually gain about five to eight pounds during their first HST cycle.

Let's get down to the nitty gritty. HST is based on the following principles:

Mechanical Load

Mechanical load is necessary to induce muscle hypertrophy. This mechanism involves, but isn't limited to: calcineurin, satellite cells, growth factors, calcium, and a number of other fairly well-understood factors associated with tissue strain. So, the primary stimulus for muscle-fiber growth is the physical effects of loading the muscle (lifting and lowering a weight), not the "effort" required to lift or lower it.

You may be wondering how in the world you're supposed to focus on the load and not on the effort it takes to lift it. To better understand the principle of mechanical load, keep in mind that fatigue (or exhaustion) isn't inseparably linked to the effect of load on muscle growth. Lifting a weight doesn't have to make you tired in order to make you grow; it only has to be heavy enough to strain the muscle tissue a bit.

So in the gym, you needn't focus only on how tired you are to judge whether you've had an effective workout. Instead, focus on whether you're lifting more than you did the last time you trained that muscle. If you are, your workout will be effective.

High Frequency Principle (Chronic stimuli to create growth "environment")

In order for the loading to result in significant hypertrophy, the stimulus must be applied with sufficient frequency to create a new "environment," as opposed to seemingly random and acute assaults on the mechanical integrity of the tissue. The downside of taking a week of "recovery" every time you load a muscle is that many of the acute (immediate) responses to training, like increased protein synthesis, prostaglandins, IGF-1 levels, and mRNA levels, all return to normal in about 36 to 48 hours. So, you spend two days growing and half a week in a semi-anticatabolic state returning to normal. (Some people call this recovery.) Research shows us that recovery can take place unabated even if the same muscle is loaded again in 48 hours.

So, true anabolism from loading (proper training) only lasts two days at best once the load is removed. The rest of the time you're simply balancing nitrogen retention without adding to it. With HST you're going to train the muscle every 48 hours. This training frequency is based on research that demonstrates you can train a muscle before it's fully recovered structurally and not inhibit its ability to continue to recover.

HST uses this evidence and calls for repeated loading (training) every 48 hours or so to keep the anabolic activity of the muscle high, while trying to stay slightly ahead of the structural recovery curve by constantly increasing the load each workout. Staying ahead of the structural recovery curve is really key in eliciting growth in a person who's lifted for quite some time.

Progressive Load

The muscle is sensitive not only to the absolute load ("absolute" meaning how heavy it is, as opposed to how heavy it feels), but also to the change in load (up or down). Therefore, you can get a hypertrophic effect from increasing the load from a previous load even if the absolute load isn't maximum, assuming conditioning (resistance to exercise induced micro-damage) isn't too extensive.

Over time, the tissue adapts and becomes resistant to the damaging effects of mechanical load. This adaptation (resistance to the stimulus) can happen in as little as 48 hours (known as Repeated Bout Effect or Rapid Training Effect). As this happens, hypertrophy will stop. The load must then be increased consistently and frequently for growth to continue. This means if you aren't increasing the weight you're training with every two weeks or so, you're at best only maintaining your muscle mass.

Strategic Deconditioning

Strategic deconditioning (taking some time off) re-sensitizes the muscle to weight loads that once were able to promote growth, but since have failed to do so. Once a muscle has grown

significantly from the current weight loads, it's necessary to either increase the load (progressive load) or decrease the degree of conditioning to the load (strategic deconditioning).

There's a limit to the number of times you can add more weight once your muscle adapts. You'll eventually reach your maximum voluntary strength. This is why once your muscle is as tough as shoe leather, all the work in the gym serves only to maintain what size you already have. Strategic deconditioning primes the muscle to respond once again to the training stimulus and allows growth to resume.

Once growth has stalled, a period of about one to two weeks should be taken where no training is performed to let the muscle decondition and become sensitive to the effects of training again.

In summary, to apply the principles of hypertrophy just explained, you're going to:

• Train each body part every 48 hours, or basically three times per week.

• Increase the weight each and every workout.

• Decrease the reps every two weeks.

• Decondition the muscle before you do it all over again.

Sound pretty simple? It is, but don't let that fool you into thinking this is for beginners. HST applies the most-potent growth stimulus of any method you can use.

HST Guidelines

With all that out of the way, let's talk about how to set up your own HST program.

Determining weights for each workout

Find all your RMs (repetition maximums) for each exercise you're going to use. You'll need to know your 15 rep max, your 10 rep max, and your 5 rep max for each exercise, and you'll need to know these numbers before you start the first HST cycle. Your maxes will determine what weights you'll use throughout the entire cycle. For the second cycle, simply add 5 to 10 pounds to all lifts where necessary.

(This may sound complicated, but I'll provide charts and examples later on in this article.)

There's an obligatory increase in weight in increments of 5 to 20 pounds each workout from beginning to last. Your last workout of each two-week block will be your max weight. This means that at times you'll be working with less than your maximum weight for any given rep scheme. This is by design. You'll reach max poundage’s for a given rep range on the last workout of each two-week block.

Assign your max weights to the final workout of each two-week block. Then, in 5 to 10 pound increments, assign weights in decreasing fashion starting from the last workout working backward to the first. So, for example, if your 10-rep max on a given exercise is 200 pounds, assign 200 pounds for the last workout of the 10-rep block, then assign weights that build up to your max in six workouts (two week's worth of training sessions). For our example, using five

pound increments, the weights for the whole two week block of 10 reps would be 175,180,185,190,195, and 200. Do this for each exercise and for each rep scheme.

Reps

Repetitions will decrease every two weeks in the following order: 15 reps for two weeks, 10 reps for two weeks, 5 reps for two weeks, then continue with your 5 rep max for two weeks or begin two weeks of negatives.

The decrease in reps simply accommodates the increasing load. However, the high-rep workouts serve an important purpose. Higher rep sets that really burn benefit the tendons and muscle by both increasing resistance to injury (i.e. promotes tendon healing) as well as increasing functional capacity respectively.

Here's an example of what your weights might look like for your HST cycle. This particular chart is just a sample of a 10-rep block of HST. Keep in mind that your choice of exercises and maxes might be different.

[refer to graphics under the 'HST' tab]

If necessary, you can adjust any of the weights for each workout as you go, but try to stick with a constant progression in weight from workout to workout. Sometimes, due to lighter weights for high reps (e.g. lateral raises), it might be necessary not to increase the weight every workout, but instead use the same weight for two consecutive workouts.

There will only be a few exercises that will be appropriate/practical to use for negatives. For those exercises that aren't practical to use for negatives (like squats, legs presses, and the like) simply continue an additional two weeks using your 5-rep max each workout for those exercises.

Sets

Sets will be limited to one or two work sets per exercise. There's no problem with a single work set per body part as long as the frequency is sufficiently high and the progression in weight is consistent followed by an appropriate period of strategic deconditioning. There's nothing wrong with doing more than one or two sets, it's just more taxing on the central nervous system without significantly contributing to growth.

Frequency

Each muscle group should be trained three times per week. This adheres to the frequency principle. A loading stimulus for hypertrophy must be frequent enough to create a consistent "environment" for the muscle to adapt to. This frequency is also based on the time course of acute anabolic effects of training (see "High Frequency Principle" above).

Sunday, Tuesday, Thursday and Saturday are rest days. Light cardio (20 to 40 minutes) may be performed on rest days. Incline treadmill (brisk walk) should be your first choice. Adequate rest is important. Although it's fine to experience some accumulation of fatigue, adequate and regular rest is important to avoid injuries and control central fatigue.

Other

• Complete each workout using designated poundage's, even if your muscles are slightly sore from the previous workout. It's important to know the difference between an injury and ordinary muscle soreness. Never train a muscle that's at risk of injury. Always warm up sufficiently and use correct form to avoid injury. Listen to your body.

• Following each 6 to 8-week cycle, a nine day period of strategic deconditioning should be taken during which no training should be performed.

• The whole workout can be split into a morning and afternoon session if you want. It can likewise be doubled, performing the same workout morning and evening. Keeping volume (number of sets and exercises) low is critical if doubling the workout.

To summarize, you'll do fifteen reps per exercise the first two weeks and train the entire body three times per week. You'll only be performing one or two work sets per exercise in this full body workout. In the second two week block, you'll increase the weight and drop the reps to ten. In the next two week block you'll do the same, only this time dropping the reps to five. Finally, you perform only negatives where appropriate (continue using five reps where not appropriate) and then take nine days off for the strategic deconditioning period. During this off time, you can perform light cardio.

Here's another sample program:

HST

HYPERTROPHY-SPECIFIC TRAINING

	15 RM						10 RM							5 RM						2 RM
Exercises	Inc	1	2	3	4	5	6	Inc	1	2	3	4	5	6	Inc	1	2	3	4	5	6	Negs
Squats	20	125	0	165	0	205	0	20	0	235	0	275	0	315	20	305	0	345	0	385	0	405
Leg Press (ALT)	20	0	235	0	275	0	315	20	305	0	345	0	385	0	20	0	415	0	455	0	495	495
Leg Curl	10	40	50	60	70	80	90	10	60	70	80	90	100	110	10	75	85	95	105	115	125	125
Dips	0	220	220	220	220	220	220	5	220	225	230	235	240	245	10	215	225	235	245	255	265	265
Chins	0	220	220	220	220	220	220	5	220	225	230	235	240	245	10	215	225	235	245	255	265	265
Incline Bench	10	105	115	125	135	145	155	10	135	145	155	165	175	185	20	125	145	165	185	205	225	225
Bent Rows	10	105	115	125	135	145	155	10	135	145	155	165	175	185	20	125	145	165	185	205	225	225
Lateral Raise	5	15	15	20	20	25	25	5	20	20	25	25	30	30	5	25	30	35	35	40	40	40
Rear Delt Laterals	5	15	15	20	20	25	25	5	25	25	30	30	35	35	5	25	30	35	40	45	45	40
Preacher Curls	10	50	50	60	60	70	70	10	65	65	75	75	85	85	10	60	70	80	90	100	100	100
Tricep Extensions	10	20	30	40	50	60	70	10	40	50	60	70	80	90	5	85	90	95	100	110	110	110
Shrugs	10	175	185	195	205	215	225	20	205	225	245	265	285	305	20	230	250	270	290	310	330	330
Calf (Straight Leg)	10	265	275	285	295	305	315	20	305	325	345	365	385	405	20	395	415	435	455	475	495	495
Abs (Machine)	10	50	60	70	80	90	100	10	70	80	90	100	110	120	10	90	100	110	120	130	140	140

www.hsnhst.com

Note: In the program above, you're alternating between squats and leg presses, hence the "0's".

Again, this may all seem complicated, but if you study the charts for a few minutes, it should all become clear to you. Try it and you'll see why HST is getting so much attention!

12. What increments to use, 5lbs, 10lbs, 5% or what...

Quoting Bryan - "Is there something magical about using 5-10 pound weight increments each workout? No. The idea is that the weight must steadily increase over time, or no further growth will occur. Go ahead and use the same weight twice, it's no big deal. If your starting weights are too small, use fewer increments and start with more weight.

The smaller the muscle group, the smaller the increment. It's all relative. Using percentages of your max for each exercise will manifest the relative nature of increments. For example, if you decide to use 5% increase in weight each workout. For curls I would increase the weight 5lbs if my max was 100lbs. However, for squats a 5% increase would dictate that I increase the weight 15lbs if my max was 300lbs. So its relative to your max, which in turn reflects the size of the muscle group.

To simplify things, I just use 5-10lbs (~2.25-4.5kgs) for upper body, and 10-20lbs (~4.5-9kgs) for legs.

Larger increments will tend to cause greater microtrauma, and by extension hypertrophy. Lower increments will be more conducive towards strength increases (and not so much hypertrophy). The reason is that you want the workout to be traumatic to the muscle tissue each and every workout. Therefore, the weight load has to exceed the muscles ability to structurally adapt from workout to workout. If the increments are too small, the workout won't really be that much different from the previous workout, and as a result, will not cause much trauma to the tissue.

Once again, smaller increments are generally more effective at developing "strength".

Here are the factors involved when establishing increments:
1) The minimum amount of effective (for hypertrophy) weight to start with.
2) The difference between the minimum effective weight, and your max
3) The number of workouts to go from the minimum amount of effective weight, to your max.

Keep in mind that the above factors aren't "constant". Meaning, they are in turn affected by your level of conditioning, and your level of strength. The lower the level of conditioning, and the higher the level of "native", or untrained strength, the larger the increments can be, and in turn, the more effective the cycle will be.

Using smaller increments would indeed allow you to add workouts before reaching your max. Whether this hurts, or helps your particular gains depends on many factors that you couldn't predict. This is because "progressive load" is not an all or none principle. As with the other physiological principles of hypertrophy, it is a matter of degrees.

The afore mentioned interaction between the Repeated Bout Effect and Progressive Load can be summarized in the following HST principle:
- Muscle tissue is sensitive to both the "absolute", as well as the "relative increase" in load.

The "absolute" load is determined by the minimum effective load (which varies according to length of SD), and the "relative load" is determined by the size of increment you choose.

How much the "minimum" load is, depends on the condition of the muscle at the time you impose the load. If you are an astronaut and have been weightless (extreme deconditioning) for 2 months, just the force of gravity on your limbs will induce hypertrophy. Also refer to the thread on Strategic Deconditioning for further discussion."

12.1. From ThinkMuscle Newsletter 23

Question:
Hi. How do I decide how big an increment (i.e. weight increase) to use from workout to workout? I hear some people say to just use tiny increases (i.e. small percentages) in weight and others advising bigger increments. I'm not
interested in strength so much as I am in size, so what should I do if I want to put on as much size as possible?

Thanks!

Answer:
It is important not to get too caught up in small percentages. In other words, no need to split hairs when you don't actually have a view of the hairs you're trying to split. We cannot predict exactly how much weight to use at any given time because we simply can't see into the muscle tissue itself. Therefore we work our way along by finding an advantageous starting point and then keeping track of where we've most recently been.

12.2. The Principles Involved:

Your muscle, depending on the size of the muscle group, will not likely be able to sense small increases in load, such as 2.5 pounds or 1 kilo. Your CNS won't really know the difference either. It doesn't get direct feedback from your muscle tissue about actual tension levels (aside from golgi tendon organs and to lesser extent muscle spindles). The CNS is more sensitive to the degree of exhaustion, or a given level of output for a given duration. You will, however, because you know what you loaded on the bar last time and you know that you're putting 1 kilo more weight on this time. So aside from a mind game we play with ourselves, we need to try to make each workout a relatively more severe structural challenge to our muscle tissue. The challenge to our CNS and to ourselves is secondary to this. This is and important element that distinguishes Hypertrophy-Specific Training from other methods of training done for other reasons.

Speaking short term, what your muscles are responding to from workout to workout (~48 hours later) is the "repeated" structural challenge. The frequency that this occurs is also important. This will be true for about 3-4 weeks. The more
frequent the load, and the more sensitive your tissue is to that loading, the longer you can get away with no increase in load. You heard me correctly. Until your tissue has finished building up its resistance to the current level of abuse you're putting it through (Repeated Bout Effect), it will continue to respond (i.e. grow) to the workouts even if the weight has not increased.

Depending on the absolute amount of weight used, and the level of conditioning the tissue had when you started, this can work for anywhere from 3-4 weeks. However, there is a definite curve of diminishing returns during those weeks. The last workout won't be near as productive as the 2nd or 3rd workout.

Despite this short term efficacy of constant or static weight loads, increasing the load from workout to workout does serve an obvious purpose. It helps to cause adequate physical trauma to the tissue more consistently, thereby more consistently activating important hypertrophic pathways like satellite cell activity and internal mechanotransduction pathways. Too **little** or **no** damage due to imperceptibly small increments means your muscle's ability to resist trauma will soon catch up to you and growth will stop. Too **much** damage from huge increments means you're headed for injury, extreme DOMS, and possibly fiber necrosis and an increase in fibrous connective tissue (not good).

12.3. The Application of those Principles:

So how do we apply the principles we just discussed? After all, just knowing that something works a certain way, doesn't mean you know how to make it do what you want it to. So lets summarize this first. You want the tissue to be traumatized more than just on the first workout. So, considering the tissue's ability to rapidly protect itself from
further trauma (growing resistant to the tension itself), you have to continually increase the weight in order to stay ahead of the tissue's physical adaptation to the last workout (RBE). This is fundamentally contrary to ALL other programs before HST which preach full recovery before hitting the muscle again. Anybody serious about hypertrophy will need to train again before the muscle is recovered.

So we know that the load must be continually increased in order to grow consistently. However, this poses a problem to us because we are only so strong. Unlike Superman, there is only so much weight that we can lift. So our well-validated strategy to continually increase the weight is only a temporary solution. Here we come to another juncture that is fundamentally different from other programs. Some programs, unable to understand why growth stops, would have you change exercises to *confuse* the muscle. After all, don't all our organs grow in response to confusion...? Just think if this were true, people with blond hair would have HUGE brains. (Just kidding ). Others would have you
simply train harder, do more sets, do forced reps, decrease the rest period, or whatever they can think of to make the same weight loads *feel* more difficult. They call it upping the *intensity*. Why? Because they don't really understand why they have stopped growing. If you don't know why you've stopped growing, you are going to have a very hard time fixing the problem.

So back to our dilemma, we deal with the problem of limited strength with Strategic Deconditioning (SD), which then allows us to use the minimum possible weight that will still produce hypertrophy when we start training. This is the only reason using submax weights during an HST cycle works. After SD you have effectively decreased the amount of weight required to stimulate growth. And at the same time you have given yourself some headroom to increase the weight each and every workout for a decent length of time before you max out your strength.

Even when using SD properly, we still end up with certain limitations, or boundaries, that we must work within. The lower boundary is that we still have to start with a good amount of weight to cause hypertrophy, regardless of how weak we are. The upper boundary is due to the fact that we are only so strong, so we can't increase the weight forever. The difference between the **lower** boundary (minimum amount of starting weight) and the **upper** boundary (max strength) will differ from one person to another. Sure, these boundaries change over time. We get stronger over time and we also tend to be more or less conditioned when we start. So both boundaries can move up or down over time.

Here is the key to understanding the answer to your question about increments. The smaller the difference between your required starting weight and your max strength will determine what kind of increments you will use. This is not
complicated, nor does it need to be. On average you should be able to make 6 increments between your minimum effective weight and your repetition max. It is not uncommon, however, that people will need to reduce the number of increments and repeat a few poundage's to accommodate small muscle groups such as shoulders (lateral raises etc). All in all you will end up increasing the weight 18 -20 times over the course of 6-8 weeks. This consistent increase in load and Strategic Deconditioning has a great deal to do with the effectiveness of HST.

In the end it isn't necessary to focus on how big of an increment to make. What will determine your success is more dependent upon how wide the range is between your effective starting poundage's during the 15s and your ending poundage's used for 5s or negatives. So your goal for continued success, cycle after cycle, is to increase that range - by either decreasing the effective starting weight and/or increasing the finishing weight of the cycle.

13. Does HST work for strength, SST, strength-Specific-Training

It takes quite a bit of time and effort to piece all the strength research together to form a big comprehensive picture with which to base an SST method. HST was not born overnight, neither would SST. Fortunately, there is a lot more applied strength research out there than there is hypertrophy research. The reason for this is that strength research is used to help countries fair better in international competition. This has been extremely important to most of the world for many decades...especially the Eastern block countries of the 70s and 80s. It is important to distinguish whether strength was the goal of the research or hypertrophy. Contrary to popular belief, they are not synonymous.

Remember, when training for strength, you are training the entire neuromuscular system. This requires special attention to not only the muscle tissue itself, but also to the nervous system and the emotional state of the lifter. These variables require certain training principles to achieve the most predictable increases in strength. But when training for muscular hypertrophy, your focus should only be in the muscle itself. Work it until it is "done". Like kneading dough. You knead it until it is done. Getting a muscle to grow is a mechanical phenomenon. You will also find that your pumps are as good as ever (if your not dieting) when you work a muscle until it is done, no more, no less.

The whole point of HST (which others have already summarized aptly) is to:
1) Increase the frequency of loading each muscle to 3 times per week.

2) Continually increase the load. Zigzagging is fine as long as the general trend over time is upwards. If you don't, the condition (which is to say, the resistance of the tissue to the mechanical strain of a given weight load) of the muscle will catch up with you and your growth will plateau. Growth with a given load will probably only produce gains for about 4-6 weeks. The lighter the load, the shorter the amount of time it will be able to induce muscle growth.

3) Use Strategic Deconditioning to enable a given load to once again induce muscle hypertrophy. This occurs once the tissue has been resensitized (i.e. made susceptible) to the mechanical strain of load bearing.

These are the principles (or characteristics) that distinguish a hypertrophy-specific program from a strength-specific program. Is it complicated? No. Need it be? No. Is there evidence to support the idea that these principles really do change the effect of a training program from inducing strength to inducing hypertrophy? Of course, otherwise I would never have brought it up.

In order to come up with a method that is "strength-specific" we first have to have an understanding of those factors involved in the production of voluntary strength. Here is a "brief" review of those factors that you must figure out how to manipulate if you are going to develop a strength-specific training method. (I took this from an article I wrote a few years ago so the references are not included. In a future article I will include those and newer references).

As an untrained individual begins a strength training program for the first time they will experience quite dramatic increases in muscular strength. These improvements in strength will continue almost linearly for about 8-12 weeks. The dominating mechanism of these initial strength gains are neurological in nature (Morianti,1979; Sale,1988). These adaptations take place with or without increases in muscle cross sectional area (CSA).

Some ways that a muscle may undergo neural adaptation include cross-education, increases in electromyographic (EMG) activity, reflex potentiation, alterations in the co-contraction of antagonist muscles, and improved coordination of synergist muscles.

The foundation for the development of strength is neuromuscular in nature. Increases in strength from resistance exercise has been attributed to several neural adaptations including altered recruitment patterns, rate coding, motor unit synchronization, reflex potentiation, prime mover antagonist activity, and prime mover agonist activity. Aside from incremental changes in the number of contractile filaments, voluntary force production is largely a matter of "activating" motor units. In order to ascertain the relative contribution of each of these mechanisms, various measurement techniques have been utilized. Hereafter we will briefly discuss each of these mechanisms as they relate to resistance training.

Recruitment of motor units can be measured with Electromyography (EMG). As a muscle contracts, the electrical signal initiated by the motor nerve can be detected with EMG. The intensity or magnitude of this signal is sometimes described as "neural drive". In order to explain increases in strength from resistance exercise, researchers have measured the changes in EMG activity in weight training subjects.

Hakkinen and co-workers have shown that there is an increase in EMG activity with strength training as well as a decrease in EMG activity upon cessation of training (Hakkinen,1983). Fourteen male subjects (20-30 yr) accustomed to weight training went through progressive strength training of combined concentric and eccentric contractions three times per week for 16 wk. The active training period was followed by an eight week detraining period. The training program consisted mainly of dynamic exercises for leg extensors with the loads of 80-120% of one maximum concentric repetition (1RM). Significant improvements in muscle function were observed in early conditioning; however, the increase in maximal force during the very late training period was greatly limited. Marked improvements in muscle strength were accompanied by significant increases in the neural activation (EMG) of the leg extensor muscles. The relationship between EMG and high absolute forces changed during the training period. The occurrence of these changes varied during the course of training. During detraining, there was a decline in EMG activity.

Now those who would argue that increases in strength are solely due to increased recruitment of motor units would have a difficult time defending themselves in light of other research. There is a method of measuring motor unit activity called "Interpolated Twitch Technique", or ITT. ITT is used to determine the extent of activation of the entire muscle. Merton (Merton, 1954) was the first to use this technique to describe whole muscle activation. He showed full activation of the adductor pollicis with fatigue in untrained subjects. Several other studies have since shown a similar ability of untrained subjects to voluntarily fully activate various muscle groups (Bellemare 1983, Chapman 1985, Gandevia 1988, Belanger 1981). This directly contradicts the theory of strength increases due to the ability to activate more motor units.

The activation of motor units is done in an asynchronous fashion, meaning that not all fibers contract at the same time within a given muscle. There is a hierarchy to the order of fiber recruitment in muscle tissue. Because fiber activation is not "analog" or variable in nature, in other words, a fiber is either fully activated or fully quiescent, the brain must control contraction intensity by altering the number of fibers it activates. In general, slow twitch fibers are activated first followed by larger fast twitch fibers. Now when muscles begin to fatigue the asynchronous firing of fibers become more and more synchronized (Butchal, 1950). This allows for greater force production. This synchronization of muscle fibers has been linked to increases in voluntary strength (Milner-Brown, 1975).

Now although increases in motor unit synchronization have been reported with training, studies involving artificial stimulation show that force development with asynchronous stimulation is greater and smoother (Clamann, 1988). In addition, researchers have shown that the rate of force development in brief maximal contractions is faster in voluntary than in evoked contractions (Miller, 1981). So from these studies we see that although synchronization of motor units can increase with training, asynchronous motor unit activation is more advantageous to rate and magnitude of force development than is synchronous activation.

Increases in "reflex potentiation" have also been linked to resistance training (Sale & Upton 1983, Sale & MacDougall 1983) as well as decreases with immobilization (Sale, 1982). The actual benefit, if any, of this adaptation is unclear. An increase in reflex potentiation would contribute to the voluntary EMG signal augmenting the motor or neuronal drive. Nevertheless, because untrained individuals have been shown to be able to fully recruit their motor units, the purpose of increased reflex potential remains undecided.

Finally, that activity of prime mover agonists and antagonists plays a role in directed voluntary strength. The obvious role of agonists is to assist the prime mover by guidance and stabilization. This could be termed "coordination". It is well known that any unaccustomed exercise requires practice in order to develop sufficient coordination to allow maximum efficiency of muscular effort. The role of antagonistic muscle groups is more complicated. They serve to prevent damage through co-contraction as well as ensure less resistance through relaxation to prime mover contractility.

The protective mechanisms function by way of golgi tendon organs (GTO). The GTO is sensitive to force output or tension within the muscle. They are located at the musculo-tendonous junction and are contained within a compressible collagenous capsule. Fibers of the GTO are connected directly to muscle fibers as well as to Type "Ib" inhibitory neurons within the muscle. The physical structure of the GTO allows it to be sensitive to stretch or load present in the muscle. Think of the notorious "Chinese finger trap". You first stick you fingers in each end. Then as you pull your fingers apart, the structure of the woven tube causes it shrink (or in the case of GTO it compresses) in diameter in order to stretch. The GTO works very much like this. When the collagen around the GTO is compressed because of contraction or stretch by the muscle, the Ib neurons generate an impulse that is proportional to the amount of GTO deformation. In this way the GTO can decrease contraction of a muscle being stretched in order to protect it from being torn. Likewise, GTO are thought to prevent unusually high contractions of a muscle in order to protect it from tearing itself apart. So in an antagonist muscle, the GTO can serve to inhibit co-contraction, facilitating contraction of the prime mover. In a prime mover, the GTO acts to prevent torn pecs, biceps and whatever else you are using to lift insanely heavy weights.

Another neuronal structure regulating involuntary muscle activity is the muscle spindle. The muscle spindle is found in greater abundance in the muscle belly as apposed to the musculotendonous junction. The muscle spindle also responds to stretch. However, the spindle is less like a Chinese finger trap and more like spring. When the muscle undergoes stretch, the center of the spindle is stretched. These spindles contain neurons that are sensitive to this stretching. Unlike with the GTO, when a muscle spindle is stretched its excitatory neurons fire in order to counteract the stretch.

When a stretch is imposed on a muscle, the Type-I sensory neuron sends impulses into the spinal cord and connects with interneurons, generating an excitatory local-graded potential that is sent back to the muscle being stretched. If the stretch is of sufficient magnitude and/or rate, a local graded impulse will be sent back to the same muscle with sufficient strength to initiate a contraction via alpha motoneurons. This reflex arc in known as the "stretch-reflex" and is characterized by a quick muscular contraction following a rapid stretch of the same muscle. Now this stretch reflex primarily functions in slow twitch muscle fibers.

Alterations in the sensitivity of these two regulatory mechanisms have been seen with training. Carolan (Carolan, 1992) showed a decrease in antagonist co-activation of the lex extensors with training. On the other hand, increases in co-activation have been seen in longitudinal studies comparing explosive trained athletes to non-explosive trained athletes (Osternig 1986, Barrata 1988). These somewhat contradictory results may reflect the possibility that co-activation alterations are very specific in nature and depend on things such as contraction velocity, range of motion, and training specific effects.

The nature of these changes is determined by the nature of the stimulus. If you regularly allow only very slow contractions of a given muscle (such as with Super Slow methods), that muscle will improve its ability to contract slowly, at times at the expense of its ability to contract rapidly and powerfully. If you train a muscle for endurance, it will improve the oxidative capacity and fatigue resistance of muscle fibers, and even begin to change the contractile properties of all fibers in favor of endurance-type activity. All this due to chronic, and specific neural activity patterns.

13.1. Plyometrics

If you are serious about using plyometrics they should be used in a different phase of your training. If hypertrophy isn't a priority, simply do skill training on legs for a given period, and continue HST for upper body.

Once/week 5s on squat might also be helpful for power development, while doing plyo's on the other days. Still make an effort to "explode" out of the bottom of the squat. Don't move/lift slowly on purpose, if power and explosiveness is your goal.

14. Selecting exercises and related topics, also some stuff on injury management

14.1. How many exercises?

I am a big fan of reducing the number of exercises and increasing the number of sets. For example, if you can stick with only 4 or 5 exercises per workout (e.g. squats, dips, chins, shoulders [only an example]) you can get in some really good work for the whole body without running around the gym from exercise to exercise. When doing this I definitely recommend using 2 different sets of exercises which you alternate between each workout, each set of exercises still geared towards major muscle groups with compound lifts. This is for overall body growth/mass.

If over time, a person feels they are neglecting a minor muscle group, it is easily addressed in a cycle or two before a competition (bodybuilding).

This is the most common mistake I see - people do too many exercises each workout on HST. They are so concerned with hitting every possible exercise that they aren't able to really focus on any of them.

(from an old post) :

I may only use 6-7 exercises to train my entire body. One major exercise for legs, back, chest, delts, bis, tris and calves. This doesn't have to be done all in one workout either. I may only do 4 of those exercises in the morning, and 3 later that evening. Or sometimes, if I can't train twice a day, I do 4 body parts on Monday and the other 3 on Tuesday and then repeat the process on Wednesday. That way I can spend as much time on each exercise/bodypart as I need. 3 insufficient sets using 3 different exercises for a muscle group will do less than 3 sufficient sets with one exercise...make sense?

If you are concerned about not using enough exercises, simply set up two sets of 6-7 exercises for the entire body. Use the calculator and get all your weights for each exercise. Then alternate between the two sets of exercises each time you train the whole body. So, if you train everything in one day, you would do one set of exercises on Monday, and the other on Wednesday, then repeat the first on Friday, followed by the second on the next Monday, etc, etc.

If you can train twice per day, do one set in the morning, and the second set of exercises in the evening (you will definitely drop fat by doing this).

If you train your whole body in 2 days, alternate between the two sets of exercises in the obvious way. That way, instead of 6-7 exercises, you would be using 12-14 exercises within 2 full body workouts.

14.2. Squats and dead lifts in the same week?

There is no need to do squats and deadlifts during the same week, unless perhaps if you are training for a powerlifting event. Even then, you should alternate between squats and deads every other workout. These two exercises are essentially full body exercises. Unless you are chemically assisted doing both of these exercises with such frequency will lead to burnout.

Most people can only handle 2 exercises per week that stress the lower back. These include squat, deadlift, stiff leg DL, unsupported bent over rows.

If you are doing squats and SLDL 3 times per week during the 5s it's no wonder your back hurts. I can only do squats twice per week during the 5s, and I don't usually do a lot of SLDL.
I would highly suggest you either drop the SLDL all together during the 5s, and only do a major exercise like squats or deadlifts twice per week. You can hit the quads and hams with extensions and curls in-between.

14.3. Various

Grip width only affects the lats or pecs differently if the elbow is moved into a different plane of motion. There is no need to do incline press, shoulder press, and overhead db press all in the same workout, not to mention 3 times per week. If you insist on doing all of these shoulder movements you need to arrange an alternating workout schedule. Do flat bench and shoulder press on one workout, then dips and incline press on the next. Then just alternate between the

two exercise routines each workout. The same goes for biceps. If you are training back properly, there is no need to do two different curling movements in a single workout. As with shoulders, alternate between curling movements from workout to workout.

14.4. Leg extensions

Aren't "bad" for your knees per se, they are hard on somebody's knees that are already bad.
Leg extensions are an integral part of knee rehabilitation in clinical settings. They wouldn't use knee extensions if they were bad for your knees. Done properly, knee extensions can actually help heal knees that have started hurting do to training stress. HST is designed to allow a person to heal up old aching joints, in order to allow them to train effectively once again. If you have a preexisting serious knee problem or injury, check with your orthopedic doc before doing any leg training.

14.5. SLDL

Your depth on Stiff Leg Deadlifts depends on the flexibility of the hams...not the back. The only movement should be the pelvis. When done properly, very few people can even go parallel to the floor with their torso. The stretching sensation with the legs straight will be felt behind the knees. As you begin to bend your knees the stretch will move up the back of the leg. The lower back should not give way.

SLDL is NOT a back exercise. It is strictly for the hams. It isn't necessary to do really heavy SLDLs - since this isn't a "strong position" for the body and it may expose a person to injury if pushed too heavy.

14.6. Biceps

You don't have to change bicep exercises if you don't want to. I just do it because I enjoy doing it.

If you are going to change them "strategically" you want to start with a non-stretch movement like concentration curls, and move to a stretch movement like incline curls. This switch can be done once in a cycle, switching half way through the 10s. Or only switch as you go from one full HST cycle to the next.

Any other switching is just for variety. Try not to go from a "strong" exercise to a weak one though. The absolute load on the biceps should still increase steadily as the cycle progresses.

14.7. Calves

When approaching calves, don't change the principles.
- Increasing load
- sufficient volume
- sufficient frequency
- SD

Now the calves are virtually never deconditioned because we walk and stand on them all day. This makes them very resistant to the effects of doing "reps". They're tuff as nails. In general, calves will require greater loads, greater volumes, and greater frequency to equal the effects of a lesser amount of training on the chest for example.

So, don't get caught up in all the fiber type jibber jabber. ALL fibers grow with overload. Your fiber type determines what they do for you, NOT what you should do to them.
Start with SD. If you are running you will have to cut that out for a bit.

Start with 15-20 reps. Do this everyday while the reps are high.

Keep the increments proportional to the strength of the muscle. Most people can calf raise huge amounts of weight, so make the increments 10-20 pounds at a time.

Don't skip the negatives. You don't need a training partner to use both feet to lift, and one to lower. Don't forget to cut the weight in half though when you switch to one leg sets.
When your all maxed out and they don't seem to be changing from week to week, take a 14 day SD period and do it all over again.

One thing I have found is that adding running or jump-rope towards the end of your calf cycle can help get a bit more size out of your calves before you SD.

14.8. Should I vary exercises?

Should a person “switch” exercises frequently? Well, that depends. If she is going from an exercise that doesn’t stretch the muscle significantly, to an exercise that does, then Yes. You will benefit from switching, but only after the muscle has “adapted” to the exercise with less stretch involved.

Switching exercises that require a high degree of neural skill (most compound exercises) is generally less productive. The hypertrophic response is delayed according to the duration of learning to manifest the neural drive necessary to generate the tension on the muscle fibers for microtrauma to happen. This is generally not a concern with isolation exercises.

As to the value of Weider’s Confusion principle (sorry couldn’t resist), lets consider what we know both about strength, and the physical properties of muscle tissue.

The foundation for the development of strength is neuromuscular in nature. Increases in strength from resistance exercise have been attributed to several neural adaptations including altered recruitment patterns, rate coding, motor unit synchronization, reflex potentiation, prime-mover antagonist activity, and prime-mover agonist activity. Aside from incremental changes in the number of contractile filaments, voluntary force production is largely a matter of "activating" motor units. In order to ascertain the relative contribution of each of these mechanisms, various measurement techniques have been utilized. We can go into this if you wish, but it is largely just an exercise in motor-unit physiology with little applicable value to muscle hypertrophy.

One study might be worth mentioning though. Hakkinen and co-workers have shown that there is an increase in EMG activity with strength training as well as a decrease in EMG activity upon cessation of training (Hakkinen,1983). Male subjects accustomed to weight training went through progressive strength training of combined concentric and eccentric contractions three times per week for 16 wk. The active training period was followed by an 8 week detraining period (not to be confused with SD). The training program consisted mainly of leg extensions with the loads of 80-120% of one maximum concentric repetition (1RM). Significant improvements in muscle function were observed in early conditioning; however, the increase in maximal force during the very late training period was greatly limited. Marked improvements in muscle strength were accompanied by significant increases in the neural activation (EMG) of the quads.

And as you might expect, during detraining, there was a rapid decline in EMG activity patterns.

Now here is something interesting and illustrative at the same time. The relationship between EMG activity and high voluntary forces varied during the training period. The occurrence of these changes varied during the entire course of training. This points out the fact that other neurological factors are involved such as rate coding, motor unit synchronization, reflex potentiation, prime-mover antagonist activity, and prime-mover agonist activity.

Now with respect to the question of changing exercises every 2 weeks or so, you have to ask yourself why? Keep in mind that there are entire textbooks devoted to the field of "motor learning". It is a very complicated field of study because it involves the whole organism or being. It involves the brain to a much greater extent than the muscle tissue. This of course makes it NOT hypertrophy-specific. Anyway, people are used to asking the question why, they just aren't accustomed to having to answer it without simply deferring to some widely accepted authoritative source, or simply saying "it makes it harder". "Harder" is a subjective term related to another subjective term "intensity". Intensity is only important as it defines the amount of tension applied to the muscle, not how heavy it feels that day or how hard it is to lift when you are really tired.

14.9. How does grip width and different angles change the stimulus?

In general, when person moves their grip from wide to narrow, the elbows will pull in towards the side of the body during the pulling motion. This changes the line of pull transferred to the muscles of the back and shoulders.
It also changes the degree of stretch, or the length of the muscle during the contraction.

As for recruitment, the innervation of the lats is from the thoracodorsal nerve. With practice you can lean to control the lat, apart from the surrounding musculature. This however, isn't necessary for typical lifting, nor is it possible with heavy loads.

Think of the lat as a sheet that can experience different levels of tension depending on how you stretch it.
Training a muscle in a lengthened position will cause more microtrauma than training it in a shortened position. Decline curls stretch the short (inner) head more than the outer (long) head of the biceps simply due to their different origins. The short head originating at the coracoid process and the outer head attaches to the humerus. So the outer head doesn't stretch as the upper arm is moved away from the center line of the body whereas the inner head does.

The pec minor actually lies beneath the pec major so you don't actually see it. The pec minor attaches to the ribs and the coracoid process. The pec minor simply pulls the shoulder girdle forward. The pec major moves the upper arm because of its insertion at the humerus.
Studies have shown that the upper portion of the pec is usually just as active as the lower portion during heavy flat bench. However, there is some benefit to doing incline bench because it seems to help build the clavicular portion of the pecs and the front delts.

Nothing isolates the "inner" portion of chest. The myth arose out of the "sensation" that one feels as the pec becomes cramped while contracting it (with the arms brought close together in front of the body and flexed hard). Isolating the inner pec is like isolating one portion of a rubber band as you stretch it from either end. Now, there are differences in the way the muscle experiences stress due to the convergence of the fibers near the insertions at the musculo-tendonus junction...but that's more detail than is necessary.

One thing everyone should keep in mind. The distribution of androgen receptors is not even throughout the body. There is a greater density of androgen receptors on the shoulder girdle (delts, traps, upper pecs). You will notice, that once a guy begins to use androgens, he almost immediately grows traps and delts. In short, there are disproportional increases in muscle mass

in certain muscle groups when one begins using steroids. This is due to androgen receptor distribution patterns.

All right, we already went over the neurological adaptations that a muscle will undergo when exposed to a new movement. So aside from neurological issues, changing an exercise for the same muscle group does what?

1) It changes the angle of the limb to the body and/or the position of body itself

2) It usually changes the degree of stretch that the muscle experiences during the movement.

3) 2a) Incident to this, the muscle will also often experience a change in the distribution of resistance throughout the movement (free weights are not isotonic do to the fixed direction of gravitational pull and the variable angle of pull of the muscle/joint).

So now you have to ask yourself, how do these things effect what we know about "why" muscles hypertrophy. Lets look at them 1 at a time.

1) It changes the angle of the limb(s) in relation to the body and/or the position of the body itself. Great, but does this really effect a muscle which has both a fixed origin and insertion? No. All the muscle knows, is that it is stretched to a given degree, and then forced to contract. Your "brain" knows where the muscle is in space (proprioception) but the muscle doesn't know anything of the sort. It is 2 dimensional for the most part. It does only two things, it lengthens and shortens in a straight line between its origin and insertion. You can't change that straight line between origin and insertion, only its orientation to the body or other frame of reference.

2) It usually changes the degree of stretch that the muscle experiences during the movement. Does this really affect hypertrophy? YES!! It absolutely does. When a muscle goes from less stretch, to more stretch, it will elicit a hypertrophic response.

3) Or "2a", the muscle will also often experience a change in the distribution of resistance throughout the movement. Will this effect hypertrophy? Generally No. It only encourages neurological adaptations to better able itself to generate force at a given muscle length. As the SAID principle demonstrates, you will increase strength in that specific range of motion where the resistance is highest.

14.10. Squats

The problem with squats is that they are a very complicated exercise...By complicated I don't just mean the movement itself, but the number of variables that come into it when you are dealing with all sorts of people with all sorts of abilities and tolerances.

I would say about 85% of the bodybuilding population don't perform squats properly. Why so many? Because they are unaware that they are not doing them correctly. They think they're doing squats, when in reality they are doing partials, using a lot of low back. Balance is usually over the balls of the feet and the knees come in until they nearly touch. Power lifters and Olympic lifters are much better at this because they are "trained" to squat properly from the very beginning. Olympic lifters, in my opinion, have the most beautiful squatting technique I have seen among all lifters.

There is also the problem of ego. Like bench, everybody seems to think you aren't cool unless you squat a ton of weight. This puts undue pressure on people to increase the weight beyond their capacity. As a result, their execution of the exercise deteriorates even further.

Finally, one other variable referring specifically to muscle growth is exercise tolerance. People often don't realize how agonizing and painful a true set of squats can be. I mean, anybody can burn the crap out of their biceps doing concentration curls, or even their chest doing crossovers or pec-deck. But put several hundred pounds on their back and tell them to keep going until the pain is so bad they think they will surely be crushed, die, or both and you are talking about something most people have never experienced…even most casual lifters. Most people simply rack the weight before they really stress the legs. As a result, their squatting weight will be significantly less than it is for their other leg exercises. In other words, they are unable or unwilling (consciously or not) to perform squats in the way necessary to illicit a significant growth stimulus.

So take this group of bad squaters, give them squat advice, and it is anybody's guess what kind of results they will have. Simply because they don't perform them properly. As a result of that, there will crop up dozens of squatting routines all promising huge gains. Not only that, but squats do not cause whole body growth. They only have the potential to cause growth in those muscle groups directly involved in the squatting movement. However, because squats involve at least half of the body, you can increase overall bodyweight as a result of so much of the body's musculature being stimulated to grow. Despite Kraemer's claims that the miniscule spikes in Test and GH as a result of squatting without resting too much in-between sets is responsible for muscle growth, it isn't entirely true. Otherwise, if these minute spikes in Test and GH had any significant physiological effect, squatting would put hair on your chest. Ok, I'm being a little sarcastic but you get my point.

The anabolic potential of any given squatting routine, be it 20 rep, Breathing squats, Oxford method, Straight sets, Super Slow, HIT, GVT, EDT, or HST, depends on the individual's level of conditioning in the legs when they begin a squatting routine.

For someone who has been frustrated with their legs and/or squats and hasn't been squatting properly or diligently, anyone of the above mentioned methods would lead to some size gains… Then that person runs out and tells everybody that they have found the answer to getting legs like Tom Platz. So depending on who's asking, sure, small increments, or even no increments will work for a lot of people, just as long as they are consistent, and are able to push themselves to the point that they are really causing some trauma to the tissue.

For those who are healthy, squat well, squat relatively frequently, and are somewhat already developed, I recommend HST as indicated (accept for negatives). For those who struggle with squats for one reason or another, simply add leg extensions, and/or leg press, using the HST method.

So, both SD and the bigger increments are going to be necessary for people who have been already training legs properly and are already bigger than they would be without training much. Other people will get by with less simply because they haven't been training all that well to begin with.

14.11. Kate on posture, form, and rows

When I left fitness training to get back into massage, some of my gym clients became massage clients. Several of these people had similar posture (along with neck pain and/or headaches). None of them were very good at rowing motions and I assumed it was some kind of "communication" problem... that these people couldn't figure out how to tell their shoulder blades to move properly.

What I found out when I got my hands on them, was that they could not move the scapulae properly. Their upper back paraspinal musculature was in chronic spasm reducing proper movement of their spine. And worse, the muscles in the shoulder girdle were so locked together that their scapula were firmly fixed to the ribcage.

In other words, in a healthy relaxed shoulder, I can get my hand part way between the scapula and the back, and the shoulder blade glides smoothly. On these folks, the blades were hardly moving at all. Imagine the stress that puts on the rotator cuff and surrounding structures!

Typical with this posture then is "stuck" scapulae, immobility in the thoracic (upper) spine, overstretched and fatigued upper back muscles, and chronically contracted muscles in the front of the neck, shoulders and chest.

Proper exercise could indeed improve the posture, but deep tissue massage would certainly speed up the process. Rowing exercises should focus on squeezing the shoulder blades together (without lifting the shoulders toward the ears) and then feeling the shoulder blades pull apart as the arms extend.

The muscles in the front of the shoulders and the chest need to be strengthened and lengthened. Flyes or pec deck would work nicely for that. The shoulder blades should be moving somewhat for this exercise, although your friend should try to keep them from rolling up around his ears...

For the "stuck" upper back, he could try some hyper extensions, but focus on trying to make the motion come from his upper back rather than his lower back. Lying face up over a Swiss ball would definitely stretch that tight spot. Use a spotter the first time.

Its impossible to know what you have going on without watching you move, but stretching over the Swiss ball is a great way to bring mobility back to that area. If you do full range of motion crunches over the ball, you should be able to encourage some motion in the upper back as well as the lower. Hyper extensions over the ball should help too.

If you cannot bring your scaps together without lifting them, you either have a faulty movement pattern or a lack of mobility in at least one plane of motion. When you contract your lower traps and spinal erectors, your rib cage should lift up and your shoulders slide back (think down with the blades until you get a feel for it).

A perfect row should go like this:

1. No motion at the hips... this is not a glutes and hammies exercise. Keep the hips at approximately 90 degrees and don't rock.

2. Begin the motion by drawing the arms back without changing the bend in the elbows. The only way to do this is to draw your shoulder blades together. If you cannot pull the bar back a few inches without bending your arms, you are not getting those scaps moving.

3. Once the scaps are drawn together, pull back through the elbows, lifting the rib cage at the same time. Imagine you are doing a chin and try to lift that chest up as you pull the elbows back. This definitely requires motion in the thoracic spine.

4. Remember, this exercise is about squeezing the back and not about what the bar is doing. When you can't squeeze your back any harder the bar is as close to you as it needs to get. If you pull that bar to the belly as many people do and let the shoulders roll forward you are dropping that resistance right off the muscles you are trying to target.

I'm a stickler for form, partly because of the number of injuries I've seen caused by lousy form (had a few myself). The truth is, beautiful form yields beautiful results.

14.12. Using EMG to determine how effective an exercise is

EMG reflects the level of "electrical" activation of the muscle. As such it is a good indicator of how hard a muscle is contracting. However, it isn't perfect. Having done EMG research myself while in school (Ex phys labs) I know that there are inherent weaknesses to the methods. Nevertheless, if you want to know how much electrical activity is going on in a muscle (or at least a certain part of that muscle), EMG is the best we've got.

In a very real sense, EMG is a result of voluntary effort. So, the harder you try to contract the muscle, the greater EMG activity you will see, regardless of how heavy it is. This brings in a great deal of between-subject, and between-trial error in measurements.

EMG is also greatly affected by practice or coordination. A person who is not well practiced at a given exercise will often display erratic EMG read outs.

Fatigue also changes EMG readouts. The more fatigue there is, the greater the EMG amplitude.

Keep in mind as well that during eccentric contractions, EMG amplitude goes down significantly, yet at the same time, the eccentric portion of an exercise presents a greater stimulus for growth than the concentric portion.

EMG as a tool specifically relating to bodybuilding (muscle growth) is not an accurate indicator of the efficacy of a given exercise to induce growth. The efficacy of any exercise is determined by the load, the duration, and the condition of the tissue at the time the load is applied.

For the lats, the load is limited by your strength level and degree of stretch during loading. The duration is limited by your “strength-endurance”, and time in the stretched position. The condition of the muscle is determined by what you have done with your lats in the last 6 weeks or so.

So, speaking in general (i.e. simplified) and acute (i.e. one training session) terms, the heavier any lat exercise becomes, the more effective it will become. The more volume you do at that weight, the more effective that session will be. The greater the stretch experienced by the lat and the longer you hold it, the more effective that exercise will be. And finally, the longer its been since you trained your lats, the more effective that session will be.

On a personal note, nothing has been as effective as the weighted eccentric chins/pull-ups at the end of an HST cycle for putting on real thickness on my lats.

14.13. Treatment for sore elbows - and sore joints in general

Lying triceps extensions cause me elbow pain unless I am very careful about my weight progression.

Whatever you do, don't ignore elbow pain...it can become chronic and a real pain in the neck (and elbow of course).

If you are doing lying triceps extensions, switch to triceps pushdowns.

If triceps pushdowns also cause pain, switch to dips only.

If dips also cause pain do only kickbacks. You can't go very heavy with kickbacks but you can at least burn out a set or two.

If necessary, drop all direct triceps work until next cycle. Let your elbow heal up and start the next cycle VERY light on triceps and try to do as much burning sets as possible during the 15's and 10s.

After SD, take only the EZ bar and rep out 30 or 40 reps of skullcrushers/lying triceps extensions, and call it a day. Next time in, put on only the collars and do it just the same way. Nice and slow until either it burns too bad or all the blood runs out of your arms and they begin to go numb.

Next time in put on 2 1/2 lbs plates and rep them out again. What will happen is you will be able to rehabilitate your elbows. If I can do it, so can you.

Now, when you begin to go heavier (slowly and progressively), don't do skull crushers first. Warm up the triceps/elbows with heavy dips. I usually do a burn set of triceps kickbacks first, then do my dips, them do my skullcrushers. Even then, you should do a slow light burning set first. Then do a set of biceps first and bingo, pain is gone.

Complete rehab takes about 4-6 weeks of pretty light weight and a lot of reps. But its worth it.

The problem usually stems from the triceps actually becoming too strong for it's tendons. This happens when a guy gets used to training heavy with relatively low volume all the time. They also tend to use too little warm-up before going heavy.

If you really want to be able to do them again, give this a try...it will work. You'll still have to be careful to maintain the condition of your elbows over time, but at least you will be able to get in some great sets of skullcrushers as well.

14.14. If the elbows start hurting mid-cycle

You will have to take your triceps "out of the loop" so to speak.

You'll need to quit doing the pushdowns, and other direct triceps work until you fix your elbows. The thing about pushdowns, is that they usually don't hurt while you're doing them, but they foster the inflammation in the elbow that is at the core of our problem.

One way to check if you are having an inflammation problem in the elbow is to relax the arm, allowing it to hang straight at your side. Then take your finger of the opposite hand and press just above and down on your "elbow bone" (essentially this is the proximal tip of the ulna or "Olecranon process" of ulna where the triceps attaches), directly on the back of your arm.

With the triceps relaxed and arm straight, press your finger on the bone where the triceps attaches and see if there is any pain as you rub on the bone. If there is, you have inflammation. It may be mild or severe.

So, in order to get it to subside, you have to get rid of the inflammation first. This requires a lay off from direct triceps work. Usually wide grip pressing is ok, but any kind of extension should be avoided.

You may need to use an OTC anti-inflammatory such as ibuprofen if the inflammation/pain is significant.

So, keep training the rest of the body as you normally would, but take your triceps and put them on a rehabilitative schedule. Like I said, it may take 4-6 weeks to work your way up to any real weight on the EZ bar. But this is better than never being able to do them at all.

14.15. Movement range, or ROM

If you were to take somebody who hasn't trained before (or for a long time) and only have them do partial pull-ups, they would experience some growth in their lats.

However, they would experience better results if they started with full range contractions, and then, if necessary finished with partials after having increased the weight to where only partials were possible.

Even then however, I would suggest they add rows, making sure to pull the elbows all the way behind them, in order to hit the rear delts effectively.

So yes, you can do more weight and reps doing partials, but full range, weighted, eccentric pull-ups or chins by stepping off a bench or chair (or pushing yourself up with your legs) would be MUCH MUCH more effective.

But just doing partials for the sake of doing partials would not provide better results than full range progressively loaded reps.

15. How many sets and how to determine it

I suggest you do 2 sets per exercise during the 15s. Then do 2 sets during the first week of 10s, and 1 set during the second week of 10s. Then do 2 sets during the first week of 5s, and finish doing one set (after warm ups of course) during the last week of 5s. Always warm up first regardless of how many work sets you are doing.

The volume isn't necessarily supposed to decrease each minicycle. It often does, simply as a result of the increasing poundage’s and cumulative damage.

If you are doing HST properly you won't be able to just increase your volume at will. If you are doing HST properly you should already be using as much volume as you can reasonably handle and still feel healthy (no injuries etc).

HST builds strength sure enough, however, the actual manifestation of that strength depends on the recovery of the CNS (and other neuromuscular factors) from workout to workout. Sometimes a person will gain a little ground on their CNS recovery and their strength output will go up. Those who zigzag are more likely to experience significant "strength" gains mid cycle.

The size gains are dependant on what's happening to the tissue. This of course is dependant on the absolute load as well as the relative condition of the tissue at the time.

So, should you increase, maintain or decrease "volume" as the cycle progresses? It depends! I know how many people hate to hear that...but its true. Here is how you decide. Keep in mind that these factors are to considered “collectively”, meaning each factor must be weighted, not taken as an absolute indicator.

Increase volume if:

You are never sore
You are never tired
You are not growing

Maintain volume if:

You are slightly sore most of the time
You are tired enough to sleep well, but not so tired you lose motivation to train.
You are noticeably “fuller”

Decrease volume if:

You are experiencing over use pain, and strain symptoms in joints and/or muscles.
You are tired and irritable all the time, yet don’t sleep well.
Strength levels are significantly decreasing.

I said, “The number of Sets is determined by the minimum effective volume (this changes over time according to current load and Conditioning.)" You said, “I thought … that the expression of the hypertrophic genes was increased in proportion to time under tension, i.e. 'more is better' up to a rational point.”

If I understand correctly, you are concerned about the “minimum” effective volume part. Why should a person adjust the # of sets according to the minimum effective volume if “more is better”? Answer, because other factors such as Training Load and Training Frequency are inversely related to training volume. In other words, the higher the volume of exercise, the lower the Load and Frequency that can be effectively maintained over time. Likewise, the lower the training volume, the higher the Training Load and Training Frequency that can be effectively maintained.

It is just a matter of defining “minimum”. In this case, “minimum” means as many sets as you can do without having to reduce the Load from set to set and the without having to reduce the frequency beyond 48 hours.

Keep in mind that some signaling proteins are turned on by the combination of time and tension, sometimes referred to as the “time-tension integral”, and others are turned on primarily by the magnitude of tension without regard to time. Nevertheless, both signal-types will respond with a flattened out bell curve. There is a point where the signaling response to the stressor is at maximum. Further load and/or volume will not elicit a greater response.

So yes, there is "a point of growth/no growth". That point is determined by the Load, the Volume, and the level of Conditioning of the tissue. To understand this we have to look at what has to happen to the muscle during a workout in order to get it to grow.

In order of importance:
1) Satellite cells must be activated, differentiated, and fuse with existing fibers, donating their nuclei.
2) Mechanical stress must be transmitted to the sarcolemma (mechanotransduction) and contractile protein structures within the sarcomeres. This will trigger focal adhesion kinases (FAK) that in turn initiate the downstream signaling events leading to an increase the contractile and cytoskeletal protein expression/synthesis.
3) pH and oxidative stress must be acutely increased within the muscle fiber.

Focusing just on the workout, this pretty much sums it up. If #1 doesn't happen, you will not grow…ever. If number two doesn't happen, you will grow a little, but you will soon reach the limits of the sarcoplasmic/nuclear ratio and growth will stop. If #3 doesn't happen, you will still grow quite significantly, but the rate of growth might be enhanced or facilitated if #3 is achieved.

#1 is achieved when a certain level of microtrauma is experienced by the fibers. This is brought about by load, eccentric contractions, and to a much lesser extent, hypoxia (A.K.A. #3) When load, eccentric contractions and #3 occur, each fiber will produce and release muscle specific-IGF-1 (sometimes called mechano-growth factor) The IGF-1 in turn seeps out of leaky sarcolemmas and acts on nescient satellite cells to initiate #1. Microtrauma is rapidly reduced from workout to workout (Repeated bout effect) thereby limiting the effectiveness of any given load to induce further hypertrophy.

#2 is achieved by loading a muscle that is actively contracting.

#3 is achieved by contracting a muscle (doing reps) until you create an oxygen deficit and subsequent hypoxic byproducts (e.g. lactate and oxygen radicals).

The afore mentioned physiological principles of muscle growth are what we follow in order to ensure that 1,2 and 3 happen.

1 set is not necessarily "better" than 3 sets.

As far as muscle hypertrophy is concerned, high duration of load is best. The cellular signals that are initiated by strain on the structural and contractile proteins of the cell are increased as time under load increases. If it weren't for the involvement of fatigue in performing the actual reps and sets, you would be better off doing tons of sets and reps.

HST uses lower numbers of sets because the muscle is trained much more often. So, the muscle isn't actually loaded for less time, its just that the loading is more evenly spread out over time to keep the signal more constant. If there are any factors that allow a person to do more sets per workout, he/she should do them.

From what other research there is on the time course of genetic expression in response to overload, it is clear that we don't even come close the amount of time needed to elicit the greatest hypertrophic effect. But what are you going to do? We have to lift the weight a lower it over and over in order to overload the muscle. From the overload research, I personally feel longer time under tension is better. But you have to balance that with CNS fatigue, and absolute load.

More sets with heavier weight is better than fewer sets with less weight. But there is a limit to our exercise tolerance. So you have to figure out a way to get as much loading of the muscle as you can, as often as you can, and still be able to constantly increase the load over time, without burning out or getting injured.

Keep in mind that HST does not dictate that the total volume (i.e. number of sets per body part) over the course of the week should be lower than what a person is accustomed to using with traditional routines. HST only advises that the volume be evenly distributed over more workouts in the same time period. So if you are used to doing 9 sets for back on "back day" using a traditional routine (e.g. training each body part once per week), HST would have you do 3 sets at a time for 3 different workouts.

Obviously, a guy who is used to doing something like 12 sets for back once per week, is not going to gain much by dropping to doing only 1 set for back even if it is 3 times per week. He went from 12 sets to 3 sets per week. Not only that, but HST would have him use submax weights most of the time where he is obviously plateaued and used to doing 100% max weights (Not true 100%, but 100% with the fatigue that inevitably accumulates by the 3rd set). This is just too great a reduction in training to provide him with significant gains. The key here of course is Strategic Deconditioning, which would then allow him to begin growing again, with less "average" weight and volume, but higher frequency.

Well, for me, 2 sets is enough on most bodyparts. But then again, with body parts like back, I will usually do 3 sets at different angles of pull and grip widths.

But the amount of volume each person is used to varies. I am not saying that you have to train to your volume limit. I'm just saying that if 1 set isn't enough, do another. Do too much and you'll begin to get progressively weaker, and/or injured and you will lose your desire to train.

At first, you won't know how much is too much and how much is too little. So, start with 1 work set per body part per exercise, and work up from there.

Sometimes, you will find that you need to do more during the lighter workouts, and fewer sets during the heavier workouts. I hate to say this, but play it by ear, while you stick to the principles. You have to learn what it feels like. You have to actually experience growth from a series of workouts to be able to associate the specific feeling of "enough" work with subsequent growth.

But just a hint, you will feel whether the set is a good one or not before you finish the set. You will literally feel the strain of the weight on the muscle itself. You have to look past the effort required to lift it, and try to feel the mechanical strain on the muscle. "Off the record" it is a type of pain, kind of like the pain you feel when you stretch a muscle. Its mild, but it is in the "belly" of the muscle. When your done with the set, the muscle will pump, and in the morning you will be a little stiff in that bodypart. I hate to talk in such subjective terms like this but this is where experience actually means a hill of beans.

Yes, you can damage a muscle to such a degree that it doesn't work properly 36-48 hours. The thing is, this type of damage isn't necessary to get it to grow. In fact, you can get necrotic fibers (dying fibers) if the damage is too severe. So too much of a good thing is a bad thing.

It isn't absolutely necessary to be able to "feel" this in the muscle. It is just a way of judging something that is inherently hid from view.

Trial and error is just as good as "feeling it". If you get so sore that you can't move, you've obviously overdone it. You will recover, but it isn't necessary to cause that much damage. The serious damage is usually the result of too much too soon after a layoff. Too much burn won't cause it. It is usually the result of super high volume when one is not accustomed to the weight nor volume.

15.1. Time under load (TUL) - how much does it matter when loads are increasing

People often make the mistake of overthinking this. It doesn't take much time for a given (effective) load to trigger signals inside muscle cells to start growing. In a sufficiently deconditioned muscle, only 1 set of 10-12 reps is sufficient to cause measurable anabolic changes.

However, the more you train, the more resistant your muscle becomes to the training stimulus. We've know this for years, and recently we have some good research to demonstrate it by measuring signaling molecules in trained and untrained exercisers after a single bout.

So, the first solution to the problem of becoming resistant to the lifting stimulus is to create a more potent stimulus by lifting more weight. You can do this until you reach your strength limits.

Another solution is to lift the same amount of weight a bit longer by doing more sets and/or reps. This works to a point, but soon (2-3 weeks) will fail to produce growth once again.

The problem arises when guys continue to increase volume because they are at their strength limit. This begins to drain the CNS and recovery takes longer and longer. Eventually, they have to rest so long between training each bodypart that they are unable to produce consistent gains...the stimulus is just too infrequent.

I won't go into just how deep the misinformation and misunderstanding runs in bodybuilding. Suffice it to say, VERY few people who are serious about lifting understand how muscle grows and how best to train for growth. They have some idea of course, but there is enough doubt in their minds that they continually change their methods in hopes that it will work better. Eventually, they will experience gains once in a while, but because they do not understand the true cause and effect of those gains, they misattribute the gains to something else, usually something coincidental to the period during which they made gains. This leads to all kinds of false notions about what works and what doesn't.

In HST, the reason volume tends to decrease as load increases, is **to spare the CNS and allow more frequent training**. It has NOTHING to do with what people call periodization. If a young guy can handle 2-3 sets during the 5's, and still feel good for the next workout, go for it! Unfortunately, most guys can't do this, and they experience dramatic results nonetheless with 1 or 2 sets. The gains they *might* experience by doing one more set would most likely not be noticeable as long as frequency is high, anyway.

I can't really tell you how you should feel after a set. If your muscle is resistant to growth, you will have to do a little more to get it to grow, and hence, you will feel more tired. However, if your muscle is sensitive to the training stimulus, you can do less and still grow and hence you will not feel nearly as tired after an effective workout.

I would suggest that you try to do 2 sets during the 5s if you don't "feel" much from doing only 1 set. I do 2 sets on the basic movements and then I might throw in another exercise of 1 or 2 sets (depending on the muscle group) just to top things off.

Many people will also be stronger on the second set than on the first set of 5s. For this reason a second set of the same exercise would also be recommended.

16. When do most people see their gains, ...during the high reps or low reps

This is a very subjective topic, and some will say they see greater gains during 15s and 10s, while others will say during the 5s and negs. The glycogen-depleting high rep phases of the 15s and 10s necessitate a higher carb and calorie intake if you want to stay in a surplus to build muscle. During the lower volume, lower rep phase of 5s, you may decrease carbs if you notice fat gain. People who notice most of their gains during 5s most likely didn't eat sufficiently during 15s and 10s.

Please remember that the stimulus for growth has nothing to do with any specific rep count or rep range, but has everything to do with the frequency, progression, and effective SD as per the HST principles. So in theory you should be growing at a constant rate throughout the cycle, but this doesn't always happen due to the way people eat and implement the HST program.

- Blade

Here are a few things to think about:

1) The leaner you are, the easier it will be to see gains.

2) The better you eat (proper diet for gaining muscle), the greater the gains will be. (This cannot be emphasized enough)

3) The better the person has done his/her SD, the faster they will see gains.

4) The more muscular the person already is, the easier it will be to see gains.

So all of these factors will have an effect on what people see in the mirror when they begin HST.

I personally usually "feel" sore by the 3rd workout of the first week of 15s. I usually see an increase in size/fullness and slight increase in bodyweight (1-2 pounds) by the middle of the second week of 15s. Keep in mind, I really know how to SD!

17. Zig-zagging or undulating loads, vs. linear increments

When setting up your HST cycle with the proper increments, you may notice that the first workouts of a new microcycle (rep range) uses lighter loads than the last workouts of the previous microcycle. Or if your 15RM and your 10RM aren't that far apart, you will be repeating some weight loads as you go from block to block. This is what we call "zigzagging". I have yet to see a difference in gains from those allowing zigzagging of their weights, and those who don't.

Zig-zagging is fine as long as the general trend over time is upwards. If not, the conditioning of the muscle (which is to say, the resistance of the tissue to the mechanical strain of a given weight load) will catch up with you, and your growth will plateau. Growth with a given load will probably only produce gains for about 4-6 weeks. The lighter the load, the shorter the amount of time it will be able to induce muscle growth.

You can go about 7-14 days before you begin to lose some of the adaptation to previous higher loads. So one week will not cause you to lose ground. But by the end of two weeks with lighter loads, your muscles will begin to adapt to those lighter loads.

Keep in mind that these time frames are "soft" meaning that there are many variables that can affect things. But in general, 7-14 days of lighter than previous loads will not allow that much un-adaptive response. Utilizing changes in rep speeds and modes of contraction will also make the lighter loads more effective.

Do not sacrifice the size of the increments to reduce the overlap/zig-zag - it is better (to some extent) to repeat two (or even three) workouts at the same loads. Some people's RMs are so close together that this is needed.

The reason HST works even though sometimes the weight zigzags is because of the frequency. HST dictates that you train the same muscle every 48 hours, or at least 3 times per week. Most other training programs dictate that you allow what they call “full recovery” before training the muscle again, which is usually 6-7 days rest for that muscle.

If you were to zigzag your weights on a traditional routine the way HST allows, you would have to decrease your weights for at least 3 weeks just to accommodate the weight increments. While using HST, zigzagging your weights only requires 1 week getting back to your previous weight loads. If using a traditional routine you wouldn’t train at all during this period! A little CNS recovery during the zag doesn’t hurt anybody either.

If you are uncomfortable with the beginning weights for small muscle groups such as shoulders biceps triceps etc, simply decrease the number of increments and use each weight load twice. An example of this:

Mon - using 35 lbs
Wed - using 35 lbs
Fri - using 40 lbs
Mon - using 40 lbs
Wed - using 45 lbs
Fri - using 45 lbs

That way the weight is still increasing each week, and everybody is happy.

17.1. Why not set up the cycle by starting at your 5RM, and then working backwards in 5% increments?

I hesitate to use the term "micro-cycle" simply because it gives people the wrong impression about what HST is, but for ease of communication I'll use it.

Starting at your 5RM and working backwards is essentially what people do when they try to avoid zigzagging the weight as they work their way along. The only problem you run into is not knowing how many reps to use each workout. You will have to guess how many reps is good for whatever weight you are using that day.

Then you will be tempted to use "instinctive training", which dictates that you do whatever number of reps or sets and exercises you feel like doing that day. Its kind of a slippery slope...Pretty soon you will be training "instinctively" all the time. Unfortunately, your muscle tissue doesn't have instincts, nor does it communicate to our brains concerning its hypertrophic activity. It only communicates fatigue and/or pain...both being neurological factors.

Finding your 15, 10, and 5RM is a way of knowing where you are. By having these figures, you know what you are capable of lifting at various rep ranges. This allows you to plan your training to ensure consistent increases in load.

The 15's serve another purpose however and that's to address any chronic pain issues in the joints and to prepare them for more frequent heavy loading later.

There is nothing magical about using 15s, 10s, and 5s. Some people have used 15,12,10,8, and 5s, changing reps each week. This creates quite a bit more fatigue in well-trained lifters though and can begin to interfere with their training.

Finally, there isn't anything bad about repeating weights over a short period of time, say 2-4 weeks. Sure, that particular load will show diminishing effects over time, but it is still causing an effect as long as your frequency is high enough. Also, due to the delayed recovery pattern of the CNS, most people experience significant strength gains when the weight and reps drop periodically, allowing additional recovery of the CNS. This however isn't required for growth, it only makes the experience more enjoyable for many people.

There are several people here who have opted to get rid of the zigzagging. Their results are mixed. Most report that they end up using a greater percentage of their RMs throughout the entire cycle. Due to the high frequency, this has produced more fatigue than they expected and didn't help their results any.

So bottom line - feel free to adjust your weights so that there is no zigzagging or repeating of the weights. There is nothing contraindicated with that "technically speaking". However, it is unlikely you will experience greater results than if you simply base your weights on your 15,10 and 5RMs. This is because the frequency of training negates the effects of repeating a weight now and then.

- Bryan

HST is laid out in 2 week blocks of 6 workouts (=increments) because this is what it generally takes you to go from one RM to another (e.g. from 15RM to 10RM, or from 10RM to 5RM). This doesn't apply to everyone though, so in order to keep the increments as linear as possible (reduce zig-zag) you can, as mentioned, repeat workouts. The other option is simply to reduce the estimated 15RM and/or 10RM, then make up the slack on the bottom end by repeating workouts (to avoid starting out at too light weights for your liking). Since the object of 15s is to induce lactic acid, you can increase the metabolic work by slowing down the reps to compensate for the lower load.

Again - the frequency and progression after SD is what makes you grow, not hitting any predetermined RM - which in itself is affected by a number of factors (almost) unrelated to hypertrophy.

- Blade

17.2. Which is better - zig-zagging or repeating loads

Zig-zagging will result in less fatigue and more strength without losing ground size wise.

Repeating workouts isn't necessarily bad either. I recommend you repeat your 5RM for a couple additional weeks (6 workouts) at the end of the cycle (if you can't do negs) just to get as much growth out of that weight load as possible before you SD.

I seriously doubt this answer is going to satisfy you. You're simply going to have to try it both ways on two different cycles to see which way you prefer. Do 1 entire cycle using your 15, 10, and 5 RMs. DO NOT ESTIMATE THEM! Find them a week in advance using each and every exercise you plan on using. Monday find your 15s, Wed find your 10s, Fri or Sat find your 5s.

Then do another cycle where you only use your 5RM and adjust your weight increments so there is no zigzagging, repeating weights where necessary.

Then come back and tell us which one you like better and why.

18. Hyperplasia - formation of new muscle fibers, yes - it is possible

Note: There is still an ongoing debate in the scientific community of whether hyperplasia occurs in humans. The evidence that it does happen, is heavily criticized by others. We encourage people to do form their own opinions based on the available research.

Quoting from Kelly (Kelley 1996), "The results of this investigation are similar to a recent narrative review that concluded that muscle fiber hyperplasia 1) consistently occurs as a result of chronic stretch, 2) rarely occurs with overload in the form of compensatory hypertrophy, and 3) has produced mixed results when overload in the form of exercise is employed."

You will hear the term "compensatory hypertrophy" used in stretch overload studies. What this means is that the stretch overload is progressively applied, rather than all at once (i.e. chronic stretch).

What this tells us is that fiber splitting is dependant on the degree of strain (strain = load + microtrauma) experienced by the fibers as a factor of time. In compensatory hypertrophy models, the tissue is allowed to adapt to a lighter load before a more severe load is applied. With chronic stretch the max load is applied all at once and isn't changed throughout the observation period.

Intermittent stretch is similar to chronic stretch in that the max load is applied all at once, however, it is "intermittently" applied. So it is applied then it is removed, and then reapplied, etc. This has tended to result in hypertrophy without fiber splitting.

It used to be thought that muscle fibers would only split after they have hypertrophied, almost as a result of the hypertrophy itself. But a recent study which I just read the other day but can't seem to find at the moment, demonstrated fiber splitting can occur before fiber hypertrophy.

1: Kelley G. Mechanical overload and skeletal muscle fiber hyperplasia: a meta-analysis. J Appl Physiol. 1996 Oct;81(4):1584-8.

2: Antonio J, Gonyea WJ. Muscle fiber splitting in stretch-enlarged avian muscle. Med Sci Sports Exerc. 1994 Aug;26(8):973-7.

3: Antonio J, Gonyea WJ. Progressive stretch overload of skeletal muscle results in hypertrophy before hyperplasia. J Appl Physiol. 1993 Sep;75(3):1263-71.

4: Antonio J, Gonyea WJ. Role of muscle fiber hypertrophy and hyperplasia in intermittently stretched avian muscle.

J Appl Physiol. 1993 Apr;74(4):1893-8.
"Title: Effects of anabolic steroids on the muscle cells of strength-trained athletes.

Researchers: Kadi F, Eriksson A, Holmner S, Thornell LE Department of Integrative Medical Biology, Umea University, Sweden.

Source: Med Sci Sports Exerc 1999 Nov;31(11):1528-34

Summary:

Athletes who use anabolic steroids get larger and stronger muscles. How this is reflected at the level of the muscle fibers has not yet been established and was the topic of this investigation. METHODS: Muscle biopsies were obtained from the trapezius muscles of high-level power lifters who have reported the use of anabolic steroids in high doses for several years and from high-level power lifters who have never used these drugs. Enzyme-immunohistochemical investigation was performed to assess muscle fiber types, fiber area, myonuclear number, frequency of satellite cells, and fibers expressing developmental protein isoforms.

RESULTS: The overall muscle fiber composition was the same in both groups. The mean area for each fiber type in the reported steroid users was larger than that in the nonsteroid users ($P < 0.05$). The number of myonuclei and the proportion of central nuclei were also significantly higher in the reported steroid users ($P < 0.05$). Likewise, the frequency of fibers expressing developmental protein isoforms was significantly higher in the reported steroid users group ($P < 0.05$). [these researchers found embryonic fiber development in the nonsteroid using group as well...just not as much as in the group using.]

CONCLUSION: Intake of anabolic steroids and strength-training induce an increase in muscle size by both hypertrophy and the formation of new muscle fibers (hyperplasia). We propose that activation of satellite cells is a key process and is enhanced by the steroid use. The incorporation of the satellite cells into preexisting fibers to maintain a constant nuclear to cytoplasmic ratio seems to be a fundamental mechanism for muscle fiber growth. Although all the subjects in this study have the same level of performance, the possibility of genetic differences between the two groups cannot be completely excluded."

So, there is really no argument anymore among groups up to date on their muscle physiology...that includes people into HST.

18.1. What percentage of muscle growth is due to hyperplasia, and what percentage is due to hypertrophy?

It depends on the type of training stimulus.

Ultimately, ALL permanent muscle growth is due to hyperplasia. This is evidenced by the fact that biopsies of bodybuilders often don't show any difference in fiber CSA than non-trained individuals. In other words, the increase in muscle size is attributed to a greater number of fibers.

Muscle fiber hypertrophy is temporary and only remains as long as the loading is consistent. When training stops for long periods, hypertrophy will reverse. Nevertheless, if training has been maintained for years, some size stays until sarcopenia sets in later in life.

18.2. Will HST promote hyperplasia more than traditional programs?

The average serious bodybuilder will experience hyperplasia whether they try to or not.

Hyperplasia is more likely to occur when the loading stimulus is abrupt and frequent (or constant).

HST will contribute to hyperplasia more so than other programs insofar as the muscle is loaded heavily (5s-negs) and frequently. Microtrauma seems to be highly correlated with hyperplasia.

Hyperplasia does not interfere with hypertrophy. Not only that, but hyperplasia is preferable to hypertrophy.

A muscle's size has no real bearing on hyperplasia. It is the stimulus and how it is applied that dictates when and to what extent hyperplasia occurs.

18.3. If hyperplasia is a fact, why shouldn't we embrace the notion that "muscle shaping" is possible ? Perhaps we can create a "peak" in the biceps after all?

You can't control where the most tension will be experienced in a muscle when the sarcomeres are arranged in series. It's like hooking a bunch of identical rubber brands together, then pulling from each end and expecting anyone rubber band to experience more tension than any other. The load will be evenly distributed from end to end over all the rubber bands equally. That is why you can't "shape" a muscle with training. Why do you think Synthol is so popular among IFBB pros?

(Just for the sake of detail, the fibers arranged towards the distal end of the muscle converge on the tendon. As a result of their converging orientation there is often more microtrauma experienced in those fibers than other deeper and/or more proximally oriented fibers.)

But don't lose hope, all you need to do to have a bigger peak on your biceps is build bigger biceps.

19. Strategic Deconditioning, ...relation to the Repeated Bout Effect

Also read the Strategic Deconditioning (http://www.hypertrophy-specific.com/hst_artcls_stratdecon.html) article.

Once you have maxed out your voluntary strength levels, growth will stop. It may take several weeks for it to stall. Once this happens, HST incorporates Strategic Deconditioning in order to lower the level of conditioning of the muscle tissue. This is necessary in order to use "submax" weights.

Is the purpose of SD to cure overtraining? No. Research has shown a week is not long enough to reverse the symptoms of overtraining. If you have been properly managing your training volume, you wont be overtrained anyway. If you are, you should adjust your training levels. [Note] Overtraining is not necessary for hypertrophy. Methods such as "over reaching" are used to increase performance, not hypertrophy.

The efficacy of the stimulus is relative to the state of conditioning of the "tissue", not voluntary strength levels. Of course, a muscle's cross sectional area is related to the amount of force it can generate. But a load able to induce "microdamage", and thus hypertrophy, doesn't have to be at the top of the individual's voluntary strength output. It only has to be heavy enough to induce microtrauma to the tissue. This is relative the state of conditioning, or the tissues level of resistance to further damage.

Granted, any form of exercise will alter patterns of protein synthesis and degradation. But a muscle cell can only grow significantly if some degree of tissue microtrauma occurs. This is brought about when the load is sufficient to strain the cell membrane and its integral structural and contractile protein structures. This signals cellular messengers of various kinds including calcineurin and MAPKs and their associated nuclear counterparts.

Now, if you are training without the aid of exogenous hormones, you will eventually come to the limit of your voluntary strength if you have used the principle of progressive overload. Obviously, at this limit you will be training at 100% effort. And essence, your progress has also reached its pinnacle. The muscle is absolutely tuff as shoe leather (so to speak) and you can no longer add more weight to get it to grow further. What do you do? Well, you can do what thousands of people do and simply beat your brains out using the same weight workout after workout for months or even years on end. As long as your level of conditioning (resistance to microtrauma) stays the same, and the level of weight you use stays the same, your muscles will stay the same. Big or small, they will stay the same.

SD is simply a method that allows (not "tricks") your muscles to continue to grow, using weights that your muscles have seen before. The method is simple, the science is complicated, the results are significant.

P.S. If you are afraid of using baby weights, check your ego at the door, or use the heaviest weights you can lift from day one an be satisfied with your results, in other words, stop looking for anything better.

I have never claimed that a period of Strategic Deconditioning lasting 7-12 days would completely revert your muscles to an "untrained" state. I have spoken frequently of the rapid training effect or repeated bout effect. Some protection seems to last for a very long time. Still, 7-12 days of complete rest does appear to cause some reversal of the adaptations to training. And from the application, it appears it is sufficient to allow one to start growing again, once gains have stopped with a given weight. Hopefully through the forum and other articles and interviews people have come to learn that SD is more than just a break from training.

Someone who has trained for an extended period of time using 5s/negs at loads of 85%+ of 1RM would often require upwards of 2 weeks SD to ensure sufficient reversal. More advanced athletes have successfully extended the HST cycle with 5s and negatives with the addition of drop sets (refer to the drop set thread), but if this is your first time doing HST I suggest you do the regular 6-8 week cycle as outlined on this website.

****

The effectiveness of tension to elicit hypertrophy depends on the condition of the muscle at the time the tension is applied. So, after a period of regular heavy training, the muscle becomes resistant to further growth. I don't think anyone needs an article in a medical journal to tell them that.

So the only solution to overcome the progressive resistance to tension is to progressively increase the tension. This works perfectly…for a while. The problem is that once you have "maxed out" your strength you can no longer apply a consistently effective stimulus (i.e. tension) for hypertrophy. Once this happens you plateau. You are dead in the water. 99 out of 100 lifters in any given gym will not make any significant muscle growth from one month to the next because of this phenomenon, despite their efforts to constantly get stronger. So all the end up doing is busting their butt each and every workout just to stay the same. This effect is so tangible that it eventually leads to a type of paranoia of getting smaller should they ever stop killing themselves in the gym. In a word, this is modern natural bodybuilding…ok, 3 words.

The solution is to lower the resistance to the stimulus. This is called Strategic Deconditioning in HST. When Strategic Deconditioning is properly applied to ones training, growth can resume, even when using weights previously used.

Is there research to demonstrate this scenario? Yes, but it isn't exactly coffee table reading. The HST book however will not force you to rely on my word. It will contain a full treaty of the research behind HST.

Until the book is ready, you'll have to just trust me and use other people's results as evidence. If not, that's ok too. Just as long as you are growing with whatever you're doing you're fine...for the time being anyway.

19.1. Isn't SD just a form of "periodization"?

There is one traditional concept with its associated methods and practices that often make HST appear to be like previous programs. That is the concept of "periodization".

We will only briefly discuss the topic of periodization, as only a brief treatise will be sufficient to show the differences between periodization and HST. For more detailed discussions of periodization you are advised to read "Super Training: Special Strength Training for Sporting Excellence" by Siff & Verkhoshansky, "Special Strength Training" by Verkhoshansky, "Fundamentals of Sport Training" by Matveyev and "Science and Practice of Strength Training" by Zatsiorski.

Traditional concepts of periodization are based on methods used to manipulate intensity (i.e. work and/or load), volume and frequency in order to manage CNS fatigue and adaptability in athletes. To date, the art of periodization has entered the mathematical age and significant progress is being made in modeling systems designed to predict CNS fatigue and changes in the individual's fitness level. (1,2,3). Once an individual familiarizes him or herself with the true concept of periodization, they will immediately see the difference between Strategic Deconditioning and Periodization for strength training.

For example, here are a few differences between SD and Periodization:

- SD is used to decrease fitness level (A.K.A. conditioning).
- Periodization is used to increase fitness level.

- SD is used to increase the micro trauma associated with training.
- Periodization is used to decrease the trauma associated with training.

- SD is used to reduce work capacity.
- Periodization is used to increase work capacity.

- SD is applied irrespective of the need for "rest".
- Periodization is applied according to the need for rest.

- SD is not based on “peaking” performance.
- Periodization’s sole purpose is to allow the athlete to peak (strength/performance) on a specific date.

19.2. The weights feel so heavy and I'm so sore on the first couple of workouts after SD!

You will often experience an increased *sensation* of weight and/or effort, but the actual strength generating potential of the muscle does not diminish significantly.

What happens is the CNS (Central Nervous System) is also deconditioned. Perceived exertion will increase as a result. Yes, this may even be noticeable during everyday activities.
The opposite of this effect is seen when people say, "Since I started exercising I just have so much more energy!" They don't really have more energy, it's just that their CNS has up regulated itself to better cope with the increased demands for exertion during exercise. This lowered CNS activation threshold level spills over to everyday activities and makes them feel better, more energetic.

If you feel really sore, this is actually GOOD news! what just happened to you is that you successfully lowered your minimum effective weight. That is perfect! This allows even less weight to be used and still grow.

Now you should take note of this and plan your next cycle accordingly. Don't lower your 15RM, just lower your **starting** weight next cycle (make sure your SD is just as effective/long as well). This allows greater increments during the 15s, and an overall greater progression of weight used over the entire cycle. Once again, perfect!

All the pain won't hurt your gains. But it can draw unwanted attention when you walk like you're 90 years old.
Though I wish I had more time to fully address your questions here, they will be more fully addressed in one of the HST books. In the mean time, we will try to use the most representative research of SD followed by retraining as we can find (with time constraints). The following study by Hortobágyi and colleagues (Hortobágyi, 2000) is one of the best I have found to date, with special reference to the adaptive changes to both deconditioning and retraining. Here is the full reference:

Hortobagyi T, Dempsey L, Fraser D, Zheng D, Hamilton G, Lambert J, Dohm L. Changes in muscle strength, muscle fiber size and myofibrillar gene expression after immobilization and retraining in humans. The Journal of Physiology 2000 April 1;524 Pt 1:293-304.

For those of you familiar with Medline the full text version is FREE.

But here are some important points brought to light by this and similar studies.

Deconditioning (including complete immobilization or even zero gravity)
1) In vivo studies suggest that a fall in the rate of protein synthesis rather than an increase in protein degradation is the predominant mechanism of atrophy at least during the first few weeks of immobilization in rats (Booth, F. W. & Seider, M. J. (1979). Early changes in skeletal muscle protein synthesis after limb immobilization of rats. Journal of Applied Physiology 47, 974-977) as well as in humans (Gibson, J. N. A., Halliday, D., Morrison, W. L., Stoward, P. J., Hornsby, G. A., Watt, P. W., Murdoch, G. & Rennie, M. J. (1987). Decrease in human quadriceps muscle protein turnover consequent upon leg immobilization. Clinical Science 72, 503-509)

2) In his pioneering work D. F. Goldspink (Goldspink, D. F. (1977). The influence of immobilization and stretch on protein turnover of rat skeletal muscle. The Journal of Physiology 264, 267-282) demonstrated that when the extensor digitorum longus of young rats was chronically stretched while immobilized, the muscle actually underwent hypertrophy. Although this chronic stretch may not be qualitatively equivalent to dynamic muscle lengthening, there is now cumulative evidence to suggest that strength gains (Dudley et al. 1991), muscle hypertrophy (Hather et al. 1991) and myosin heavy-chain (MyoHC) gene expression are specific to the type of mechanical loading (Booth & Thomason, 1991), with greater adaptations occurring if the mechanical stimulus contains muscle lengthening or eccentric contractions compared with concentric contractions.

3) Even though strength loss correlated with muscle fiber atrophy ($r = 0{\cdot}75$), the magnitude of strength loss (47 %) was almost 4-fold greater than the magnitude of fiber atrophy (11 %) [with 3 weeks of immobilization]

4) Greater type II than type I muscle fiber atrophy occurred after elbow immobilization in the triceps brachii (30 vs. 25 %, MacDougall et al. 1980), in the vastus lateralis after an 11 day space flight (36 vs. 16 %, Edgerton et al. 1995), lower leg suspension (12 vs. 6 %, Berg et al. 1993) and knee immobilization (19 vs. 15 %, Veldhuizen et al. 1993). In contrast, others reported that atrophy was greater in type I than type II fibres (46 vs. 37 %, Sargeant et al. 1977; 26 vs. 1 %, Häggmark et al. 1981). In the present work type I and type II fibres atrophied to about the same extent, 13 and 10 %.

Retraining
1) In the current work, resumption of spontaneous activity (i.e. just being up and around) for 2 weeks after the cast was removed resulted in about 90 % recovery of muscle strength and 95 % recovery of muscle fiber size. [That's a 10% increase in muscle size in only two weeks WITH NO TRAINING!]

2) 3 weeks of immobilization significantly and uniformly reduced type I, IIa and IIx muscle fiber areas by 13, 10 and 10 %, respectively…Hypertrophy of type I, IIa and IIx fibres relative to baseline was 10, 16 and 16 % after eccentric and 11, 9 and 10 % after mixed training (all $P < 0{\cdot}05$) and these gains were significantly ($P < 0{\cdot}05$) greater than the hypertrophy after concentric training (4, 5 and 5 %). In addition, the type IIa and IIx fibres were significantly larger after eccentric than after mixed training

3) We observed a significantly faster rate of strength recovery when the exercise program contained eccentric contractions. Muscle strength recovery after 4 weeks was complete when subjects exercised with concentric contractions, whereas recovery to initial levels occurred about 2 weeks faster when pure eccentric contractions were used or added to concentric contractions…Not only was the rate of strength recovery faster with pure eccentric or mixed eccentric and concentric contractions but the strength gains and muscle fiber hypertrophy were also substantially greater compared with pure concentric contractions, confirming most (Komi & Buskirk, 1972; Dudley et al. 1991; Hather et al. 1991; Hortobágyi et al. 1996a, b) but not all (Jones & Rutherford, 1987; Smith & Rutherford, 1995) prior reports. [We are not so interested in strength, but this info is demonstrative of the importance of eccentric training.]

Now this doesn't speak much towards RBE, but it does demonstrate how muscle tissue responds differently after SD than it does during training. It's a sliding scale of sensitivity and hypertrophy. When muscle is at its highest sensitivity, it grows most rapidly, and likewise, it grows more resistant to further growth at the same rate. I have other studies on RBE that I may be able to post later.

1. McHugh MP. Recent advances in the understanding of the repeated bout effect: the protective effect against muscle damage from a single bout of eccentric exercise. Scand J Med Sci Sports. 2003 Apr;13(2):88-97.

2: Thompson HS, Clarkson PM, Scordilis SP. The repeated bout effect and heat shock proteins: intramuscular HSP27 and HSP70 expression following two bouts of eccentric exercise in humans. Acta Physiol Scand. 2002 Jan;174(1):47-56.

3: Proske U, Morgan DL. Muscle damage from eccentric exercise: mechanism, mechanical signs, adaptation and clinical applications. J Physiol. 2001 Dec 1;537(Pt 2):333-45.

4: Stupka N, Tarnopolsky MA, Yardley NJ, Phillips SM. Cellular adaptation to repeated eccentric exercise-induced muscle damage. J Appl Physiol. 2001 Oct;91(4):1669-78.

5: McHugh MP, Connolly DA, Eston RG, Gleim GW. Exercise-induced muscle damage and potential mechanisms for the repeated bout effect. Sports Med. 1999 Mar;27(3):157-70.

6: Brown SJ, Child RB, Day SH, Donnelly AE. Exercise-induced skeletal muscle damage and adaptation following repeated bouts of eccentric muscle contractions. J Sports Sci. 1997 Apr;15(2):215-22.

7: Brown SJ, Child RB, Day SH, Donnelly AE. Indices of skeletal muscle damage and connective tissue breakdown following eccentric muscle contractions. Eur J Appl Physiol Occup Physiol. 1997;75(4):369-74.

8: Ebbeling CB, Clarkson PM. Exercise-induced muscle damage and adaptation. Sports Med. 1989 Apr;7(4):207-34.

20. Training for fiber type

Also read the Training for Fiber Type - article by Bryan Haycock (http://www.thinkmuscle.com/articles/haycock/hst-07.htm).

You can't isolate fiber types in training for hypertrophy (or strength for that matter). All the notions of training for different fiber types is a misunderstanding of how muscle fibers are activated, or recruited.

Slow twitch fibers are activated first, followed by fast twitch fibers in any muscle contraction. This is a function of small "motor units" (slow twitch fibers) being activated first for small precise movements/contractions of low force, followed by large motor units (fast twitch fibers) for large and powerful movements of relatively high force. All fibers are generally activated in a muscle at 85% of 1RM, but this may actually be as low as 50% of 1RM for some muscle groups.

So the argument about training specifically for different fiber types is wrong from the very foundation. It is simple misinformation based on a lack of understanding about motor units and their recruitment patterns. What those programs you have come across aimed at training for specific fiber types are actually doing is training for different metabolic pathways (e.g. ATP>Glycolytic>beta-oxidative).

In order to make a muscle grow you must apply high forces. This requires high loads. This requires that the body activate ALL fiber-types/motor-units during a contraction that is against sufficient load to induce microtrauma and hypertrophy.

ANY biomechanics or kinesiology text book will explain in great detail the correct properties, functions, and recruitment patterns of different fiber types and motor units. Anyone with this basic knowledge of functional anatomy could not possibly claim that isolation of fiber types is possible with loads required for muscle hypertrophy. In essence, it would be like saying that you could rev a motor at 1,000 RPM without revving it at 500 RPM.

If you have a high makeup of slow twitch fibers, all that changes is the relative %ages of 1RM you can do a certain amount of reps with. Just lay out your HST program, get your diet in order, and you will grow....day by day. Just like everybody else.

20.1. ...but there is still a lot of controversy over this

In response to:

"A. Jones, in particular, has argued that an individual's muscle fiber recruitment and fatigue characteristics are largely genetically determined, so that there may exist an optimal TUL for each exercise, where one's musculature receives optimal growth stimulation (30). In fact, MedX technicians often incorporate the use of a "Fatigue Response Test" as a way of finding out one's particular fatigue and fiber-type characteristics. More recently, this theme has been repeated by several other authors who contend , "that (even) the concept of double progression (increasing weight and reps) is actually mistaken. Instead one should find the signature TUL for a given person in that movement and then carry out single progression. That is, progress weight at a fixed TUL as is determined by a particular fiber type and MU recruitment pattern. Once you know the ideal TUL, single progression (increasing resistance) appears to be the way to rapid gains."

- Gus Karageorgos

I've been there done that and everybody threw a fit and said I was blind (and presumably stupid) and that I was saying things contrary to what everybody already knows and accepts about fiber types and training.

I am addressing this very issue in the next HS:Report so I will only touch on it briefly here.

First of all, if Gus Karageorgos is "GusK", I thoroughly enjoy reading his articles. I really like the way he writes and wish he would donate something to ThinkMuscle. My comments here have nothing to do with him or his views on fiber types.

Here is a statement as simple as I can make it on fiber types and training: “All muscle fibers undergo hypertrophy with increasing loads.”

That’s as simple as I can make it. There is no need to train “according” to some presumed ratio of fiber types that one is guessing they have. Besides, fiber types (MHCs) are “induced”. The type of MHC that a given fiber produces is a result of what you make that fiber habitually do through neural activity. MHC characteristics of any given muscle are constantly changing according to what it is forced to do. So if you begin to train with higher exhausting reps thinking you are making your type-Is grow, all you are doing is creating greater type-I fiber characteristics in your muscles.

Now, I will refer people to a study that was done comparing 3 different routines. (Campos GE, Luecke TJ, Wendeln HK, Toma K, Hagerman FC, Murray TF, Ragg KE, Ratamess NA, Kraemer WJ, Staron RS. Muscular adaptations in response to three different resistance-training regimens: specificity of repetition maximum training zones. Eur J Appl Physiol. 2002 Nov;88(1-2):50-60.) They used an 8-week high-intensity training program for the legs.

Workouts were performed 2 days/week for the first 4 weeks and 3 days/week for the final 4 weeks. The subjects used one of three different regimens. The different training regimens were designed to be approximately equal in volume (resistance x repetitions x sets) with the rest periods between sets and exercises adjusted according to the strength-endurance continuum. Therefore, those individuals working on the high-rep end of the continuum performed fewer sets and had shorter rest periods compared with the other training groups.

The exercises were performed in the fixed order of leg press, squat, and knee extension. After warming up:

· The Low-Rep group used their 3-5RM for four sets with 3 min rest between sets and exercises.

· The Intermediate-Rep group used their 9-11RM for three sets with 2 min rest.

· The High-Rep group used their 20-28 RM for two sets with 1 min rest.

During the study, the resistance was progressively increased as subjects were able to perform more reps in order to ensure subjects were always using their true RM for each rep range.

So what happened? Did the type-I fibers increase most in the high-rep group? Did only the type-II fibers hypertrophy in the low rep group? If you believe you must do high reps for type-I fibers to grow and low reps for type-II fibers to grow then that's exactly what should have happened!

On the other hand, if hypertrophy is a matter of load, and all fibers hypertrophy in response to increasing load, then hypertrophy should go up as load goes up. In other words the group that lifted the heaviest relative weight should have experienced the greatest amount of hypertrophy in ALL fiber types irrespective of the number of reps (within reason). And that is exactly what happened.

Here is a breakdown of the hypertrophy caused by each rep range. [Remember, each group trained to failure regardless of RM used so muscular fatigue was equal between groups.]

High-Rep (20-28RM)
Type-I
· pre = 3894 post = 4297 (10.3% increase)
Type-IIA
· pre = 5217 post = 5633 (8.0% increase)
Type-IIB
· pre = 4564 post = 5181 (13.5% increase)

Med-Rep (9-11RM)
Type-I
· pre = 4155 post = 4701 (13.1% increase)
Type-IIA
· pre = 5238 post = 6090 (16.3% increase)
Type-IIB
· pre = 4556 post = 5798 (27.3% increase)

Low-Rep (3-5RM)
Type-I
· pre = 4869 post = 5475 (12.4% increase)
Type-IIA
· pre = 5615 post = 6903 (22.9% increase)

Type-IIB
· pre = 4926 post = 6171 (25.3% increase)

Should this surprise anybody? No! Higher loads with equivalent volume leads to greater hypertrophy regardless of fiber type. It also doesn't surprise me that these researchers were confused by the fact that the low rep group had as much or more hypertrophy that the other groups. They too have the idea cemented in their brain that you can't use heavy weight to stimulate hypertrophy. The strength training dogma of the past has deeply influenced even the research community with regard to hypertrophy. This has done nothing but hinder their progress in understanding it because they end up designing studies on false premises.

I'm not sure why people are so hesitant to accept the preeminence of load for producing hypertrophy. Perhaps it is that they fear not growing as fast as they think they can.

It would be of much greater benefit for people to discuss issues of fiber type with regard to muscle "performance" (i.e. strength/endurance/power). After all, the very distinctions themselves are based on how the fibers used fuel, not how they respond to load. Hence, basing predicted hypertrophic outcomes on the metabolic characteristics of a fiber will never lead anybody to a correct understanding of the mechanisms of hypertrophy.

21. DOMS, or Delayed Onset Muscle Soreness

Getting sore from training is like sweating from training. It often accompanies training but can't effectively be used as a measure of the effectiveness of the workout. They are related, but not "correlated".

This does not stop people from using DOMS as their measure of the effectiveness of the workout. This is not a bad thing! Nor is looking for sweat a bad thing to do when trying to tell if you're working hard enough.

The problem comes when people change their workouts inappropriately based on signs of soreness. An effective workout doesn't necessarily lead to soreness. The effectiveness of a workout depends on what type of workout is imposed on tissue that is at a certain level of conditioning (i.e. resistant to damage).

I personally like to maintain a very slight level of soreness at all times. The kind of soreness that most people might describe as simple stiffness.

The DOMS that is felt the day after, or even not until 2 days after, is most likely a result of an inflammatory response. Prostaglandins are released in the tissue which hyper-sensitize the nerves. This is not the only reason but most research seems to agree that this is the most likely mechanism.

Microtrauma can occur with or without this type of soreness. At the same time, a certain degree of growth can also occur with or without microtrauma depending on how you define microtrauma. It isn't necessary to have major microtrauma. We only need to disrupt the membranes enough to get satellite cells activated and fusing with existing fibers. Without this step, the fiber may enlarge slightly, but it cannot grow significantly because of a fixed nuclear to sarcoplasmic ratio. Unless new nuclei are added from satellite cells, the volume of the fiber will not increase beyond rather small increments.

So my point is that although DOMS, microtrauma, and hypertrophy are all related, they are not entirely dependant on one another.

However, a low level of DOMS is a good indicator of what kind of stimulus you created for the tissue and *usually* indicates that you are in the process of growth **if** you can maintain an adequate stimulus over time. I like to be a little sore throughout the entire cycle. When my training is too infrequent and/or my increments are too small, the soreness usually goes away and gains "seem" (this is subjective) to be slower. Then again, I have made good gains at times with little or no soreness...

22. Diet and nutrition, for fat loss or gaining muscle

All weight loss programs that recognize a few basic, yet important principles of proper weight loss can be effective. These principles include:

- Exercise (not appetite) should be the "primary" strategy for controlling body weight and increasing health.
- Eating habits must be adjusted not only to ensure weight loss, but also to ensure adequate nutrition.
- Fat loss will slow and eventually stop on any weight loss program.

Of course, when trying to apply these principles to each individual, some concessions and a little creativity may be needed to reach goals and overcome plateaus.

You should count calories for at least a week to establish what your caloric intake is (99% of the dieters over- or underestimate this), and your macronutrient ratios.

- Create a caloric deficit. 10-12kcal/lbs works great for most people. 14-15kcal/lbs may be better for someone with a high activity level during the week.
- Eat 1g/lbs of bodyweight in protein.
- Get 25% of calories from fats, mostly EFAs.

Aim for 1-1.5lbs/week of weight loss. If you lose more and notice your strength decreasing, you may be sacrificing muscle and should increase calories.

Basically, you just have to:

1. Meet certain requirements: caloric deficit, protein, EFA's. That's required of any diet, no matter the interpretation.

2. Figure out the rest of the diet dependent on the person. If they are active, have decent insulin sensitivity, and enjoy eating lower GI carbs, a moderate to higher carb diet will probably be sufficient. Something like 50/25/25 or 40/30/30. If they are very inactive, highly insulin resistant and/or simply won't remove the high GI crap from their diet, reducing carbs further or removing them completely may be the only workable approach to get calories/hunger under control.

So there's what's required (deficit, protein, EFA's) and there's what's optional (everything else). What's required isn't up to debate: it applies to everyone. What's optional depends on the needs of the person.

The ease with which a person loses weight depends on several factors. Some of these factors include:

Body size (height, frame size)
The amount of lean mass (muscle) a person has
Hormone levels

Without going into too much detail, the bigger you are the more calories you burn in a day. Likewise, the more muscle you have the more calories you burn. So the bigger and more muscular you are, the easier it is to lose weight.

Hormones like estrogen can make losing weight much more difficult. Testosterone, on the other hand, facilitates fat loss. This alone can account for some of the differences seen between men and women.

Additionally, thyroid hormones play a major role in regulating body weight. If you have been "sort of dieting" for a long time, your thyroid levels may be reduced. The only way to get thyroid levels optimized for fat loss is to refeed yourself with more healthy food and calories for a couple weeks before attempting to diet again. Blood tests may also be helpful in detecting hormonal deficiencies that may hinder weight loss.

22.1. Exercise

On the one hand, higher volume/shorter rest burns more calories, depletes more glycogen (which tends to enhance fat burning to some degree) and the hormonal response may be beneficial from a fat loss standpoint (although the GH pulse is fairly small and short-lived). But it may not maintain muscle mass as well because of decreased tension requirements.

On the other hand, heavier/longer rest training tends to maintain muscle mass better but doesn't burn as many calories (well, not during the workout, the damage may burn considerable calories in the day or two after) or generate the same hormonal response.

So the combination of HST and moderate-intensity cardio should work just fine. When you get into 5s/negs, you may add drop sets or high-rep sets to enhance fat loss, as well as the other improvements discussed in the 'drop set' thread.

22.2. Getting rid of stubborn body fat - by Lyle McDonald

Without going into the brutally long and complicated mental computations that led me to this (and I'm still working on the overall scheme), here's my current thoughts on how to approach it.

First and foremost, this is one of the places where morning/pre-breakfast cardio is probably crucially important.

An hour or two before cardio, take 200 mg caffeine with 1-3 grams of L-tyrosine (NO ephedrine).

There are two segments to the cardio:

- The first segment is for mobilization, to get those stubborn fatty acids out of the fat cell.
- The second segment is the oxidation part, to burn them off in the muscle.

For the first segment of the cardio, use a machine that you don't normally use. So if you normally do the treadmill, do the first segment on the Stairmaster or bike or something. Just make it different.

First segment:
warm-up: 3-5 minutes
go hard: 5-10 minutes. I mean hard, as hard as you can stand for the entire time. This will NOT be fun on lowered blood glucose. I've considered putting intervals here but haven't found the data I need to make up my mind. If you do intervals, go something like 5X1' all out with a 1' break (10' total intervals)

Rest 5', just sit on your butt, drink water, try not to puke.

Go to your normal cardio machine. Do at least 30 minutes at moderate/high moderate intensity (below lactate threshold but decent intensity). I'd say 45' maximum here but I'm still making up my mind and looking at data.

Go home, and wait and hour before having a small protein meal (25-50 grams or so). No dietary fat. 2-3 hours later, go back to normal diet eating. Your daily calories shouldn't be any different than they were already, they are just distributed differently, you only have 100-200 immediately after cardio, and then the rest afterwards.

I'd do that maybe 3 days per week to start, and see what happens.

Why this works

To get stubborn fat mobilized, you have to overcome a fairly severe resistance in terms of both blood flow and lipolysis, this requires very high concentrations of catecholamines (adrenaline/noradrenaline). Sadly, jacking up levels of catecholamines (necessary for mobilization) limits burning in the muscle which is why you follow the high intensity with low intensity.

Basically, you jack up levels to get the fat mobilized, and then let them fall so that the fatty acid can be burned in the muscle.

I have a study showing that Ephedrine before intense activity lowers the catecholamine response, that's the reason for avoiding it. Studies also show a lower than normal catecholamine response as people adapt to a given type of cardio; doing a different machine will result in a higher catecholamine response than you'd other wise get.

The bigger problem with stubborn fat has to do with:

- Blood flow to the fat cells: which is typically very low, odds are your butt is cold to the touch compared to other areas of your body
- It's harder to mobilize: both because of impaired blood flow, and because of adrenoceptor issues.

Oral yohimbe (0.2 mg/kg) can be effective when used over the long term. Don't take it within 3-4 hours of taking ephedrine, and start with a half-dose to assess tolerance (some people get really freaky responses from it). IF you can find pharmaceutical yohimbine, it's far far better than the herbal version (and most of the herbal versions are crap, the only one I trust is Twinlab Yohimbe Fuel).

Taking the yohimbe with caffeine prior to morning cardio does seem to help with very stubborn fat.

22.3. Lyle discussing the various dieting approaches

Here's the thing: all hypo caloric diets cause fat loss. And, for the most part, once you meet some basic requirements (mainly protein and essential fatty acids, without generating too massive of a deficit), the differences in fat loss are pretty minor and even more highly variable. Some folks appear to do better on keto diets (although I suspect that's the carb-load more than anything) but some do better with moderate carbs. Even there the differences are minor. Folks were reporting *maybe* 3 lbs extra fat loss over 12 weeks for CKD vs a Zone type of diet.

Others reported better fat loss on the Zone type of diet. These were lean folks who were meticulous about counting their calories.

As far as I'm concerned it becomes a case of food/appetite/calorie control at that level (note: one exception is that women will tend to lose bodyfat better on lowered carbs, men might mobilize ab fat more effectively but that's debatable and highly variable). If a higher carb diet makes you hungrier and you eat more calories, you're going to lose less fat. Because you're eating more.

I've got a study here looking at wrestlers who were at 6% bodyfat. They were all on hypocaloric high-carb diets and they lost fat just fine. They were all on 12.7 cal/lb and 55-60% carbs. Yeah, they all lost some muscle but that's what happens at that bodyfat level, almost no matter what you do.

Seriously, as long as there's a caloric deficit, carbs don't magically prevent you from losing fat despite what many seem to think. Any 'magic' from a particular diet interpretation usually has to do with people spontaneously (or more easily) reducing calories and eating less. Which is fine, controlling hunger/etc. is crucial to diet success.

Even Duchaine, in one of his last Ironman columns commented on this. He mentioned that all of the goofier diets didn't seem to really give the expected benefits. It became more an issue of limiting diet breaker foods (typically carbs) at that point.

The reason being that most of what you lose (fat vs. muscle) is being controlled by internal determinants (leptin and all the hormones its controlling). So composition of the diet, beyond meeting protein and EFA requirements, and not creating too big of a deficit, tends to be fairly irrelevant outside of calorie/appetite control.

Even the simple "Eat less fat" is based on the presumption that if people follow that advice, they'll eat less total calories. Same with 'eat less carbs' (or more radically no carbs) or 'eat less sugar' (Sugarbusters) or the complicated food combining stuff. Whatever.

It's all a way to trick people into eating less without making them fixate on food (which causes psychological anxiety). Which isn't an inherently invalid concept, don't get me wrong. Of course, in reality we find out that while such approaches frequently do work for a while, people invariably compensate and end up eating about the same amount. But they have been so convinced by the diet book's spiel that calories don't count, that you can't get them to even count the calories at all. Atkins dieters are notorious for this: even if they haven't lost a pound in months, they will refuse to accept that they still have to monitor calories because of the line Atkins fed them.

One of the most staggeringly 'brilliant' comments I read one time in a review paper was to the effect of "While we don't know what the ideal diet for the treatment of obesity is, it will most likely contain adequate protein, sufficient dietary fat, and emphasize fruits and vegetables."

Seriously, 3 decades and 10 billion dollars worth of nutritional research and they came up with what my grandmother knew 50 years ago. I mean duh.

The bigger problem is arguably this: getting people to follow whatever dietary and/or exercise changes they make. Frankly, the issue of how to lose weight is trivial. The issue of how to get people to maintain their behaviors in the long-term is not. Obesity treatment research HAS to get away from the focus on this or that diet or macronutrient. It needs to focus on the behavioral stuff, getting people to change their habits for long enough to break old patterns.

Of course, statistically, most people fail at any behavior change they attempt. Stopping smoking, alcohol, whatever; the failure rate is generally pretty high. It's human nature: change begets anxiety and we don't like anxiety. It's usually easier to go back to old habits then to develop new ones.

As well, there is a psychological aspect of 'goofy' diets that appeals to many (it used to appeal to me). Basically, in order to stay on the diet they have to really, really believe in it. That means being fed a really good line of hooey by the diet book author. Zone dieters are generally *convinced* that the reason they're losing fat is because they are IN THE ZONE. Try to point out that they're losing fat because they are on a severely calorie restricted diet that is adequate in protein and fat - and they'll have none of it. Basically they have to believe in the diet to follow it long-term. Again, not a real problem except when the line of hooey that the diet book author is feeding people is such crap that it gets them into problems.

You'll note that most diet books are mainly an attempt to 'sell' the reader on the approach to tie into this psychological aspect of it all. Chapter upon chapter of why that particular diet is superior. This typically includes crapping on the mainstream dieting establishment, crapping on all other diets that are out there, and making up some reasonable sounding science to support whatever diet is being pushed. Because most diets can be summed up in about 3 pages but that doesn't sell books. The rest of the book is food lists and meal plans which makes it easy for the average person to follow it. But most of it is simply to convince the reader why the diet is superior and/or valid because that makes people more likely to stick with it.

Yeah, seriously, don't get me wrong. There may still very well be advantages to lowcarb diets over other diets (although even that is highly individual) even if increased fat loss at the same calorie level isn't one of them.

If nothing else, they do help to ensure adequate protein intake. A mistake that many make on high-carb diets (and one I have made) is eating too dang many carbs, which means that protein and fat (and EFA's) get shorted. Personally, I think a 75% carb diet is horribly imbalanced. I ate such a diet in college (didn't know any better and listened to my professors, which was a mistake).

You simply can't get enough protein or EFA's (or you can get one but not the other) when carbs make up that much of your diet. But I have routinely seen people eating like that (female clients would frequently be eating like 80% carbs, 10% protein and 10% fat). People tend to get and stay absurdly hungry on such diets as well which doesn't help with compliance in the long-term. Nor does it help with controlling total calories.

I don't even think that the 60/30/10 diet that Dan presented in Bodyopus is particularly balanced. Fat is too low. Yeah, he did actually state that fat would be 18% when you figured in EFA's but it's still on the low side IMO.

However, if you were to move someone from 75%/whatever to 50% carbs, 25% protein (or 1 g/lb) and 25% fat, I suspect that that would make a HUGE difference. Not because you're reducing carbs per se, but rather because you're finally able to get sufficient protein and fats (and can get enough EFA's).

I really suspect that's why so many people do report what appear to be magic results when they move to Zone or lowcarb types of diets. They tended to have been following crappy diets to begin with (too high in carbs and/or too low in protein; usually the latter) and just about any change would have been an improvement. Keto and Zone diets force people to get sufficient protein and fatty acids (and hopefully EFA's). They are superior to a 75% carb diet for that reason alone.

They also control hunger better. Meaning better compliance and calorie control. Both of which are crucial aspects of a diet. In that sense (hunger/calorie control), lowered carbs may very well be considered to have a 'metabolic advantage'. And one that makes such diets very beneficial from a fat/weight loss standpoint.

But in terms of causing significantly greater fat loss/less muscle loss at a given calorie level, the data just doesn't seem to be there. Not in the research, not in the real world. Not assuming the person is getting enough protein and EFA's in the first place. Basically, that's the issue in a lot of studies. Take someone with a crap diet (usually too little protein) to begin with, and a keto diet will be superior. Ketosis is VERY protein sparing if your protein intake is inadequate to begin with (many studies give 50 grams of protein or so while dieting). Assuming protein intake is adequate to begin with (at least 150g/day or 0.9g/lbs of bodyweight), ketosis doesn't appear to have much of an impact.

And don't get me wrong, I really wanted it to be true, I really wanted such diets to cause greater fat loss and spare muscle better. I really did. This is just one of those cases where I don't think the research/real world results support the idea that they do.

Now, some people do seem to benefit further (again, mainly calorie control/hunger) from reducing carbs even further (to 40% or 20% or even lower). Or even eliminating starches completely (this may help to break various food preferences/psychological carb addiction issues). Usually it's folks who are severely insulin resistant (generally very overfat, inactive, and were consuming the crappy modern diet to begin with). They can have a horrible time controlling appetite/hunger with even the smallest amounts of carbs in their diet because they have such severe rebound hypoglycemia, which tends to promote hunger. Removing carbs (starches, not vegetables) completely may be the only practical way to control hunger and reduce calories. Which is fine too.

22.4. Gaining muscle mass

Read the following articles:

Eating for Size (http://www.hypertrophy-specific.com/HSreport/iss04/eat_size.html)

Pre/Post-exercise nutrition (http://www.hypertrophy-specific.com/hsn_artcls_prepostnutri.html)

Exposing the myths about protein
(http://www.hypertrophy-specific.com/hsn_artcls_proteinmyths.html)

Calories should be high. Take bodyweight and multiply it by 18 or 20 depending on fat gain. This should give you about 500 to 1,000 above maintenance. Protein should be at least 0.8-1 gram per pound of bodyweight. Avoid saturated fat (within reason).

Take a protein supplement before and after training. Use creatine as well. EFAs should be included (Fish oil and CLA).

Actually, most guys take in too much protein. It isn't that too much protein will hurt them - assuming they are healthy to begin with - but too much protein can actually inhibit gains. I know, it sounds totally contradictory to what you read everywhere, but it is true. Let me explain.

The ability of the body to grow is effected by the ratio of protein to carbs. It is an inverted U shaped curve - or bell curve - where the top or highest point of the curve is a ratio of 12-15% protein to carbs (diet consisting of ~15% protein). At one peak you have all carbs, at the other you have all protein. It has to do with thermogenesis and hormones.

So, if a skinny guy wants to gain weight, he needs to plan a diet where he gets 15% of his calories from protein.
Now this may seem contradictory to the general rule of 1 gram per pound bodyweight. I'm not saying that a guy can't gain weight with more than 15% calories from protein, I'm only saying that weight gain is greatest at 15%. He will be ok with an intake of 0.75 grams/pound FFM to gain muscle. In fact, everybody should use FFM instead of bodyweight to plan protein intake, but sometimes it's just too hard to figure it out, so most people use bodyweight.

For a guy who isn't all that skinny, or even a little fat, he should increase his protein intake to 20-25%. This will increase thermogenesis and prevent some fat gain as calories increase above maintenance.

The problem with protein cycling is that it is hard to get ahead of your body when it comes to managing protein. The body adapts fairly quickly to changes in protein intake. If you eat more during the day, your body will get rid of more during the night. That changes according to intake on a daily basis.

Longer term, your body will adjust to a drop in protein intake over the course of 12-14 days. In other words, you will go into a negative nitrogen balance on day one, and it takes about 12-14 days for your body to be able to reduce protein breakdown to the point of reaching balance again.

Some may argue about the different turnover rates of muscle protein and splanchnic proteins. This should have led to real success from protein cycling, yet it hasn't.

If you do decide to cycle your protein, I would not drop your intake below 15% (or ~1g/kg bodyweight) while maintaining total calories. Then keep protein intake at this lowered level for at least 2 weeks.

Your diet can effect Test and IGFBPs. IGFBPs dictate how much IGF-1 is actually available for your body. Too much protein relative will lower insulin, and thus available IGF-1 and free test levels. Too little fat will also lower test levels. Keeping fat at 30% of total calories is optimum for testosterone.

I'm sorry for any confusion I may have caused by my previous comments about amino acids a mechanical load.

Maybe this will help clarify. If you starve a guy, and surgically remove his gastrocnemius, his soleus will double in size to compensate, even though he is not eating.

Now this does not mean that this is something you want to do. It only shows that the body is able to increase the size of a muscle when nutrients are next to nil. Nor does this mean that he would grow all over from simply training with weights. More than likely he would not grow unless he was fed.

So, as far as you and I are concerned, we need both protein and carbs to get our muscle to respond well to lifting weights. Ideally, you will consume your protein and a few carbs both immediately before and after training. This is the whole reason why I formulated my pre and post workout proteins. So that if you took them right, you would increase your chances of growing as much as possible. Add a few carbs to them and you are set.

There is some interesting research on protein coming out that indicates that when you add carbs to your protein, more of it gets "trapped" (incorporated into gut proteins and/or oxidized in the gut and liver) in the gut. This is because of the anabolic effect of insulin on enterocytes. Insulin isn't really anabolic in skeletal muscle but it helps nonetheless.

Anyway, my point is this, Take your protein without (or with less) carbs immediately after you workout. This will allow more amino acids to skirt past your enterocytes and liver and make it into the blood stream where they are taken up by skeletal muscle. Then take your carbs one hour later, which still allows you to take advantage of the metabolic "window" post workout.

Several small meals aren't as important as you might think. You can get the same benefit from eating meals that take a long time to digest (e.g. steak, fiber, and fat). However, in the period immediately surrounding your workout, I would suggest a small meal both before and after. Ideally they would be liquid meals. Then a big slow digesting meal 1-2 hours later.

If you are dieting, many small meals can help retain some mass by preventing acidosis and controlling appetite.

Consistent macronutrient ratios throughout the day are not as important as you might think either. I wouldn't worry too much about it. However, do not compromise on your meals immediately before and after your workout. These should never be without protein.

Well, it is true you don't want to buy protein of low biological value. But for the most part, nobody sells any so its a mute point. Casein, whey, and egg are all very high biological value proteins. This accounts for about 99% of all the protein powders you can buy, at least for bodybuilding.

Besides, Gelatin isn't worthless. It just doesn't have a very good amino acid profile.

It is important to realize that not all "hydrolyzed" protein is gelatin. You can buy whey hydrolysates and even casein hydrolysates. To hydrolyze a protein simply means to predigest it. BTW, it isn't necessary to predigest your protein at the factory. Your stomach does this just fine all by itself.

Guys don't want too much soy protein either. It has demonstrated estrogenic effects. So, that’s good. But once again, unless they are selling soy, its obvious there is no soy in their product.

This kind of advertising/marketing is like having a restaurant put out an ad that says, "Our food is poison free!". In essence, so what? So is everybody else’s.

Here's a tip, and this is totally objective. Buy Primer and Driver and rest easy at night knowing that you can't buy a higher quality protein.

I would not suggest that you eat raw eggs.

Even if you refrigerate your eggs right away after purchasing them, you don't know what they have gone through from the time they left the chicken. It has been documented several times in the States where during shipping and storage they haven't been kept at safe temperatures...before they are ever purchased by the consumer.

If you're sick of eggs I would just try to eat something else. It's just not worth getting really sick.

It is true, or at least believed, that big meals can make you feel sleepy. This has been attributed to a number of things, including an alteration in serotonin levels, and "sludging" which refers to the slowing down of the flow of red blood cells through micro-capillaries. Whether this is a fact or not, remains in question. We have probably all felt this effect of a big meal before, but more often than not, we don't really notice any effect of eating.

Insulin, though it obviously lowers blood sugar, does not overwhelm the effects of catecholamines (adrenaline, noradrenaline) that are released upon the onset of exercise. Catecholamines increase blood sugar and alertness/energy levels.

Now, a comment about goals. With HST as well as HSN, our primary goal is hypertrophy. We care only about how to get the muscle to grow as fast as possible. When it comes to nutrition during exercise, this means keeping cortisol low, and amino acid levels high. Carbohydrates help to keep cortisol low, while protein helps to keep amino acid levels high. Combine this with drastically increased blood flow to muscle tissue (pre-workout nutrition) and you have optimized the environment to favor net muscle accretion…growth! No fat in the pre-workout drink. How soon you drink it depends on how long it takes to digest. You want the Amino acid levels high in the blood stream as you begin your workout.

You'll see no difference between using dextrose (glucose) or malt dextrin. I add about 7tsps (~20grams) of NOW brand dextrose to my Primer before and then 7-14 (~20-40grams) tsps to my Driver afterwards. It gets really really sweet with 14 tsps so I just ad more water. Primer+ and Driver+ will both have glucosepolymers.

The percentage of calories absorbed doesn't change as intake goes up. So, you absorb 90% of a 2k calorie diet and you will absorb 90% of a 3k calorie diet.

With distilled water you lose all the minerals. I would agree, any claims about water sources and health are irrelevant (splitting hairs) beyond infectious organisms, high levels of heavy metals and other inorganic poisons, and radio activity.

Fiber helps to slow down the digestion/absorption of carbs. This "tends" to lower insulin levels which in turn "may" help to prevent fat gain, and perhaps facilitate fat loss. Fiber is good.

22.5. Comments by Lyle

Bryan Haycock advocated a 15/85 ratio between protein and carbs for optimal "weight gain". It was not clarified further, and I would like your input on the subject.

Bryan is probably basing this on a paper I came across/sent him a year or two ago (1). In short, it looked at the influence of protein on growth in both animal and human models (in humans, it was during weight regain during refeeding). It demonstrated that both insufficient and excessive protein intakes produce less than optimal/maximal gains. Insufficient amounts provide less than optimal amino acid amounts so growth is limited. Excess protein stimulates protein oxidation and TEF which burns off calories that could otherwise go towards growth.

Optimal levels for humans was in the 15-20% total calorie range.

And are the protein requirements of an AAS-using athlete overrated?

I personally think so. If you pay attention, most of the suggestions for massive protein intakes are coming from...people selling protein powder. It's amazing how that works.

At the same time, AAS does jack up protein synthesis above normal, I can see 1.5-2 g/lb for drug users. I see little point to go higher than 1 g/lb in non-drug users but that assumes a couple of other things (mainly adequate caloric intake).

You have mentioned that about half of ingested protein is converted to glucose in the absence of carbs, but do you have any estimations of this when ample amounts of carbs are ingested as in a common bulking diet?

As far as I can tell, this number is relatively absolute, carbs or not. It's simply the way the liver handles amino acid intake.

Although protein synthesis is greatly elevated with a higher protein intake, protein breakdown is also elevated - but I believe there are studies pointing to an overall higher net accretion of protein, correct?

yes -ish... Studies using nitrogen balance show better balance with higher protein intakes. Critics of these studies point out that, based on the nitrogen balance values, there should be a monstrous gain in LBM (on the order of 5-10 lbs of muscle if you extrapolate the nitrogen balance data) during the length of the study. These gains are not occurring by measurements of body composition. More likely, nitrogen balance is giving skewed results, especially at high protein intakes.

I also see a point in limiting fat intake to e.g. 20-25% in the presence of higher amounts of carbs, but would there be reason to expect significant de novo lipogenesis on a 600g+ carb diet?

Doubtful. In the presence of 'high-fat' diets (basically anything over 10% of total calories), DNL is totally down regulated. As well, odds are that the amounts of carbs needed to stimulate DNL are going to scale with bodyweight. 600 g carbs at 250 lbs is only 5.3 g/kg. That's not even close to what's required. Also, in a hard training bodybuilder who was depleting glycogen, it becomes much less of an issue.

Ultimately, fat gain comes down to how much of an excess of calories you are creating, and how well you're partitioning them to muscle vs. fat. Both excess fat and carbs can make you fat, even if the mechanisms are different. One of the advantages of drug use is that it can significantly impact partitioning: for a given caloric excess, more goes to muscle vs. fat. So for the same excess, you get a greater proportion of LBM: fat gains.

There are some pretty extreme intakes in AAS-using BBs - e.g. 5000kcal+ for 200lbs guys not uncommon. Given 2g/lbs of protein and the metabolic rate of a drug-using, hard-training guy - that might actually not be too excessive, correct?

Sure, 18-20 cal/lb is one of those rough starting place types of things. I've known a natural or two who had to go 25 cal/lb to get significant weight gain. There are some folks who simply burn off excess calories (as heat) no matter what they do; odds are these naturals were one of them. But 25 cal/lb for a drug using athlete probably isn't out of the question.

Ok, so here are my personal opinions on the whole mass gain thing. As with fat loss diets, I look at it mainly in terms of what's required (from a physiological standpoint). The rest is details and/or optional.

1. It must be hyper caloric. Obviously.

2. Sufficient protein: for non-drug users, I see little point in going above 1 g/lb as long as it's high quality and you meet #1. Some people swear 1.5 g/lb gives them better gains. I suspect they are confusing issues (i.e. eating too few calories and using protein as an energy source) but whatever.

3. Adequate dietary fat: 20-25% total calories to make sure hormones are optimized. Some of that needs to come from EFA's but some should be saturated as well. Red meat = good.

4. I would certainly put carb intake above keto levels (100 g/day) for hormonal reasons. Odds are it'll be much higher than that. How much higher will depend on total caloric intake and how much fat you eat.

5. Pre workout shake containing 25-30 grams of carbs and 15 grams of protein.

6. Post workout shake containing about 1 g/kg carbs and 30 grams of protein or so

Lyle
Oh yeah, and the true secret to mass gains: stack ferulic acid with gamma oryzanol. That's the TRUE secret of the pros!

22.6. Pre- and post-workout nutrition

Pre- and Post-workout nutrition article
(http://www.hypertrophy-specific.com/hsn_artcls_prepostnutri.html)

I would suggest you leave the carbs out of the pre-workout, and add them to the post workout drink. This should allow fat to be mobilized during exercise, and at the same time, replace calories with carbs instead of fat post-workout, with an over all effect of preserving muscle and losing fat.

I'm sure you already know this, but your calories throughout the rest of the day are going to make a big difference too.

It depends on your goals really. If you are trying to get big at all costs, you want plenty of carbs in both your pre- and post-workout drink.

If you are trying to grow while leaning out, you will want no carbs in your pre-workout drink, and delayed carbs about 30 minutes after your post workout protein drink.

If you are trying to get lean and keep as much muscle as possible, use only protein pre- and post-workout, then have carbs with your first whole food meal following your workout.
These are just guidelines. There is nothing special about them. You can still get lean with carbs in your pre-and post-workout drink. You can still get big without carbs in your pre- and post-workout drink. Overall calories is still the most important factor and shouldn't be forgotten while nit-picking over subtle physiological mechanisms, etc.

In order to minimize muscle loss during cardio you should treat it just like your other training. Take a pre-cardio protein drink and then follow your cardio immediately with another protein drink.

This may increase amino acid oxidation, but it will spare muscle proteins as well as not interfere with fat mobilization (unlike carbs pre- and post-workout).

And there is some benefit to delaying your carb intake for a while after cardio. This of course is assuming you are trying to lose fat as fast as possible (short term).

The pre-workout protein is still beneficial because it is shuttled to working muscles at a much greater rate than when only taken post-workout, and allows higher intracellular amino acid levels for recovery afterwards.

I see guys "eating big to get big" with a thousand calories over what they need, 500-600 grams of carbs per day, and still choking down 75g of sugar in their protein because they think they have to replace all that glycogen they just burned training HIT on bench and sitting around gabbing to their buddies while eyeballing themselves in the mirror. Not only that but they are often training each muscle group once a week, perhaps because their glycogen stores are frightfully low! Why is everyone so afraid of *not* going into hyperglycemic shock after their workout?

The macronutrient composition of a protein meal effects where that protein is ultimately deposited and incorporated into new proteins. This is due mainly to the effects of insulin on amino acid uptake in tissues that will either deaminate and/or retain that protein well before your muscles ever see it. Such tissues include the gastrointestinal tract (stomach, small and large intestines, and the splanchnic bed (liver), then into the periphery which include ALL organs and tissues of the body, not just muscle tissue.

It turns out the insulin causes fewer amino acids to make it past these first pass organs/tissues. Why? Because as I said, those tissues will take up a greater percentage of those amino acids and use them for their own purposes or deaminate them.

A model based on the collected tracer data demonstrates the effects of carbs on the partitioning of ingested proteins. (note the difference between fast and slow proteins as well)

Milk protein
Splanchnic proteins 18%
Peripheral proteins 34%

Sucrose and milk protein
Splanchnic proteins 35%
Peripheral proteins 26%

Sucrose and soy protein
Splanchnic proteins 37%
Peripheral proteins 19%

So, this data/research is what my comments were based on. Of course the absolute amount of protein ingested can make these facts less important. You can simply overwhelm the system with quantity and get more amino acids out to the muscle tissue. But as far as my earlier comments are concerned, I stand by them as accurate.

Here are a few papers that illustrate these points further.
1: Fouillet H, Mariotti F, Gaudichon C, Bos C, Tome D. Peripheral and splanchnic metabolism of dietary nitrogen are differently affected by the protein source in humans as assessed by compartmental modeling. J Nutr. 2002 Jan;132(1):125-33.

2: Fouillet H, Gaudichon C, Mariotti F, Bos C, Huneau JF, Tome D. Energy nutrients modulate the splanchnic sequestration of dietary nitrogen in humans: a compartmental analysis. Am J Physiol Endocrinol Metab. 2001 Aug;281(2):E248-60.
3: Fouillet H, Gaudichon C, Mariotti F, Mahe S, Lescoat P, Huneau JF, Tome D.
Compartmental modeling of postprandial dietary nitrogen distribution in humans.
Am J Physiol Endocrinol Metab. 2000 Jul;279(1):E161-75.
4: Gaudichon C, Mahe S, Benamouzig R, Luengo C, Fouillet H, Dare S, Van Oycke
M, Ferriere F, Rautureau J, Tome D. Net postprandial utilization of [15N]-labeled milk protein nitrogen is influenced by diet composition in humans. J Nutr. 1999 Apr;129(4):890-5.
5: Fouillet H, Bos C, Gaudichon C, Tome D. Approaches to quantifying protein metabolism in response to nutrient ingestion. J Nutr. 2002 Oct;132(10):3208S-18S.

What I meant to convey was that a greater percentage of a single dose of protein might reach your muscles if there isn't a lot of insulin at that moment. I did not mean to sound as if there was a way to absorb protein without your intestines or enterocytes being involved.

Based on those studies looking at the effects of carbs/insulin on regional protein deposition it's possible that if I take 20 grams of protein without carbs, I might get a greater percentage of those 20 grams to make it through first pass metabolism by the splanchnic bed, and therefore be available for uptake in the muscle.

On top of this, research on Eukaryotic Initiation factors have made me further question the benefits of so many post workout carbs for well fed bodybuilders. It doesn't hurt to figure out what direct role, if any, carbohydrates play in post workout protein synthesis. For the sake of body composition, I like to maximize amino acid uptake into muscle (hence the Primer) without relying on so much sugar intake.

22.7. Leptin and setpoint

The observation of a "set point" is the result of the activities of several hormones. Leptin is the most well know and easiest to explain.

Leptin acts on the brain to reduce food intake. Leptin also effects other reproductive hormones like Test and estrogen. This makes sense from an evolutionary view point (i.e. linking food supply to fertility).

When leptin drops, appetite goes up and reproductive hormones go down.

Leptin also increases fat mobilization and reduces fatty acid uptake into fat cells.(good) As a result it also spares muscle tissue during caloric deficit.

Fat cells produce Leptin when they are happy (growing or at least well fed). When fat cells begin to shrink because of less food or more exercise they produce less leptin.

So, just by looking at this one hormone (1 of many involved) you can see how your body is sensitive to the amount of fat tissue you have. And that the amount of fat tissue you have ultimately effects your metabolism, and muscle gains/losses.

The activity of leptin is also dependant on the leptin receptor. Some people may have more receptors or better working receptors, and this may account for their ability not to get fat.

Keep in mind that your set point can be "reset" with exercise and proper diet.

Ok, to be more specific. As you might expect, there are a few things that effect your metabolism. They are:
>Age
>gender
>muscle mass
>activity level
>Food intake
>Diet composition

From the top, can't do much about age...oh well.
Can't do much about gender either.
Muscle mass we can increase.
We can increase our activity level.
We can increase our food intake.
And we can adjust our diet composition.

There is also a belief, that if you were never "obese", especially from childhood, you can normalize things at a lower body fat level if you are able to normalize nutrient intake while avoiding fat regain. In other words, you can increase leptin levels by increasing food intake. So, if you can increase food intake without increasing body fat, you will stay at that new lower bodyfat afterwards.

Diet is another BIG issue here. Certain foods lend themselves to making you fat. Other foods do not, even at equivalent calories levels.

Supplements can also help. Omega-3s and CLA have a direct leptin like effect on fat cells.

22.8. The bottom line

1) The leaner you are, the higher your "Partitioning Ratio" (P:Ratio). This means more energy from the diet will be directed towards lean body mass. The opposite is true if you are fat.

2) The P:Ratio also works in the same way while dieting. The leaner you are, the more lean mass you will lose while dieting. The opposite is true if you are fat.

3) The higher your calories above caloric balance, the greater the percentage of dietary fat that will be stored as fat. Diets such as the Isocaloric-Zone are not a good idea when eating a lot of food. The reason is that your carbs will more than meet your energy needs and all the fat is then stored. When calories are deficient however, the lack of carbs prevents significant fat storage and even facilitates fat loss.

4) The more calories you burn, the more you can eat. All exercise creates an anabolic environment when calories are sufficient. So it is better to eat more, and then use a little cardio to keep the fat in check, than to simply eat less.

5) There is a difference between weight gain, and lean mass gain. Just because 15% calories from protein is the most efficient ratio for weight gain (meaning the least energy loss), it does not mean it is the best for every person in every situation. For a very tall guy who is very lean and has trouble putting on any size and/or weight, keep protein lower in relation to carbs. For a shorter stocky guy who isn't terribly lean (12-14%) you should keep protein higher to keep the Thermic Effect of Food (TEF) higher.

6) Protein is always more anabolic when combined with carbs. [NOTE] HSN Primer and Driver don't have carbs in order to allow you to control your own carb intake, not because it is better without carbs.

7) It is better to significantly increase calories incrementally rather than over night. And extra 100 calories added to the diet each week is a good place to start. This allows a modest adjustment of the body's metabolic rate to increase at a closer rate to the increase in caloric intake. This helps you avoid some fat gain in the beginning.

*8) Using additional testosterone significantly increases a person's P:Ratio. I have seen lean guys weighing 230-240 able to consume 4,500-5,000 calories per day and still get leaner each week unless they pushed the calories even higher. This is extremely unusual for a natural lifter, so unusual I have never seen it happen. My comments on diet are always based on the assumption that an individual is training naturally.

23. Optimizing HST, ...and AM/PM workouts

A natural trainer can probably put on an additional 30-40 pounds of muscle. Muscle growth requires the proliferation and differentiation of satellite cells. When this stops, so does muscle growth. Muscles can also grow by increasing the number of cells (hyperplasia). This is greatly enhanced by using testosterone. It also happens in natural trainers depending on their age and training style.

Bone structure and height play no role in muscle "growth". They only play a role in a muscle's appearance. There are other and more important factors involved - such as hormonal milieu, efficiency and levels of various enzymes pertaining to biochemistry (which also determines how your body handles nutrients), length of muscles and attachment of tendons etc. just to name a few.

Nutrition (supplements) also plays a role. With HST the same muscularity can be reached in much less time. Under the right conditions, muscle mass can increase dramatically within a few weeks.

Theoretically, with heavy drug use, a human could probably put on 20 pounds in 4 weeks. That same person could probably put on 50-60 pounds in 12 months. I have never personally seen anyone do this though.

Reaching your potential while training natural is still going to take time...years. But you can knock off quite a bit of time with HST and good nutritional and supplementation practices.

Please understand that when people ask me answer questions like, "how big can someone get", I have to be conservative to avoid undue criticism...I couldn't promise anyone 60 lbs of muscle...that’s quite a bit of extra muscle for a natural trainer. I don't really know how much I have "put on" because I began lifting at age 8. So, I don't know how big I would be without lifting. I did get down to 155 however after a severe illness. Since then I have gained about 60 pounds of LBM.

To optimize HST a person should train twice per day. He/she should use 2 routines, and AM program and a PM program. Some exercises could be repeated but most should change from morning to evening. The normal progression of weight increments and reps to be followed. That is twice per day, 3 times per week. So still only train MWF but train twice on those days. I think I get a little more out of it when I do whole body twice. Although, I often split up upper and lower body when something cuts my workout short in the morning. Don't forget we're talking about volume too. The volume doesn't necessarily double. Just the frequency.

There is the possibility that training once per day 6 days per week would be just as effective. But to be on the safe side, a rest day with massage is probably better to avoid injuries.

On days off, you should receive a full body deep tissue sports massage. However, it isn't necessary to get to painful. The massage is simply a way to eliminate spasms, increase blood flow, increase protein uptake, and activate satellite cells. You shouldn't be "sore" after the massage. if it is done properly, your muscles will literally be pumped afterwards. A protein supplement should be taken before and after the massage.

Calories should be high. Take bodyweight and multiply it by 18 or 20 depending on fat gain. This should give you about 500 to 1,000 above maintenance. Protein should be at least 0.8-1 gram per pound of bodyweight. Avoid saturated fat (within reason).

Take a protein supplement before and after training. Use creatine as well. EFAs should be included (Fish oil and CLA).

Also read the Eating for Size article:
(http://www.hypertrophy-specific.com/HSreport/iss04/eat_size.html).

If you do these things you will grow very quickly. There are other things you can do but then you wouldn't be "natural" anymore.
growth.

23.1. Should I modify HST if my goal is fat loss?

HST should not be altered according to caloric intake. Although you will notice decrements in performance when calories and/or carbs are very low, the training stimulus will still be optimized when the program is followed as outlined. While calories are high, the program will optimize the anabolic effects of feeding. While dieting, the program will minimize the catabolic effects of starving (i.e. dieting).

In reality, nutrition should be optimized for the desired goal, then left alone regardless of the training regimen. HST principles optimize the training stimulus. Now, if you go on a fat loss diet and eat too few calories, HST will prevent as much muscle loss as possible because it is optimized for muscle growth. If you are trying to gain weight, HST is still optimized for muscle growth, so HST will ensure the greatest possible gains with a mass building diet.

Here is the only thing I would recommend as far as adjusting the diet:

The purpose of the 15's and early 10's is to flush the tissue with lactic acid and create and accumulation of oxidative byproducts in the cells. In order to optimize this you must be eating a fair amount of carbs. When you eat a lot of carbs the muscle will burn a lot of glycogen, creating lactic acid and producing the desired effect (enhanced tendon strength and functional oxidative capacity). When you get into the heavy 5's and negatives the carbs should come down a bit. Insulin sensitivity declines as muscle damage increases. I would say about 30% carbs during the really heavy weeks is sufficient to support growth.

23.2. Tweaking HST

I frequently hear comments both for and against tweaking or personalizing HST on an individual basis. This is to be expected among people who are real enthusiasts of weight training. You also find this irresistible urge to tweak among other enthusiasts such as audiophiles. An audiophile will go out and spend obscene amounts of money on the highest end exotic equipment they can find. But this isn't good enough! They must find some way to "tweak" it, some way to make it their own delectable creation. Anything from placing the turntable on a 3 inch marble slab, putting sand bags on and/or in the speakers, or using speaker wire that cost as much as the car you used to drive to the store. Whenever you find people who are really into what they are doing, they will try to find ways not only to squeeze out the last bit of performance, but also make it their own creation.

I think it comes down to a couple issues which I'll address after a short review for those new to HST.

First let me clarify that HST is based on physiologically sound principles, not numbers. In short, they are:

• Progressive load
• Training volume
• Training frequency
• Conditioning (Repeated Bout effect)/Strategic Deconditioning

So we are dealing with 4 basic issues, Load, Volume, Frequency and Conditioning. Within these basic factors we have reps, sets, and rest. HST differs from previous training methods in many aspects, but particularly in how it incorporates knowledge of how the "cell" physiologically responds to the training stimulus in its methodology. Previous methods focus on effort (A.K.A Intensity), current voluntary strength, and psychological factors such as fatigue and variety (i.e. many different exercises).

• The number of Reps is determined by the minimum effective load (this changes over time based on Conditioning)

• The number of Sets is determined by the minimum effective volume (this changes over time according to current load and Conditioning status.)

• The Rest between sets is determined by the amount of time required to regain sufficient strength to successfully achieve the minimum effective Volume.

• The Frequency (rest between workouts) is determined by the ability of the CNS to recover sufficiently to maintain baseline "health" indicators. It is also determined by the time course of genetic expression resultant from the previous workout.

• The interval of Strategic Deconditioning (SD) is determined by the time course of adaptation to the individual’s maximum weight loads. In other words, SD is required to reset growth potential after plateauing. The duration of SD is determined by the level of conditioning attained during the training cycle.

Anyone who argues with these points after understanding them correctly is in error. That is a strong statement but it is true. These are principles that we "know" from research and experience. The data from this research is not theoretically based. It is based on identification, measurements, and direct microscopic observation. All future research will show us is more genetic detail, NOT that we were wrong on some sort of fundamental basis.

So, anyone can with confidence apply these principles to their training and successfully induce muscular hypertrophy.

If anyone should attempt to apply these principles and not experience some degree of muscle growth, it is not because the principles are wrong, it is because the application of the principles was flawed. Once again, another strong statement, but it is true. For example, just because you plant a garden and water it does not mean you will successfully grow prize-winning vegetables. Does this mean that your garden acted by some other mysterious agricultural principles other than those based on water, sunlight and soil? Of course not! We "know" the principles of growing plants. Where we fail, is in our application of those known principles.

The application is where the details lie. Issues such as how much, how many, how fast, when and where to name a few.

Whether it be growing plants, or growing muscle, you are dealing with a moving target. Because plants are alive, or put another way, because plants are biological systems, the best application of agricultural principles to grow vegetables will change as conditions change. The same is true for the application of the principles of hypertrophy or muscle growth. The application will change as conditions change. All the while, being careful to stay faithful to the underlying "known" principles.

Why do people tweak and change HST? Well, when done haphazardly it is usually because they have no faith in the underlying principles. This almost never leads to progress, only constant tinkering and frustration. Without adequate knowledge of the principles, and faith in their effectiveness, their expectations will never be realized and their "locus of control" will move ever outwards, blaming everything but themselves for their lack of progress.

In contrast, when people tweak and change their program based on changing conditions, they almost always experience success and they gain valuable experience in the process. Their locus of control will move inwards and they will grow ever more effective at adjusting their training as conditions dictate to keep the gains coming.

If you find yourself lacking faith in your training program, you will most likely fail to reach your goals. You must first prepare yourself. Take it upon yourself to gain the required knowledge of the principles of muscle growth. Only then will you really have faith in your plan. Look up the studies and compare the traditional methods to what the research tells you. Ask questions of people who seem to have faith in what they are doing. Find out whether they are doing it because they were told to do it, or because they know it is the right way to do it. And of course, ponder your own experience and try to make sense of past periods of growth and past periods of stagnation.

23.3. How to get in more volume

Having the liberty to train twice per day and/or everyday opens up the possibility to significantly increase training volume.

As long as a "highly conditioned" person stays within his/her limits of exercise tolerance, doing more *generally* means better gains. I don't mean more fatigue, I mean more reps with a given load... Sounds like one in the same but it isn't really. To understand, consider the "effort" (A.K.A. CNS activation, or even "intensity" by its incorrect HIT terminology) it requires to do the 1st as compared to the last rep of your 10 rep max. The tension produced on the tissue doesn't change from the 1st rep to the last. The only thing that changes is the amount of CNS activation required to contract the muscle under load.

So, more reps doesn't necessarily mean more fatigue *if* you can get enough rest in between sets. To get more and more rest, simply do 2 workouts spread out by several hours. Hence, the value of training twice per day.

Another advantage is being able to do more volume per bodypart during one session. You can also split the body up into 2 halves and train half in the AM and the other half in the PM. This essentially allows you to double the amount of volume per session per bodypart.

My comments about training twice per day, 3 times per week as optimal stem from the ability to increase the volume per bodypart, and still having adequate rest between training sessions (e.g. M,W,and F).

This also applies to cardio.

It may sound counterproductive but it isn't. Just consuming more food will create a more anabolic environment (more insulin, more leptin, more test, more GH), and the additional exercise also enhances this by increasing IGF-1, and protein synthesis rates in tissues. (yes, cardio increases protein synthesis in that muscle you are using)

The additional exercise will also lower your average glycogen levels and increase your insulin sensitivity at the same time, in addition you will get some upregulation of lipolytic enzymes. All of this makes those additional calories that you are eating less lipogenic.

23.4. More on AM/PM splits

Ok, here are a few points to think about.

1) Increasing volume isn't a bad thing. The only time it is contraindicated is when you can't handle any more volume because the current weight loads are sufficiently heavy and are causing sufficient trauma to the tissues with minimal volume and adequate frequency.

There is a false notion that HST is about “low volume”. This notion arose from people erroneously stereotyping HST as a previously existing “muscle beach” method used by guys in “the good old’ days”. HST prescribes that volume be more evenly distributed over time to create a more constant environment and thus and more consistent stimulus for muscle growth. The volume of training in HST does not differ significantly from previous programs.

2) The only physiological benefit to training twice per day is to increase the amount of loading the muscle is getting. So, if I were to go from once per day training to twice per day training, and not increase the volume, I would not be deriving any particular anabolic benefit from splitting up my workouts into two shorter sessions. You may however benefit from doing this in other ways such as accommodating a tight schedule or getting the most out of limited energy levels.

3) It is ok to either repeat the previous workout, or to use a different group of exercises, as long as the second set of exercises is comparable in effectiveness to the first group. In other words, you can have Workout A and Workout B and simply alternate between them, using workout A in the morning and Workout B in the evening or vice versa.

Different exercises for the same muscle group usually only differ in the number of muscle groups involved, and the degree of stretch experienced by each muscle group during the movement. In the end, when things get really heavy, all primary movers will be activated 100% regardless of the stance, or foot placement, or hand position, etc. So for example, wide stance squats will hit just as much muscle as shoulder width squats. All that differs is the amount of stretch involved for the inner thigh (adductors).

However, when a maximal squat is attempted with either stance, all muscle will be equally activated. This can be better understood by considering each joint separately. It is either extending or flexing…regardless of body position.

The point of all this is that you can pick two different compound exercises for each major muscle group, squat/press for legs, high-/mid-pull for back, incline/dip for chest. Then do whatever you want for bis, tris, delts, calves, and abs. The reason you can do whatever you want for the smaller muscle groups if because of the limited natural of their function on a single joint.

Another option is to split the body into two halves (e.g. upper/lower or push/pull) and do half in the AM and the other half in the PM. This will allow more time (i.e. sets) to be done per muscle group during a single workout. You can either do more sets per exercise, or simply add exercises and keep the sets per exercise the same.

Now we haven't touched on the "consequences" of two-a-day training. Briefly, you will be more tired and you will burn more calories. This means that two-a-days will be easier using lighter weight loads such as the 15s, or the first week of any rep range. It also means you will be more likely to experience a caloric deficit. This means you may need to up your carbs while doing two-a-days.

Just as important to realize is that you will be more likely to experience "burn out". Your motivation to train can really take a hit after several weeks of two-a-days. Keep this in mind! This does not mean that your muscles are experiencing the same mental boredom or fatigue, it simply means that doing something relatively difficult and tiresome twice as often makes you get tired of doing it twice as fast.

23.5. Recommendations on AM/PM split during your HST cycle

You won't last long doubling the volume just because you are using am/pm splits.

Here is what I suggest.

1) When using 15s: Go ahead a repeat the am workout in the same day pm workout. Especially when things are very light (1st week of 15s).

2) When using 10s: First week of 10s, assuming some zig-zag, go ahead and repeat the am workout in the pm. During the second week of 10s, split the body up into two halves, either push/pull or upper body/lower body. This will allow more sets for each exercise because you are only training half the body at a time.

3) When using 5s: Once again, if you are getting a pretty good zig-zag in weight loads (which is just fine), go ahead and do 2 identical workouts, one in the morning and then once in the evening. When things get heavy however, split the body up again into two halves and train have the body in the morning and the remaining half in the evening.

NOTE: training twice per day significantly increases the number of calories you burn in a day. If you are trying to gain weight, take this into account and add additional calories.

24. AAS and Prohormones with HST

Disclaimer: *Bryan Haycock does not condone nor recommend that anyone use anabolic-androgenic steroids (AAS) or other hormones and prohormones (PH). This discussion is for informational purposes only.*

SD allows microtrauma to happen at lighter loads. You need to progressively increment the load to accommodate the Repeated Bout Effect, i.e. continue to induce microtrauma. Microtrauma allows IGF-1 inside the damaged muscle fibers to leak out into the interstitial space and act on satellite cells. These satellite cells lie dormant until stimulated by IGF-1 into proliferating (reproduce) and differentiate (become muscle cells). When they "melt" together with muscle cells, they donate their myonuclei - thus increasing the total number in the cell. There exists a specific ratio between number of myonuclei and the (potential) volume of the muscle, so this chain of events eventually lead to a larger muscle. So, microtrauma - IGF-1 acting on satellite cells - donating myonuclei to muscle cell - muscle cell growing.

AAS stimulate satellite cell activity independently of microtrauma, so neither the "reset" function of SD nor the need to cause microtrauma each and every workout is a necessity to grow.

Testosterone has the following effects on muscle tissue:

* Enhanced growth factor activity (e.g. GH, IGF-1, etc.)
* Enhanced activation of myogenic stem cells (i.e. satellite cells)
* Enhanced myonuclear number (to maintain nuclear to cytoplasmic ratio)
* Enhanced protein synthesis
* Enhanced new myofiber formation

So you can easily see why testosterone is an incredible anabolic hormone in muscle tissue. It tips the scales in every beneficial way towards muscle hypertrophy.

To put it in a very simple way, if there are no side effects using a prohormone, it doesn't work. Because, if there are no androgenic side effects, the compound is not working on the androgen receptor. Since there is only 1 androgen receptor in the body to do all the variety of things androgens do in various tissues, if you don't see signs of androgen activity in other parts of the body, you aren't getting it in your muscles either.

All the ad copy about "no side effects" is marketing dribble.
Now I never said that these were "serious" or "dangerous" side effects. Did you know that birth control pills are steroids? Asthma in children is treated with steroids. These have the same if not worse side effects than testosterone.

Here is a quote from the Myo Health Clinic:
"Intramuscular testosterone injections (testosterone cypionate and testosterone enanthate) are effective, safe and inexpensive."

Now, I'm not arguing with the opposition to use steroids either. Not everybody is interested in using hormones to improve their body.

The best time to take the any androgen is just “before” the heaviest portion of your cycle.

A number of things are going to happen when you go off. If not countered they will cause you to lose much of what you gained. Of primary concern is the load with which you are using to train when you go off. What often happens is that guys will max out their strength while "on" by pushing low rep weights as heavy as they can possibly go. Then when they go off, they are forced to drop the weight because their strength and exercise tolerance goes down. This creates an environment of both "low testosterone" AND "decreasing weight loads".

So, there are two possible remedies.

1) Don't increase the weight loads just because the androgens are making you stronger. Instead, just increase the reps. So where you were doing 5 reps with a given weight before you started taking some AAS/PH, now you can do 8 or even 10 reps with that same weight now that you are "on". Then when you go off, you simply drop the number of reps, NOT the weight.

2) Train in the rep range just before your most heavy weights in an HST cycle. So, if you are doing a 2-on/4-off cycle, begin using it during the last week of 10s and continue into the first week of 5s. Then when you go off, you will begin the second week of 5s with the weight actually getting heavier for at least a week, and then maintained for an additional 2 weeks. So when you go off the weights are actually getting heavier.

It's the timing that is important. You would want the 2 weeks "on" to happen during the second week of 10s and the 1st week of 5s. The only thing you are trying to accomplish by timing it that way is to have an increase in training load at the same time you are going "off" to offset the effects of low test during that 3-4 week period.

So, you will at least be increasing the weight for 1 week and at the very least, maintaining the training load at 5RM for an additional 2 weeks. This will help you retain the gains you made.

Obviously this doesn't turn out to be exactly 2-on/4-off.

Diet (protein and calories) is going to be probably the most important factor in predicting whether or not you experience gains while using androgens. Training is of course important, but the proper drug regimen and diet is really what determines how big you get. You can train like crap and still grow if your diet and androgens are right.

"However, Bryan wouldn't one need to taking into account the half lives of the androgen, and in fact the general serum blood levels through one's lifting cycle? For example, dbol's average life is 4 hours, while I believe Cyp is more like 15 days."

Well, not with respect to Mag-10 or the other Diols. Their half lives are very short. They don't reside in the system more than a day in any "active" form. So, when your off, your off. Unlike something like Deca or Cyp, which will cause test suppression long after your last injection.

So, as far as countering the catabolic effects of going "off" a prohormone, you still only have the weight load to counter the negative effects of low testosterone levels. You might be able to load creatine beginning the first day off to counter the catabolism, but you will still experience some shrinking if you are big to begin with.

1) About SD while on a cycle: SD isn't necessary while "on" a cycle. If you are doing 10 weeks, your weights should stay heavy or be slightly increasing the entire cycle. Then, you shouldn't do SD until AFTER your natural test is back up to at least normal. This is very important. As long as test levels are low, you must continue to train uninterrupted.

2) Increased volume during a cycle: Yes, there is nothing "bad" about high volume. In fact, it is good if your exercise tolerance is high. When on increased androgens your exercise tolerance is higher, and you can train with higher volume, thereby increasing the time that the muscle is actually loaded, without risking overtraining (within reason).

3) Skip the SD and 15s. As long as you are injury free, you should train with heavier weights. There is no benefit to cycle the weight down while you are "on". The only benefit from cycling weight loads down is to increase the muscles sensitivity to being loaded, and to heal injuries. While androgens are high, the muscle remains sensitive to consistent/constant loading much much longer. If you are injury free, there's no need to stop to heal.

Now, if you were going to embark on a cycle lasting several "years" in order to begin competing at a high level, you would want to cycle weights and do some SD in typical HST fashion. When going on a cycle lasting for years, you would pretty much train as if you were natural, accept for taking advantage of increased work capacity and recovery ability. However, you would still benefit from the HST-type cycling of weight loads and SD, its just that the time frame for this cycling would be stretched out considerably.

Guys Like Millard and Boris (click the HST tab above) have adjusted there training pretty much as I suggested above. They will start with 15s or 12s, and increase the weight each workout until they either hit their 5s, or stop because the weight is not safe to use anymore.

Both Millard and Boris, independent from one another, found that they needed to stop increasing the weight beyond their 8 rep max for safety.

They don't do SD, unless they go off completely for an extended period, and if they don't go "off" they only drop the weight back down to 15s if they get a strain injury or sore joints (elbows are very susceptible). The 15s seem to really work well for getting rid of tendon pain.

Of course, the diet is paramount. Continued progress requires sufficient calories and protein.

For those of you who don't know Millard, he is one LARGE man. He is a mean 260 off season. Hopefully he will show some pics soon so people can get over the notion that "nobody big uses HST".

Millard made a very good comment about the lower reps that was also said by Boris Kleine (monster from Germany). That is, that HST seems to induce quite significant increases in strength all by itself, but when the hormonal milieu is optimized, strength goes through the roof. You have to be careful using such high poundage’s (600 deadlift, 572 incline bench is just plain heavy!) These guys are getting so strong using HST style routines they have to hold back for safety. This in no way means that HST is not the best way to train, quite to opposite. But, safety is safety, and everyone has to use their head in the gym.

HST is about principles, not blind adherence to somebody's predetermined workout. Anybody can use these proven principles to start growing again...no matter what their current level of development.

24.1. Cycling lengths

Blade:
The short cycle concept was popularized by Bill Roberts, but I heard of it many years ago - even the late Duchaine talked warmly about it. There is only one study that I know of, and that one used Testosterone Propionate for 2 weeks. The reasoning is that using short-acting esters (propionate, acetate + orals) and ending the cycle before the 14 day point will restore endogenous T faster than a longer cycle. Whether it is 14 days or longer is not proven yet, but anecdotal evidence points to 14 days being pretty close to it, and going past this point will prolong recovery.

This translates into it being more reasonable to do a cycle of sufficient duration to actually add some muscle mass, since cycles of 3-7 weeks requires the duration of recovery sometimes equaling the length of time, but occasionally just as long as cycles lasting 8-12 weeks. 8-10 weeks is close to optimal, and 12 weeks is pushing it in terms of increased risk of HPTA recovery problems - or more so the length of recovery will dictate post-cycle losses which in this case would be excessively lengthy.

I've personally used 2on/4off cycles with great success in many of my clients, and also received positive feedback from the multitude of people who have tried it after being inspired from my online articles. 2 weeks off might not allow full HPTA recovery in individual cases, but should also be OK provided proper auxiliary supplements. 4-5 2on/2off cycles can be strung together before taking 4 or more weeks off, and then HCG might be needed in case of testicular atrophy. One isolated 2 week cycle is ineffective, since the body needs some time to adapt to levels of hypertrophy beyond the genetic potential (or more specifically satellite cell activity and hyperplasia). For most people wanting to achieve as much muscle mass as possible within a short timeframe, I usually recommend 10 week cycles. It all depends on your goals.

Bryan:
The problem with a 4-5wk on/3wk off cycle is that you can't gain enough mass to carry you through the recovery period, (assuming you don't use clomid and hCG). In other words, 2on/4off works because your natural test recovers so quickly that your baseline levels are able to support the new mass you've gained (this does not apply for a bodybuilder who is already sporting a lot of extra muscle) until the next cycle. With the Borresen cycle you are simply wasting your time during the 3 week period because your levels won't return in that period of time, then for 4-5 weeks you won't be able to build "significant" mass either. Will it work at all? Depends on your history of use and current mass.

Now, if using an estrogen antagonist and gonadotropin (e.g. HCG) you can do whatever you like and your baseline test levels will be maintained. Cycle however you want and you will always have a soft landing. This does not mean you will "keep" any amount of mass you gain. Your baseline test will only be able to support a given amount of muscle mass. The amount of mass your natural levels can support will be however big you "stay" once you have been "off" for at least a year or so. This is usually more than you can build naturally simply because of the effects of androgens on satellite cells and fiber number. Fiber number will stay higher even if diameter returns to normal.

So, I guess what I'm trying to say, is that if you are going on for longer than 2 weeks, you have to stay on long enough (6-8 weeks) to build more muscle than you will lose when you go off - with low test lasting for at least as long as you were "on". That's at least a general rule of thumb

- test levels will stay low for about as long as you were on (without antiestrogens and hCG). If you are bigger than you could have gotten naturally, you will generally lose most of the mass you gained during the cycle. If you are still below your "natural" limit, you may keep a bit more.

Using Test does change things, at least until you max out your dose (voluntarily or otherwise) and your growth stops for at least 8 weeks without changing anything.
So when you reach a point of stagnation both in dose and weight gain, you are essentially in the same situation as a natural lifter, but at a much elevated body mass. If you are competing at a high level and stay "on" year round, you should do HST as prescribed, SD and all.

If however, you are doing cycles on and off. you need to carefully time everything to avoid a crash. One thing to also note, strength seems to increase to dangerous levels when using high dose Test and HST at the same time. It is advised the reps not drop any lower than 8 in such circumstances. Always use your head, not just your ego.

24.2. More on prohormones

Brand	Brand labeled to contain:	Average amount found (range [mg])
1	5-Androstenediol 100 mg	77.3 mg (66–83) Androstenedione 3.3 mg (3–4)*
2	4-Androstene 3,17-dione 250 mg	166.3 mg (163–170) Testosterone 10 mg (10)*
3	4-Androstene-3,17-diol 100 mg	78.5 mg (77–82)
4	Androstenedione 100 mg	45.5 mg (41–50)
5	Androstenedione 100 mg	51.5 mg (49–54)
6	Androstenedione 100 mg	84.5 mg (76–93)
7	Androstenedione 100 mg	98.5 mg (98–99)
8	4-Androstene 3,17-dione 50 mg	35.3 mg (33–37)
9	4-Androstene 3,17-dione 3.33 mg	1 mg (1)
	4-Androstene 3,17-diol 83.33 mg	35.8 mg (35–37)
	5-Androstene-3,17-dione 3.33 mg	Not found
	5-Androstene-3,17-diol 3.33 mg	Not found
	19-nor-4-androstene-3,17-dione 3.33 mg	1 mg (1)
	19-nor-5-androstene-3,17-diol 3.33 mg	Not found
10	5-Androstene-3β,17β-diol 50 mg	44 mg (43–45)
	19-nor-4-androstene-3β,17-diol 50 mg	Not found
	19-Norandrostenedione 100 mg	76.5 mg (71–82)
11	Androstenedione 100 mg	70 mg (70)
	4-Androstene-3,17-diol 100 mg	87.5 mg (87–88)
12	5-Androstene-3β,17β-diol 50 mg	88.5 mg (83–94)
	Tribulus terrestris 250 mg	See text

* Ingredient not listed on product label.

Various prohormones require conversion into other androgens before they are actually anabolic and/or androgenic. In essence, until they pass through an enzymatic conversion, they are inert in the body.

4-androstenediol (4-AD) requires conversion but it also posses some anabolic/androgenic activity before conversion. Yes, it acts as a "class II" androgen, meaning it does not bind strongly to the androgen receptor, nor does it appear to stay bound. In contrast, DHT binds both strongly and does not easily separate from the receptor. Keep in mind however that both androgens act on the exact same receptor. The differences in their effects are caused by the strength and duration of their bond with the receptor.

The risks of using any androgen are similar, differing only in their severity. It all depends on the dose. And yes, side effects include alterations in cholesterol ratios, reduction in testosterone production, hair thinning, oily skin, alterations in libido, etc.

The positive effects are increases muscle mass, increased bone mass, decreased fat mass, increased energy levels, increased libido, increased mental focus, and elevated mood, and a few others.

However, it is important to remember that all of these effects are dependant on how androgens are used. There are many thousands of men on testosterone replacement who experience nothing but positive effects.

When someone in the supplement industry talks about prohormones and side effects in the same sentence they are talking about either of 2 things, the conversion into estrogen, and the potency of the androgen itself. If an androgen doesn't "aromatize" it doesn't convert into estrogen, therefore it won't produce any estrogen-related side effect like gyno. Keep in mind that estrogen levels also regulate testosterone production, the more estrogen you have floating around the less testosterone will be produced in the testes. The potency of an androgen is self explanatory and relates to side effects such as hair thinning as well as suppression of test production.

You are fooling yourself is you think that using a prohormone is "not" androgen use. Of course it is. In a general sense, it's no different than using testosterone from a syringe. But you have to make up your mind about whether you feel male hormones are evil or good. If you feel they are evil, don't use them and pray for the day when your own natural levels diminish. If you feel they are good, learn everything you can about them and the body's endocrine system, and them use them as a tool to accomplish your physique augmentation goals.

The notion that knowledge and lifting technique can "replace" androgen use and produce comparable gains in muscle mass is false. Once a person has maxed out his body's ability to support more muscle tissue, he will not grow any larger until his hormones increase as well. Using androgens before your LBM is naturally maxed out will only get you their faster. Not only that, but a natural lifters physique will almost always show different proportions than an individual using androgens, even if their overall body mass is the same.

There is only one receptor for androgens. Thus, testosterone, prohormones, and synthetic anabolic steroids all work the same way. They all cause anabolism through the androgen receptor. Most do this through nuclear receptors, others also interact with androgen receptors at the cell membrane.

So, anything we say about prohormones, also applies to testosterone and anabolic steroids. The only difference (I'm generalizing a little bit) is seen by different amounts used and for different periods of time. The effects of Androgens are dose dependant.

All androgens cause muscle growth by a similar mechanism(s).

· Enhanced growth factor activity (e.g. GH, IGF-1, etc.)
· Enhanced activation of myogenic stem cells (i.e. satellite cells)
· Enhanced myonuclear number (to maintain nuclear to sarcoplasmic ratio)
· Enhanced protein synthesis
· Enhanced amino acid recycling within muscle cells
· New myofiber formation

All of these things lead to bigger muscles, whether you train or not. Add to these effects, Hypertrophy-Specific Training and Hypertrophy-Specific Nutrition and you see dramatic increases in muscle mass.

Now when a person quits using prohormones/steroids, they have a greater number of myonuclei than they did before and additional new muscle fibers. This allows them to maintain a greater amount of muscle mass than they could have naturally. This “recently-natural” look is what you see in a lot of magazines today.

As long as you can maintain the new myonuclei, and new muscle fibers, you will store up muscle memory and a greater potential for later drug-free regrowth.

24.3. A few helpful pointers from Bryan

Focusing on volume would be better than on frequency. Androgens don't accelerate the rate at which a cell repairs itself or builds proteins. Androgens enhance the magnitude of the response....make sense?

I think you will experience better results doing more sets per workout, rather than doing more workouts, as long as you are using a ~48 hour frequency. Take your days off to focus on getting an appropriate amount of protein and good carbs.

The exception: When the weight loads get light enough (especially 1st week of 15) doing higher frequency is recommended while leaving the volume (~2 sets/exercise) pretty much the same. This is because there is less damage/inflammation caused by the lighter weights. 15s cause more of an "acute" anabolic effect (amino acid uptake, PGs, ribosomes, etc) without activating significant satellite cell activity.

Using an antiestrogen can increase testosterone levels, but they will need to increase considerably before you begin to see a significant anabolic effect. For example, if you are taking straight testosterone, you probably won't see a whole lot of extra growth until you reach 400-600mgs per week. below that you do get some effects but it is mostly mood, and perhaps exercise tolerance.

So in short, taking an antiestrogen probably won't be terribly "anabolic" at the tissue level. It may however help you retain some mass you gained while using androgens.

25. Summary of HST principles, In simple terms

I wrote this the elite fitness training board, both in response to and to try and feed a recent HST buzz that's started there. I figured it was appropriate to repost it here.

There have been a lot of questions and potential confusion surrounding HST (hypertrophy-specific training) recently. What I'm going to attempt to do is give a very non-technical explanation of the program itself as well as the physiology behind it. The purpose is to clearly present the program as an effective means of achieving hypertrophy.

Bryan Haycock, the guy behind HST, has already done this before: http://www.hypertrophy-specific.com/hst_index.html. The website is somewhat technical, and I remember feeling just as confused after reading it. What I'm going to try to do is fill in the gaps try to clarify, practically, why the program works.

Most training programs were conceived based on practical experience and modified based on medical knowledge. What makes HST special is that it is the opposite: it was formulated based on the way muscle grows in the lab, and then modified based on practical experience.

What is hypertrophy?
hypertrophy - n - A nontumorous enlargement of an organ or a tissue as a result of an increase in the size rather than the number of constituent cells

In other words, muscle hypertrophy is the enlarging of the muscle fibers as opposed to an increase in the number of muscle fibers (hyperplasia).

The principles behind HST:
1) Mechanical Load:
Tension upon muscle cells is necessary to induce hypertrophy. When cells experience tension, the delicate sarcomeres are disrupted. Given adequate nutrients, the muscle is then repaired to a greater size than it originally possessed.
Side note: It is commonly misunderstood that muscle failure is the stimulus for muscle growth. Intuitively, it makes sense. How can someone not sustain growth if they are working to the very limits of their capacity? Unfortunately, this is not true! The tension on the muscle is what actually causes growth.(1)

2) Frequency Potentially the most controversial, so I'll be spending a lot of time on it.

The various growth factors initiated by training all peak at around 24 hours post-workout, and than fall back to baseline by 48 hours. (2, 3, 4, and especially 6, 7) Typically, programs will sacrifice training frequency for the ability to add volume. This is counterproductive if your goal is to have bigger muscles. Given the average split of once/week, this means one will spend two days growing and five days maintaining muscle size without adding to it. This has been confirmed in the lab. One study compared the effects of a volume of weight training performed all on one day of the week to the same volume spread across three days of the week. The thrice-per-week group saw greater muscle gains as well as strength gains over 40% greater than the once-per-week group.(5)
This can also seem counterintuitive, as muscle soreness and strength often do not recover after a mere two days. In actuality, neither of those factors (soreness or voluntary strength) is related to muscle growth.

The ability to recover one's strength is directly related to muscle failure. Training to failure directly inhibits voluntary strength. Basically, training to failure fries your nerves (not the technical term ) and prevents them from being able to contract the muscles for long periods of time. So when one trains to failure and then waits until strength is recovered to train a muscle again, oftentimes the muscle has long recovered and is waiting for the nervous system to catch up.
This means that sometimes, with HST, you will be training through soreness. This is totally okay! Soreness is not harmful, and people generally find that training a sore muscle will cause the soreness to stop.

3) Progressive Load
Anywhere one goes, one hears "Changing one's routine is a way to prevent stagnation. If you're not growing, change things."

We're all in the business of growing muscle. Unfortunately, the body doesn't like to do that. It's rather expensive for the body to repair and produce new muscle tissue. It requires both lots of protein and lots of energy (sort of like the "parts" and the "labor). So, when an exercise is performed that damages the muscle tissue, in addition to the growth response the muscle also becomes *resistant* to further damage from that load. This is called the Repeated Bout Effect. (4)
This is why routines fail to cause further progress. It is also why HST incorporates progressive load.

Side note: strength programs and growth
As anyone who's done WSB will tell you, strength programs can induce a good deal of hypertrophy. As a result, many bodybuilders adopt strength-training programs as a means of causing growth. By isolating and understanding WHY they cause growth, you can just skip straight to the growth-causing elements without wasting time with all of the neural tricks that strength training uses to increase your 1RM.
Strength programs typically have people work with very low reps, often to failure. Both of those have been shown to increase the nervous system's efficiency at performing a movement, thus increasing strength. So, when someone starts a strength training program, initially he/she sees a lot of growth. His/her muscles are not that resistant to damage, and at high tension levels the Repeated Bout Effect takes a little while to kick in. As long as he/she also continues making strength gains, he/she will experience progressive load, and will see muscle growth as long as he/she is overeating. Unfortunately, after a time the strength gains will slow to a crawl, and at that point the muscles are very resistant to damage and will simply not grow.

At this point, conventional wisdom would have our trainee change up his/her routine. This advice is somewhat sound, as new exercises can put new levels of tension on muscle fibers and thus elicit more growth. Also, a rep change can stimulate new growth as well, but ONLY if the new rep range is lower and allows more weight to be used, thus loading the tissue at new levels.

Instead of changing the routine, HST advocates...

4) Strategic Deconditioning
Before each cycle, in order to make the muscles responsive to the light weights in the beginning, a period of 9-14 days is taken off from all training. This reverses some of the effects of the RBE. It allows HST-users to experience rapid and *sustainable* progress.

This is one of the reasons why newbies experience such great initial gains. They have had such long deconditioning periods. Trained individuals also notice this; when coming off of a planned or unplanned layoff they often experience a renewal of gains.

-Calkid

26. Bryan speaks up!, Time to concentrate on the basics!

Some people get confused reading the instructional articles on this website, how people implement HST, and the posts in the FAQ. Many, including myself, have a tendency to overanalyze everything in hopes of finding that elusive "perfect" routine and diet that will magically put slabs of muscle on your body in no time. Sometimes you just have to get to the gym and TRAIN. As a thread in the main HST forum evolved into personal insults, the man himself steps up and posts this great reminder for all of us - a summary of the basic principles of HST, something to keep in the back of your mind whenever you have doubts, or want to individualize your routine in the most efficient way:

Bryan Haycock:

"I'm afraid some of us are missing the point of an instructional article or even a message board such as this.

When you write an instructional article that is to be read by thousands of people, you must put out a routine that will do the most good for most people if they follow it to the "T".

Nevertheless, this type of mass instruction (no pun intended) will always be inferior to individual instruction. DO NOT CONFUSE THIS FACT WITH CHANGING PRINCIPLES! The principles do not change. They remain the same. What made a muscle grow yesterday, will be the same thing that makes it grow today, and tomorrow and so forth.

Allow me to repeat and/or refresh your memories about some of the more relevant principles of muscle size and growth with respect to lifting weights.

Several things determine the size of a muscle. First, your genetic endowment from your parents will determine what body type you have as an adult. Good or bad, you are the product of your parents genes, your muscle included: Second, environmental factors such as nutrition, hormones, and mechanical workload. For our purposes we will focus on mechanical workload (e.g. weightlifting) and nutrition.

A muscle will grow larger in response to being forced to move, support, or in any general sense sustain a weight that it is unaccustomed to. Muscle cells are a type of "mechanocyte" and respond chemically to being mechanically strained or "loaded". The effects of stretching a muscle while it is relaxed will cause it to grow. Likewise, stretching a muscle while it is trying to contract will also cause it to grow.

The reason a muscle grows when you stretch it while contracting or relaxed is because the cells themselves will undergo stretch, and the stretch- or mechano-receptors in the cell membrane will send a chemical signal to the nucleus to make the appropriate proteins. This will increase the ability of the cell to resist stretching and the damage associated with it. In the case of weight lifting where there are metabolic demands, the cells will also increase their metabolic capacity.

So, adaptation to stretching a muscle cell is both an increase in size, as well as an increased resistance to further increases in size (i.e. resistance to damage). The increased resistance to further damage is called the "Repeated Bout Effect" (RBE). The RBE is generally what causes a non-steroid using individual to stop growing larger despite continued training.

One way to overcome to RBE is to increase the load and/or increase the time that the muscle tissue is exposed to the load. In other words, increase the weight and/or the volume. Both are limited by the CNS. The later is limited by the CNS's ability to fire up the muscle and maintain contractions at a given intensity (i.e. endurance). The former is limited by the individual's "strength".

One other way that is unique to HST to overcome the stagnating effects of the RBE is by strategically deconditioning (SD) the muscle. The deconditioning effect allows weight loads the muscle has previously grow resistant to cause the desired effect once again. This is because SD helps to undue the RBE to a small extent.

So, HST uses SD to prepare the muscle to respond to less than maximum weight loads. This is important because maximum weight loads can't be used often enough over time to really grow quickly.

Then, HST uses progressive load. This is critical to cope with the effects of the RBE.

HST does not require that you train to failure because that prevents you from training frequently enough. It's better to train according to the recovery of the muscle (48 hours) than according to the CNS (up to a week or longer).

Finally, HST does not utilize useless techniques and methods pushed by bodybuilding magazines such as “muscle confusion”, “pre-exhaustion”, and “intensity” oriented training. All of which are affecting the CNS and not the muscle tissue itself.

Now, you want to know how many sets you have to use to grow your muscles. If you understood the principles as outlined above you would already know the answer to that question. If you want research on the matter, mechanical-overload studies show that a muscle can be loaded for days to weeks without being unloaded and experience tremendous growth.

So ask yourself, will any number of sets you could possibly do in one workout equal even 1 hour of constant load? So asking whether you should do 1 set or 2 sets isn’t really relevant unless you are simply interested in how to set up your routine. As far as muscle growth goes, the more time under tension the more potent the growth stimulus.

Once again, if you understand the principles of hypertrophy, you should be thinking, “My CNS could never handle loading the muscle for even 30 minutes in one session and still allow me to train again in 48 hours.” So, you must find the amount of volume you can handle and still train effectively in 48 hours. For someone who isn’t conditioned, 1 - 2 sets per exercise (~3-6 sets/week) is sufficient to cause muscle growth. If you have been training for many years (5+) consistently then it might take more time under tension. This person will either need to take more time training in order to accommodate more sets per exercise, or split up their workout into two sessions and train either twice per day, or 6 days per week. This is how guys like myself, Blade, Boris, and others train. I have been training for over 25 years, and it takes a bit more strain and time to overcome years of RBE. Does this mean that the principles of load and time under load have changed for me, as opposed to the new guy? Absolutely NOT!

Strain is what my muscles grow. It is what makes the new guy’s muscle grow. The difference? RBE. RBE makes my muscle more resistant to strain, thus, I need to either increase the strain or increase the time that my muscle is strained. Here are the limitations:

1) My strength levels limit increasing the strain
2) My tissues ability to support the strain without tearing limit increasing the strain
3) My CNS limits increasing the time my muscles can be strained.

So, I must work within these limitations to continue to grow over time. My only other option is to use testosterone which will reduce the need for both strain and time under strain for the most part. But as a natural lifter, I am left to manipulate my training to make the most of the principles. The method that results from these manipulations is called HST when growth is the primary goal.

Now, as I have already done as much as I can over the years to freely try to help people get the most from their training, I don’t know that I need to feel like I’m on trial on my own message board. The information that “I” have provided on this board is true. The research that I have shared on this board is of high quality and can be trusted to be valid. The basic HST program that I have outlined to be applied by anybody and everybody on this board is as good as can be offered considering it must be “one-size-fits-all”.

My advice, if you are interested in saving years of wasted time, use HST as outlined. Then as you grow more and more resistant to further growth (i.e. conditioned), increase those factors you know are responsible for muscle growth. Take it to the limit. But no-one can really tell you ahead of time what your limit will be. Not only that, your limit will change from day to day and will definitely change as the years go by and you begin noticing grey hairs…in your ears!

27. Estimating RMs, If you insist on guessing

I would suggest you start by actually testing for your 15RM. Once you have found it, add 20% to get your 10RM. Then add 15% to your 10RM to estimate your 5RM.

So if your 15RM for bench is 200lbs, you can estimate that your 10RM will be around 240lbs. And further, if your 10RM is 240 your 5RM will be around 276lbs.

When estimating your maxes, be conservative. It's better to guess too light than too heavy.

28. "Sub-maximal" workouts, why not train to failure all the time

28.1. Submaximal training or not

Submaximal is a term relating strictly to strength. I use the term to describe the act of doing a set with fewer number of reps x

Many have the understanding that linear increments in weight load would always be submaximal as long as you don't go to failure. This is true, assuming failure always occurs precisely at that number of reps which represents your previously established RM with that specific weight load. But like we said earlier, your 10RM on one day might be your 8RM on another, or even a 12RM yet a different day. It would also be really impractical to try to find your RMs for every conceivable number of reps (and weight increment).

Let's go back to the idea that there is no "on/off" switch for growth assigned to a given number of reps. 1 long rep (essentially just holding onto a weight for a long time) will make whatever muscles being stretched grow larger (initially). At the same time, making a muscle do 50 consecutive high-force eccentric reps will also make it grow. So it isn't critical to do a specific number of reps "per set", although a minimum number of reps per "bout" will be required to achieve the minimum amount of time under tension required to stimulate growth. This "minimum time" changes up (or down as in SD) as your muscle becomes more (or less as in SD) conditioned to the load.

I follow the 15>10>5>eccentric rep progress. I always make sure I hit the target reps on the first set, but I don't worry about falling short on the second set when I close to my RM. With sufficient rest betweens sets it usually isn't a problem though.

28.2. Simple technique to avoid failure

Since rep speed deteriorates before technical breakdown, end a set when a rep is noticeably slower than the first. So - if you slow down, you STOP. This ensures that you stay at a safe rep number short of failure. The reps decrease as the load increases and fatigue accumulates - you never lower the weight to reach a rep target or to get more sets.

I think it is important to get rid of the notion of the "number" of reps as a principle of muscle growth. Repetitions are not a "principle" of hypertrophy, any more than counting the number of cranks it takes to reel in a fish is necessary to catch fish. You simply crank as many times as is necessary to get the job done. I'm not saying you are doing this, but in order to understand what it is you need to accomplish in the gym, it will help to avoid thinking of the specified number of reps as a restriction or limitation.

Yes, the # of reps a person uses is related to the amount of a weight they're using as well as their level of strength. However, the # of reps in no way should be used to dictate how much weight they should use. In other words, the only reason we designate a specific number of reps to use is to maintain order in our training. They are used as a guide whereby we can measure our progress. An incorrect usage of reps is to only increase the weight when more reps can be performed at a given weight load. This might be sufficient for an average strength-training program, but it is not a good way to increase hypertrophy.

So if I haven't completely confused people as to what I am trying to say, let me summarize things this way:

1) There is a certain amount or threshold of weight or tension that must be applied to your muscle tissue in order to get it to grow. That threshold changes up or down depending on your level of conditioning.

2) Active Muscle Contraction (both concentric and eccentric) is facilitative to muscle hypertrophy when tension is applied. Although Passive Stretch is a potent inducer of muscle growth, in most instances we cannot apply the necessary level of passive stretch to each muscle of our body to accomplish real whole body muscle growth. Thus we use muscle contractions to shorten the tissue before stretching it. This way we don't have to take each muscle to its absolute limit of range of motion before it experiences high levels of stretch.

3) Eccentric contractions are more effective at inducing hypertrophy than concentric contractions using the same relative amount of weight.

4) There is no physiological threshold of repetitions that is necessary for the growth stimulus to be created. It is dependant on the duration and amplitude of stretch relative to the tissues level of conditioning, not the actual number of contractions.

5) Fatigue is not the muscle's way of indicating that a stimulus for growth has occurred. A growth stimulus can be created without taking a set to failure, and at other times, even taking a set to failure fails to produce an adequate growth stimulus. We have no direct way of knowing how successful we have been at creating a growth stimulus from workout to workout. Direct measurements require a laboratory setting and painful biopsies. The only way to really gauge is to look at what has previously been done to the tissue (i.e. how much weight, how much volume, what level of conditioning are we working with). By continuing to increase the duration and/or amplitude of tension/stretch/load, we can be reasonably sure we are creating an adequate growth stimulus (assuming diet is in order). "Within reason", it is the total number of reps performed of a given movement during a single exercise bout that is important, not how many are performed each set. You can blame two prominent exercise researchers and their infatuation with minuscule fluctuations in hormone levels for any confusion on this point.

I'm not sure if that clears anything up or not. But it should help to see why the number of reps per set is less important than the overall progression of critical training variables (i.e. load, volume, frequency, diet) over time.

HST's method of using submaximal weights at the beginning of the cycle is based on the fact that the effectiveness of a given load to stimulate growth is dependant on the condition of the tissue at the time the load is applied. This is a very important concept for natural lifters. It is also based on the need to maintain the health (injury free) of the tissues.

You can't really apply the external load based simply on the capacity to do so, and expect to the muscle to respond the way you want it to (growth). Too much weight too soon, even though you can lift it, will not always result in an optimal hypertrophic response. Not only that, but the greater the load, the greater the response to build resistance to it, and/or get injured.

Why not just do as many reps as possible (A.K.A. train at “100% intensity”, or “train to failure”) for every increment/workout instead of changing it only every 2 weeks? Because when using sufficient frequency to stimulate rapid hypertrophy, you tend to get CNS burn out. Fortunately, it isn’t necessary to train at “100% intensity” to grow quickly. This is a very unpopular statement to experienced lifters who have prided themselves on torturous workouts. They take pride in their toughness and in their willingness to self inflict nauseating exhaustion workout after workout. I HAVE NO PROBLEM WITH THIS. As long as it is not taught as the correct way to train for “growth”.

HST incorporates ever increasing loads in order to stay ahead of the adaptive curve. This curve is set by the tissues level of conditioning at the time the load is applied. This is as much an art as a science. Because we can't do a biopsy of the muscles every time we train, we have to guess how much, how hard, and how often, based on the available research an the "feeling" of the tissue at the time. Why use submax weights? Because using max weights eventually stops working, and simply increases the risk of injury.

Why not just do as many reps as possible (A.K.A. train at “100% intensity”, or “train to failure”) for every increment/workout instead of changing it only every 2 weeks? Because when using sufficient frequency to stimulate rapid hypertrophy, you tend to get CNS burn out. Fortunately, it isn’t necessary to train at “100% intensity” to grow quickly. This is a very unpopular statement to experienced lifters who have prided themselves on torturous workouts. They take pride in their toughness and in their willingness to self inflict nauseating exhaustion workout after workout. I HAVE NO PROBLEM WITH THIS. As long as it is not taught as the correct way to train for “growth”.

So why not train one maximal day only, then utilize "complete rest" thus preserving adaptive energies?

There is no need to preserve "adaptive energies". This is a false notion. These adaptive energies are, in reality, the ability of the CNS to recover voluntary strength. Early "thinkers" noticed the effect of stress on health and compared that to the effects of heavy resistance exercise on strength and came to the conclusion that there was some pool of "adaptive energies" that was limited. Use it all up and you can't recover. What they had not realized was that there are fundamental differences between mechanical loading and Selye's stress model. This caused them to confuse the limitations of the CNS with the resilience of muscle tissue.

Muscle tissue, as indicated earlier, has been shown to recover amidst continued loading. Take for example "synergistic ablation" studies. In these studies the gastrocnemius of an animal is cut so that the standing load is placed almost entirely on the soleus. In these studies the animal’s soleus is subject to a dramatic increase in load during every waking hour. There is no "rest between sets or workouts" or any kind of sets or workouts for that matter. There is no time off to allow "adaptive energies" to do their magic. Nevertheless, the soleus will double in size and weight within days. The muscle literally grows and adapts to the new "environment" while being continually loaded. Now I'm not suggesting that people have this done to get their stubborn calves to grow, but it does illustrate an important point. Which is - the muscle can adapt while it is being loaded, or trained. The tissue does not necessarily need time off. The central nervous system, on the other hand, does need time off. The amount of time off it needs depends on how much "fatigue" was induced.

Please try to avoid "forced reps". During the concentric phase push on the weight but make sure it goes up "quickly". If you are doing an exercise that requires a partner, and he can no longer lift the weight up quickly, you're done.

Fatigue actually "decreases" the damage caused by eccentric reps. The fibers have to be actively contracting while lengthening in order to cause the "right" kind of microtrauma.

28.3. Further discussion on fatigue and its relation to a proper hypertrophic stimulus

The 1st set, as with the 2nd set, merely places a given amount of strain on the tissue. As long as you are supporting the weight, the stimulus is present.

You may have heard some discussion about fatiguing fibers becoming disassociated from the rest of the contracting fibers, and thus avoiding the strain. This is true in one sense, and false in another. As a fiber fatigues, it is true that it will stop contracting. When enough fibers fatigue, the tissue as a whole will no longer be able to move against the resistance and you have reached what we call “momentary muscle failure”. Some studies done using eccentric exercise have demonstrated that high resistance eccentric reps produce more microtrauma when done by a fresh muscle, when compared to eccentric reps done after pre-fatiguing the muscle. This would not be wholly unexpected given the above explanation about fatiguing fibers.

However, there is another issue involved that must be taken into account. No fiber is completely isolated from the rest of the tissue, even when it becomes fatigued. So even when one fiber becomes fatigued (sarcomeres by sarcomeres) that fiber will still experience passive stretch by virtue of being attached to adjacent and in-series fibers. So even if a fiber fatigues right away, if the set continues, that fiber will be stretched and strained with the rest of the tissue, the only difference being that the forces will be shifted from the contractile elements of the fiber to the outer structural elements of the fiber. As we know, both passive and active strain/stretch produce hypertrophy.

In short, fatigue is not a critical factor, although it obviously holds importance given the nature of “lifting” weights.

I think where more confusion comes in, is when people begin talking about "intensity". Intensity is generally associated with effort; the greater the effort required, the greater the intensity. This naturally leads to the idea that the last few reps, which require the most effort, are the most effective. If we are strength training, this is often true. However, when training for muscle growth, the fatigue generated by training to failure and beyond (e.g. forced reps) quickly interferes with our ability to train with sufficient frequency.

29. Why isn't everybody using HST?

Question:
No offense, but if HST is the fastest way to build muscle, why isn’t everybody using it?

Regards,
IK

Answer:
No offense taken, and that’s certainly a fair question. There are several reasons that not “everybody” is using HST at this time. Let me list a few:

1. HST is relatively new. It was introduced in October of 2000 without any fan fare or print publication.

This is the foremost reason why everybody isn't using HST yet.

2. HST is misrepresented.

Many people only hear about HST through second hand misrepresentations. This causes many people to dismiss HST as just another workout like the hundreds of workouts they see in muscle mags every month.

3. HST is misunderstood.

This happens with many people who consider themselves experts. Many times they only skim the HST material and draw conclusions prematurely without fully engaging themselves in the research behind the method. Its like the 3 blind men who were all touching an elephant, yet thought they were touching something different, none of which was an elephant, because they failed to see the whole elephant. They drew their conclusions on only a small portion of what information was available and therefore mislead themselves as to what it was they had encountered.

4. HST is understood, yet tradition and pride prevent acceptance of new information

This occurs most often with people who have a great deal of training experience. These are people who are trainers or writers for bodybuilding/weightlifting magazines. They will read and mostly understand HST, but because accepting it would require that they change their own practices and recommendations in full view of their readers and clients, they chose not to openly endorse HST. It is unnecessarily perceived that doing so would attest to some of their former advice as being incorrect, which would in their mind damage their credibility. Still, the influence of HST is being felt and is even being subtly incorporated into existing training methods with a few minor changes just to keep it their own.

Accepting new research-based information never damages anybody's credibility of course. In fact, all HST does with respect to their previous advice and practices is explain "why" those things that they taught and practiced that actually worked, worked.

5. Some are intimidated and/or turned-off by science

There are many guys who's motto is "Shut up and lift!" They intentionally avoid scientific discussion because it isn't something they feel comfortable with it. There are relatively few people who are academically qualified to have a scientific discussion based solely on the research that lead to HST. Not everyone can be expected to follow the same academic path through college and grad school, and this is the way it should be. The problem is that people sometimes assume that discussing HST requires a bunch of scientific discussion. This is far from the truth. The principles of muscle growth and the methods employed to take advantage of these, are easy to understand and require no background in science or physiology.

6. HST not necessary for some

Finally, and there are perhaps other reasons, but there are many who have reached their goals without using HST. For various reasons, whether it be low physique requirements, or the use of steroids, or simply having been at it for so long, there are many who don't see the need to change the way they do things to have what they more or less already have. There is of course nothing wrong with that, and it certainly doesn't make them ignorant, or stubborn. They simply get by without feeling the need to change their routine for improved results.

30. The basics of HST, ...and a lot of technical stuff

30.1. Short summary

In order of importance:

1) Satellite cells must be activated, differentiated, and fuse with existing fibers, donating their nuclei.

2) Mechanical stress must be transmitted to the sarcolemma (mechanotransduction) and contractile protein structures within the sarcomeres. This will trigger focal adhesion kinases (FAK) that in turn initiate the downstream signaling events leading to an increase in the contractile and cytoskeletal protein expression/synthesis.

3) pH and oxidative stress must be acutely increased within the muscle fiber.

Focusing just on the workout, this pretty much sums it up. If #1 doesn't happen, you will not grow…ever. If number two doesn't happen, you will grow a little, but you will soon reach the limits of the sarcoplasmic/nuclear ratio and growth will stop. If #3 doesn't happen, you will still grow quite significantly, but the rate of growth might be enhanced or facilitated if #3 is achieved.

#1 is achieved when a certain level of microtrauma is experienced by the fibers. This is brought about by load, eccentric contractions, and to a much lesser extent, hypoxia (A.K.A. #3) When load, eccentric contractions and #3 occur, each fiber will produce and release muscle specific-IGF-1 (sometimes called mechano-growth factor) The IGF-1 in turn seeps out of leaky sarcolemmas and acts on nescient satellite cells to initiate #1. Microtrauma is rapidly reduced from workout to workout (Repeated bout effect) thereby limiting the effectiveness of any given load to induce further hypertrophy.

#2 is achieved by loading a muscle that is actively contracting.

#3 is achieved by contracting a muscle (doing reps) until you create an oxygen deficit and subsequent hypoxic byproducts (e.g. lactate and oxygen radicals).

The afore mentioned physiological principles of muscle growth are what we follow in order to ensure that 1,2 and 3 happen.

30.2. What are satellite cells?

Satellite cells are myogenic stem cells, or pre-muscle cells, that serve to assist regeneration of adult skeletal muscle. Following proliferation (when the satellite cells reproduce) and subsequent differentiation (when the nucleus changes to become a specific type of cell, in this case, a muscle cell), satellite cells will fuse with one another or with the adjacent damaged muscle fiber, thereby increasing the number of myonuclei for fiber growth and repair. Proliferation of satellite cells is necessary in order to meet the needs of thousands of muscle cells all potentially requiring additional nuclei. Differentiation is necessary in order for the new nucleus to behave as a nucleus of muscle origin. The number of myonuclei directly determines the capacity of a muscle cell to manufacture proteins, including androgen receptors.

In order to better understand what is physically happening between satellite cells and muscle cells, try to picture 2 oil droplets floating on water. The two droplets represent a muscle cell and a satellite cell. Because the lipid bilayer of cells are hydrophobic just like common oil droplets, when brought into proximity to one another in an aqueous environment, they will come into contact for a moment and then fuse together to form one larger oil droplet.

Now whatever was dissolved within one droplet (i.e. nuclei) will then mix with the contents of the other droplet. This is a simplified model of how satellite cells donate nuclei, and thus protein-synthesizing capacity, to existing muscle cells.

There appears to be a finite limit placed on the cytoplasmic/nuclear ratio (Rosenblatt,1994). Whenever a muscle grows in response to functional overload there is a positive correlation between the increase in the number of myonuclei and the increase in fiber cross sectional area (CSA). When satellite cells are prohibited from donating viable nuclei, overloaded muscle will not grow (Rosenblatt,1992; Phelan,1997). It is not a stretch to say that satellite cell activity is a required step, or prerequisite, in compensatory muscle hypertrophy, for without it, a muscle simply cannot significantly increase total protein content nor CSA.

So, in short, the number of nuclei determine how big a muscle cell can get. Satellite cells are the source for more nuclei.

30.3. But why is HST organized into 2 week blocks and the 15/10/5 rep ranges - I don't understand it...

Keep in mind that you have to consider the tensile strength of the tissue itself. Lifting weights to induce hypertrophy is a very much a mechanical process. You are causing physical stress to the protein structures of the muscle tissue. A given amount of load is going to be required regardless of the number of repetitions, to induce hypertrophy.

So, please try to think outside of reps and sets. The purpose of every workout is simply to apply an effective stimulus by providing an incremental increase in tension from the last workout. Just arbitrarily picking a certain number of workouts before you change isn't going to ensure you are applying an effective stimulus. That's more akin to periodization, rather than hypertrophy-specific progressions.

Muscle tissue does not distinguish between rep ranges. There is not a special number of contractions that "triggers" a hypertrophic response. The only thing that triggers hypertrophy is sarcolemma distortion and subsequent microtrauma and to a MUCH lesser extent, metabolic activity. Metabolic activity is more anticatabolic, then anabolic. These pathways of mechanotransduction have been mapped and are not in question. Yes, there are always more details to be ironed out, but the pathways are now established that go from mechanical load to muscle cell growth.

In order to adhere to the principles of training induced muscle hypertrophy we must have progressive load. Progressive load sufficient to cause hypertrophy will limit the number of times the muscle can successfully contract against the resistance. There are several old studies that narrowed it down to a range of perhaps 20 reps (if the muscle is deconditioned) all the way up to 120% of your 1RM. So, depending on how conditioned the muscle is, you can use any rep range between 20 reps and negatives.

While using HST, your reps decrease over time simply because the load is constantly increasing. It's that simple. There is no magic number, though others might have you believe there is.

Why 6 workouts in 2 week blocks? Because it takes about that long using decent increments to reach your specified RM.

The whole purpose of HST's organization is to give you some idea of what that stimulus needs to be on that day's workout.
SD is kind of like a reset button. It gives you some place to start, where you are pretty sure about the condition of the tissue when you begin.

Because you can't see what is actually happening inside the microscopic world of your muscles, you can only get an idea of what kind of stimulus is required by knowing what the tissue has recently undergone. Even then, all you really know is that the tension applied has to be either greater in amplitude, duration, or some combination of the two, with amplitude being the most effective of the two.

All of this methodology (for lack of a better word) is based on tangible yet invisible things like heat shock proteins, microscopically thin connective tissue, kinase-type signaling proteins, and all the protein synthetic machinery and all the genes that regulate them.

Now, it isn't necessary to become an expert on the details of each of these cellular components, but it does become necessary to have a basic understanding of "what it all means" if you really want to understand HST.

Without this understanding, HST will appear to be no better or worse than any other routine. This is the trap that many experienced lifters fall into. They been around the block, they've seen it all before, but they fail to understand that there is an underlying truth about how muscle works that the previous routines weren't able to pattern themselves after. They were in the general vicinity, through trial an error, but there just wasn't enough research available to reduce the uncertainty that drives the endless variation in strategy and method.

So you aren't going to understand HST by studying its sets, reps, and workouts. You can only understand HST by studying how muscle tissue works. I can't emphasize this enough. HST is not about sets and reps, it is about getting people to change the way they think about training for size. It is about introducing demonstrable physiological concepts into a culture dominated by marketing hype, tradition and regurgitation of every single BB myth ever known.

30.4. The more advanced insights

First let me clarify that HST is based on physiologically sound principles not numbers. In short, they are:

• Progressive load
• Training volume
• Training frequency
• Conditioning (Repeated Bout effect)/Strategic Deconditioning

So we are dealing with 4 basic issues, Load, Volume, Frequency and Conditioning. Within these basic factors we have reps, sets, and rest. HST differs from previous training methods in many aspects, but particularly in how it incorporates knowledge of how the "cell" physiologically responds to the training stimulus in its methodology. Previous methods focus on effort (A.K.A Intensity), current voluntary strength, and psychological factors such as fatigue and variety.

• The number of Reps is determined by the minimum effective load (this changes over time based on Conditioning)
• The number of Sets is determined by the minimum effective volume (this changes over time according to current load and Conditioning.)
• The Rest between sets is determined by the amount of time required to regain sufficient strength to successfully achieve the minimum effective Volume.
• The Frequency (rest between workouts) is determined by the ability of the CNS to recover sufficiently to maintain baseline "health" indicators. It is also determined by the time course of genetic expression resultant from the previous workout.

• The interval of Strategic Deconditioning (SD) is determined by the time course of adaptation to the individual's maximum weight loads. In other words, SD is required to reset growth potential after plateauing. The duration of SD is determined by the level of conditioning attained during the training cycle.

Mechanical tension on the protein structures of the muscle cells is the primary stimulus for hypertrophy. This tension can elicit anabolic processes with or without damaged to the cell membrane. However, some damage to the cell membrane seems to be critical for the action of autocrine and paracrine growth factors (FGF, IGF-1, etc). Without the activity of these growth factors outside the cell there will be no increase in myonuclei, and thus no significant increase the volume and/or number of the cells.

Some improvements in muscle cell function do occur even if the number of myonuclei remains the same. These won't lead to significant hypertrophy though. These improvements in muscle cell functional capacity involve ERK1/2. This is the pathway activated most when you get an intense burn and/or train to failure.

Muscle "activity" such as the typical repetition, and the metabolic byproducts and change in the internal milieu of the cell also "contribute" to hypertrophy, but only indirectly. Reps, and fatigue activate signaling proteins and transcription factors that increase protein synthesis. This increase in protein synthesis allows an increase in crucial enzymes, receptors (yes even androgen receptors), membrane and structural proteins. Remember that protein breakdown is also accelerated so the net effect is most often merely a maintenance of muscle protein levels. This is what goes on after each workout when plateauing after years of training.

As mentioned, without the activity of IGF-1 and FGF outside of the cell, satellite cells will not contribute significantly to hypertrophy. The process is dependant on microtrauma at some degree.

Studies have shown that the ability of a given amount of tension to elicit hypertrophy decreases over time in a given muscle. This is because the same adaptive process that leads to muscle growth, also leads to resistance to the stimulus of muscle growth. It has a lot to do with the principle of homeostasis, in other words, the body will always fight further change as it's changing.

Studies have shown too much microtrauma is a bad thing. The rapid infiltration of immune factors (the primary cause of DOMS) actually causes significant breakdown of muscle proteins and the death of some cells.

Now, the ability of mechanical tension to cause microtrauma to the cell membrane is dependant on the condition of the extra cellular matrix. If it is robust as a result of chronic strain, is will take an unaccustomed load to induce any trauma. Your ability to apply this load is dependant on your voluntary strength. Your body is able to protect your muscle cells from microtrauma even when using max loads. It isn't always able to protect tendons.

Anytime you do a set and it burns like crazy (painful burn) you are creating the same conditions of the occlusion studies. In other words, its not that the effects seen in this study don't happen without cutting off the blood supply, they do depending on the type of set. I would guess the vascular occlusion is increasing phosphorylation of MAPKerk1/2. erk1/2 appears to be more sensitive to acidosis, and oxygen radicals, both of which would be increased by lack of blood flow. Although less of a contributor than p38, erk1/2 does appear to contribute to hypertrophy.

Keep in mind that as a muscle contracts, it squeezes the blood out from the blood vessels around it.

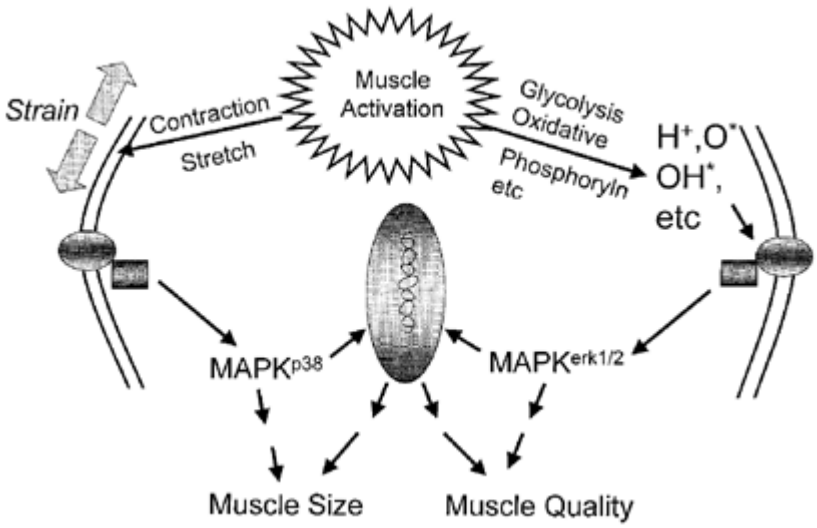
That is why your blood pressure goes up as large muscle groups contract (even clenching your fists actually raises blood pressure). This is also why pilots learn to contract their musculature to keep from passing out during high G-forces.

Contracting and relaxing a muscle acts like a blood-pump and plays a role in proper function of the cardiovascular system during exercise.

As was mentioned earlier, if you can increase the level of metabolic byproducts, decrease the pH and increase the level of oxygen radicals you will "help" to stimulate hypertrophy. However, this is not sufficient to elicit significant hypertrophy in the absence of progressive loading. In other words, flexing your muscles until they really burn won't really make you grow all that well. But combine it with progressive load and you will facilitate growth.

There is an excellent issue of The Journal of Physiology that ties in the participation of mechanical strain vs Metabolic strain to muscle hypertrophy. In the issue you will get good explanations of mechanotransduction and how it relates to genetic expression leading to muscular hypertrophy. Its a must read for anybody into the science of contraction induced hypertrophy. J Phys Vol 535 No.1

Here is a model from the article showing in general terms how mechanical strain, and metabolic strain both contribute to hypertrophy, but to differing degrees. p38 leading more specifically to muscle size, while erk1/2 leads more towards improvements in muscle function or capacity. However, there is some overlap:



There are studies showing passive stretch eliciting a greater influence on erk1/2, and less so on p38.

Passive stretch puts the strain of the load on “structural” proteins (both collagenous and otherwise) and the cell membranes. When the fibers contract, it shifts the load to the contractile proteins (myosin, actin, z-discs, etc). This appears to be crucial for activation of p38, which of course leads to significant fiber hypertrophy.

I still like the loaded stretching. I do it where I can, shrugs, incline curls, chins, etc. But not all movements lend themselves to this kind of stretching.

Whether actual detrimental disruption of the structural proteins is required for growth or not is a good question. But what is not in question, is that mechanical (as opposed to metabolic) strain is required. The load must be transferred through mechanotransduction to the cell membrane and contractile structures.

I have used "muscle damage", "microtrauma" and "tissue strain" interchangeably...just easier to grasp I guess.

I would have to argue with the concept of the need for inflammation. With the release (autocrine & paracrine) of intracellular IGF-1 and subsequent activation of satellite cells, inflammation per say isn't required at all...

So, erk1/2 is phosphorylated in response to a drop in pH (lactic acid) and increase oxygen radicals. These are the two primary effects of metabolic activity. Thus, the cell will respond by increasing its metabolic and oxidative capacity in response to increases in erk1/2 and its associated transcriptional factors.

p38 on the other hand is not really effected by either pH or oxygen radicals. It is phosphorylated in response to strain on the contractile proteins in a muscle cell. This is why moderate "passive" stretch has little effect on muscle cells in-vitro.

In-vivo is a different situation using stretch. Animal models using stretch are not true stretch conditions because the animal will contract the muscles being stretched. The stretch is like holding onto a set of dumbbells for days at a time. You will naturally contract against the pull of the weight by contracting the traps, even if it isn't hard enough to actually shrug the shoulders, you will hold a static contraction as long as you can. Make sense?

This is why in animal stretch studies you see significant hypertrophy associated with both erk1/2 and p38 activity.

30.5. Hyperplasia

"Title: Effects of anabolic steroids on the muscle cells of strength-trained athletes.

Researchers: Kadi F, Eriksson A, Holmner S, Thornell LE Department of Integrative Medical Biology, Umea University, Sweden.

Source: Med Sci Sports Exerc 1999 Nov;31(11):1528-34

Summary:

Athletes who use anabolic steroids get larger and stronger muscles. How this is reflected at the level of the muscle fibers has not yet been established and was the topic of this investigation. METHODS: Muscle biopsies were obtained from the trapezius muscles of high-level power lifters who have reported the use of anabolic steroids in high doses for several years and from high-level power lifters who have never used these drugs. Enzyme-immunohistochemical investigation was performed to assess muscle fiber types, fiber area, myonuclear number, frequency of satellite cells, and fibers expressing developmental protein isoforms.

RESULTS: The overall muscle fiber composition was the same in both groups. The mean area for each fiber type in the reported steroid users was larger than that in the nonsteroid users ($P < 0.05$). The number of myonuclei and the proportion of central nuclei were also significantly higher in the reported steroid users ($P < 0.05$).

Likewise, the frequency of fibers expressing developmental protein isoforms was significantly higher in the reported steroid users group ($P < 0.05$). **[these researchers found embryonic fiber development in the nonsteroid using group as well...just not as much as in the group using.]**

CONCLUSION: Intake of anabolic steroids and strength-training induce an increase in muscle size by both hypertrophy and the formation of new muscle fibers (hyperplasia). We propose that activation of satellite cells is a key process and is enhanced by the steroid use. The incorporation of the satellite cells into preexisting fibers to maintain a constant nuclear to cytoplasmic ratio seems to be a fundamental mechanism for muscle fiber growth. Although all the subjects in this study have the same level of performance, the possibility of genetic differences between the two groups cannot be completely excluded."

So, there is really no argument anymore among groups up-to-date on their muscle physiology...that includes people into HST.

30.6. Effects of exercise on GH

I don't know if you will find any studies showing that "blood" lactate levels stimulate GH release, but the available research does demonstrate that lactate production within muscle cells is associated with the stimulus for GH release during exercise. And an increase in lactate production doesn't cause a decrease in fatty acid oxidation. On the contrary, a decrease in fatty acid oxidation will necessarily increase glycolytic pathways and thus lactate production (see nicotinic acid studies below).

Anything that puts an acute demand on the anaerobic metabolic pathways will stimulate GH release. One of the early processes involved in the stimulation of GH and gonadotropic hormones is the intramuscular accumulation of metabolic subproducts such as lactate and proton (1,2). The elevated concentration of metabolites and associated acidification within the muscles stimulate chemo receptors (3), which then send afferent signals to the hypothalamic-pituitary system through group III and IV nerve fibers (4).

Anything that will increase the metabolic demand on the muscles themselves will increase GH release, including vascular occlusion (cutting off the blood supply). In a study of vascular occlusion they were able to demonstrate a doubling of lactate levels and, as you might expect, significant GH release, even with loads as low as 20% of their 1RM. (5)

Not only does vascular occlusion increase GH release, but so does anything that is more metabolically demanding, such as concentric reps vs. eccentric reps. Concentric reps cause a greater increase in GH than Eccentric reps (6)…why? Because concentric reps activate the anaerobic pathways more than eccentric reps.

Nicotinic acid (NA) ingestion prevents fatty acid levels from rising above resting values when giving before exercise. (7) In a study looking at the effects of using NA to blunt the rise in fatty acid levels, the NA ingestion was associated with a 3- to 6-fold increase in concentrations of growth hormone throughout exercise. (8) This occurs for at least 2 reasons, fatty acids can act as negative feedback control on the hypothalamus, and the prevention of fatty acid metabolism puts more pressure on the anaerobic pathways, because the uptake of fatty acids into muscle during exercise is proportional to their levels in the serum.

30.7. Advanced Protein Synthesis Insights

When talking about elevated protein synthetic rates.

The duration of this will depend on the effectiveness of that particular workout. If your workout is inadequate, elevated protein synthesis rates will not stay elevated even 48 hours.

The accrual of muscle mass over time is a function of the overall balance between protein synthesis and breakdown. You must have a net increase in synthesis rates in order to see more muscle mass over time. Under normal conditions the muscle is in balance between synthesis and breakdown with no net change (except for losses over time due to aging)

There are several things that increase protein synthesis including, prostaglandins, hormones, and elevated extra cellular amino acid levels. Modulation of protein synthesis rates occurs at two levels, the short phase and the long phase. The short phase alteration in protein synthesis rates occurs by altering the activity of existing ribosomes and/or eukaryotic initiation factors (eIFs). This happens within minutes of the appropriate physiological trigger. The long phase modulation of protein synthesis happens by way of increasing the number of myonuclei. This mechanism involves hormones and growth factors such as testosterone, MGF, and IGF-1 bringing about the activation of myogenic stem cells. This can take several days to effect protein synthesis rates. This is a simplified view but for our purposes it is sufficient.

Initiation of translation (the binding of mRNA to the ribosomal pre-initiation complex) which is critical for the immediate response in protein synthesis, requires group 4 eukaryotic initiation factors (eIFs). These initiation factors interact with the mRNA in such a way that makes translation (the construction of new proteins from the mRNA strand) possible.

Two eIFs, called eIF4A and eIF4B, act in concert to unwind the mRNA strand. Another one called eIF4E binds to what is called the “cap region” and is important for controlling which mRNA strands are translated and also for stabilization of the mRNA strand. Finally, eIF4G is a large polypeptide that acts as a scaffold or framework around which all of these initiation factors and the mRNA and ribosome can be kept in place and proper orientation for translation.

Long term modulation of protein synthesis involves the activation of myogenic stem cells or satellite cells. This is how existing muscle cells increase the number of nuclei they contain. If you recall, when a muscle is stretched it not only produces mechano growth factor (MGF), but also PGF2α and PGE2. PGE2 is a potent inducer of satellite cell proliferation and fusion. This is important because in order for a muscle to grow rapidly, it must produce more mRNA. This is done in the nucleus of the muscle cell. The more nuclei you have, the more mRNA you can produce. Within the cell, prostaglandins may also be involved in regulating the number of ribosomes. This could have long term implications for hypertrophy. This helps shed light on the ability of prostaglandin inhibitors such as ibuprofen and other NSAIDs to prevent training induced muscle growth.

31. The studies

Here we will post links to some relevant studies pertaining to the science that HST is founded on. Note that the newest studies (2002 and 2003) can only be accessed in institutions that subscribe to the related journals, or by pay-per-view - so for those I will only post links to the abstracts instead of the full articles. Also, at the bottom of each study/article, you will often find links to related studies that will further enhance your understanding of the related topic.

Martineau and Gardiner, Insight into skeletal muscle mechanotransduction: MAPK activation is quantitatively related to tension, J Appl Physiol Vol. 91, Issue 2, 693-702, August 2001

Bamman et al., Mechanical load increases muscle IGF-I and androgen receptor mRNA concentrations in humans, Am J Physiol Endocrinol Metab Vol. 280, Issue 3, E383-E390, March 2001

Sakamoto and Goodyear, Exercise Effects on Muscle Insulin Signaling and Action, J Appl Physiol Vol. 93, Issue 1, 369-383, July 2002

Wretman et al., Effects of concentric and eccentric contractions on phosphorylation of MAPKerk1/2 and MAPKp38 in isolated rat skeletal muscle, Journal of Physiology (2001), 535.1, pp. 155-164

Boppart et al., Static stretch increases c-Jun NH2-terminal kinase activity and p38 phosphorylation in rat skeletal muscle, AJP Vol. 280, Issue 2, C352-C358, February 2001

Carlson et al., Time course of the MAPK and PI3-kinase response within 24 h of skeletal muscle overload, J Appl Physiol Vol. 91, Issue 5, 2079-2087, November 2001

Dunn et al., Calcineurin Is Required for Skeletal Muscle Hypertrophy, J Biol Chem, Vol. 274, Issue 31, 21908-21912, July 30, 1999

Haddad and Adams, Acute cellular and molecular responses to resistance exercise, J Appl Physiol Vol. 93, Issue 1, 394-403, July 2002

Carson and Wei, Integrin signaling's potential for mediating gene expression in hypertrophying skeletal muscle, J Appl PhysiolVol. 88, Issue 1, 337-343, January 2000

These are now available as Full Text

Sakamoto and Goodyear, Exercise Effects on Muscle Insulin Signaling and Action, J Appl Physiol Vol. 93, Issue 1, 369-383, July 2002

Haddad and Adams, Acute cellular and molecular responses to resistance exercise, J Appl Physiol Vol. 93, Issue 1, 394-403, July 2002

32. Cardio During HST, Off Days, During SD & Other SD questions

Cardio on Off Days

Sunday, Tuesday, Thursday & Saturday are rest days. Light cardio (20-40 min.) may be performed on rest days. Incline treadmill (brisk walk) should be first choice."

Why is incline treadmill the 1st choice?

Its easy enough to be sustained for a long period, yet doesn't interfere with big muscle group movements such as squats or leg press, like bike and stairs do.

Nevertheless, you can certainly do whatever cardio you chose without concern for effectiveness (except swimming). So, if you like biking or jogging better, it will work just fine.

PROPER WAY TO SD

"de·con·di·tion - To cause to decline from a condition of physical fitness, as through a prolonged period of inactivity or, in astronauts, through weightlessness in space."

The whole point of Strategic Deconditioning is to strategically decondition the muscle tissue. It has nothing to do with rest or strength (that's for periodization not SD).

The best way to Strategically Decondition is to sit around on your butt all day and ask people to get things for you so you don't have to get up.

CARDIO DURING SD

Will serious cardio sessions during the SD week hamper your results?

Well, it will have the greatest conditioning effect on those muscle groups used for the cardio.

Exercising has the opposite effect as Deconditioning.

By doing intense exercise you are conditioning the muscle to be resistant for future exercise bouts. Chronic aerobic exercise interferes with strength and size gains on a number of different levels (CNS, MHC expression, etc), none of which have anything to do with deconditioning.

I haven't found brisk walking (on a good incline) to significantly hamper deconditioning.

DIET DURING SD

Eat maintenance during your SD. Keep fat low though.

It's easier to over eat when fat is high. Nothing magical. Avoiding high fat foods just helps a person not exceed their maintenance calorie level.

Now, if you are going to do a LOT of cardio during your SD, it probably won't matter so much.

If you're trying to gain weight, I would suggest eating the same for about 3-4 days into your SD. Then drop the calories a bit as your metabolic rate slows down.

If your calories are really cut, and you don't want to eat maintenance for 2 weeks, don't SD. Move right into the 15s after your 5s. Not only that, but go ahead and extend the 5s as long as your joints are keeping up (i.e. feeling good).

33. Setting up the HST cycle

Get all your max lifts recorded for each exercise you are going to use BEFORE you begin the program. That means, before you start, you will know your 15 rep max, your 10 rep max, and your 5 rep max. This way you will know exactly how much weight you will use each workout for each exercise for at least the next 6 weeks. Undoubtedly, you will rapidly get stronger, making your previously established max inaccurate. This is NOT important. You will adjust the weights when you start your second cycle.

Do a 9-12 day SD, and start the HST program.

The next time around, rather than finding your maxes all over again, simply add 5-10 pounds to all your lifts. In other words, go back over your previous cycle and add 5 – 10 pounds to each weight that you recorded before for the next cycle. Keep in mind that training at your absolute max weight is not necessary to grow….trust me.

See the HST article (http://www.hypertrophy-specific.com/hst_index.html) for more info on setting up your program.

How to Find your Rep Maxes

Start with a weight slightly lower than you feel you can comfortably lift the prescribed number of times. Do one set with this weight using the same tempo you plan on using for your workouts.

When the concentric rep speed slows down dramatically from the first rep, count this as your failure point. If you were able to achieve your desired reps easily without any slowing of the tempo then add 5%-10% and do a second set. The time between sets should be enough to recover sufficient strength, see the Rest Between Sets FAQ (http://www.hypertrophy-specific.com/cgi-bin/ib3/ikonboard.cgi?act=ST;f=13;t=4).

By at least the third set you should be able to match your concentric failure point with the desired rep range. This is your Rep Max for that rep count.

A more Theoretical Approach

Charles Ridgely wrote an article for Thinkmuscle that uses a more theoretical approach.
Determination of Repetition Maximums by Charles T. Ridgely
(http://www.thinkmuscle.com/newsletter/026.htm#2)

He also wrote a second article in which he explains how to build your own Excel RM generator based on the formulas in his first article. You can find it here:
(http://www.bodybuilding.com/fun/ridgely5.htm).

What if I know one of my RMs but not the others

Then either actually find the other Rep Maxes (recommended), use Charles Ridgely's method above, see the FAQ Estimating RMs, if you insist on guessing (http://www.hypertrophy-specific.com/cgi-bin/ib3/ikonboard.cgi?act=ST;f=13;t=34), or an online calculator to identify the others.

34. Drop sets and high rep sets

At the beginning of an HST cycle you will be using a weight you can do 15 reps with. After proper deconditioning this will induce “some” hypertrophy, but after about 2 weeks the load will be insufficient to induce any further growth. At this time the load must be increased in order to get further growth.

Due to the inverse relationship between load and reps/volume (i.e. the heavier it is, the fewer times you can lift it) you have to reduce the volume as the weight gets progressively heavier. As you reduce the volume, the metabolic demands on the muscle tissue drop as well. This reduces the activity of a signaling protein called ERK 1/2 which is known to facilitate

hypertrophy. Some very interesting research has evolved in the last 2 years that demonstrate the value of hypoxic stress during muscular work with respect to hypertrophy.

So the question becomes, how do I continue to increase the weight over time, and not decrease the activity of ERK ½? Well, you can either put on a tourniquet before each set, or you can do a drop set.

Now a drop set doesn't mean 1 set of reps. It means "repping-out" with lighter weight after your work-set. But in order to be a true drop set, you don't rest after the work set. You perform your desired number of reps, in this case lets say 5. Then you immediately strip some weight from the bar and keep going without resting. Normally, you will strip the weight twice before "calling it good". All the reps performed, including the work reps, should reach about 15-20 to create a real metabolic environment inside the cell sufficient to activate ERK1/2 and related signaling proteins.

Now, in case I totally misunderstood your question and you meant, why not reduce the weight once, allowing 15 additional reps? Well, the answer is that sometimes if you reduce the weight too much, you can actually rest to an extent which ends up prolonging the set unduly.

You will be able to tell if you've created the correct environment, not by how many reps you can perform with a given weight, but because your muscle will be burning tremendously. It will burn/ache like crazy! Drop sets are done by "feel", you don't really have to plan it. So, if you want to only want to strip the weight once and rep-out...go ahead.

CNS fatigue in and of itself is not a problem. The problem arises when you begin to overtrain (general term). CNS fatigue all by itself will not hamper your gains. Your gains will only be hampered if you can't lift the amount of weight you were supposed to, or if you begin to delay training all together.

Here's what I would suggest. If you would like to incorporate drops into your 5s, just do it once the first week. So, I the first day of 5s, do a drop set for the last exercise for each muscle group. Then, see how you feel on Wed (or next workout). The next week, do some drop sets on the first workout that week, and on the last workout that week. Then, see how you feel. If you feel fine, then you can try doing them more often on your next cycle.

It all depends on how well you regain your strength from workout to workout.

Usually, when people say "metabolism" they are referring to your basal metabolic rate or BMR. That's how many calories you burn in a day at rest. I was referring to metabolism that occurs inside the muscle cell as it works or contracts. This involves rapid breakdown of fuel substrates like glycogen and rapid recycling of ATP and ADP.

Your BMR does not produce lactic acid, but high metabolic rates (fuel burning rates during work) inside muscle cells does.

So, cardio on the off days won't necessarily produce the flushing of lactic acid in the muscle accept the one you are working...usually your legs. Even then most people can't carry on an activity that produces intense burning for more than a minute or two.

To summarize, I wasn't referring to your body's metabolic rate, I was referring to the build up of metabolic by products such as lactic acid and oxygen radicals in active working muscles. The latter effects are local and have little systemic effect (except for a creating nausea in some people).

Static contractions would be fine as "part" of the high rep sets. I would suggest you add a hold at the finish of the last rep. Or, you could do static contraction for the first set, and then do normal reps for the second set. The actual contraction of the muscle is important, even during the higher burning reps.

1) If you are doing multiple sets per exercise, only do a drop set on the last set of that exercise. You don't want the drop set to prevent you from accomplishing a successful second set at your target weight. It is reasonable to do drop sets on multiple exercises for the same body part though.

2) I think it's difficult to speak in terms of % when doing drop sets. Drop sets are utilized for a very specific purpose if using HST. Unlike traditional applications of drop sets, which are designed to "increase intensity", in HST they are designed to alter the metabolic environment inside the muscle cell itself. As such, we don't think in terms of Load, we think in term of performance. This may be one of the only times you'll think in terms of performance during HST. So when determining how much weight to tear off the bar, just take some off and keep going. It isn't important just how much you drop in weight, just so long as it allows about 5 more reps.

3) A drop set should let you achieve 15-20 reps total for the entire set. So, if you are doing sets of 5, you should try to knock out 10 more reps after the first 5. This volume of reps is designed to ensure sufficient metabolic strain.

4) Drop sets are valuable for hypertrophy, as long as they don't take priority over progressive load and frequency. As mentioned in several other threads, drops sets produce the desired metabolic stimulus to facilitate the hypertrophy induced by the loading regimen of HST.

However, they must be utilized properly, and unless you understand their purpose, based on the physiological role they play in hypertrophy, you won't know how to use them. This is what you see in the articles in the muscle mags. They will write about how "intense" they are and how they'll put an inch or two on your guns. They'll show some pro, sprayed down with a water bottle, grimacing as he pretends to "break through the pain barrier". The high rep work during the 5s is beneficial because of the lack of metabolic demand (activation of MAPKerk1/2) of doing short 5 rep sets. Negatives require even less metabolic energy, so the benefit applies to negatives as well.

Of course, the benefit also depends on how many weeks you spend doing 5s and negatives. If you finish your cycle only doing 2 weeks of 5s and then start SD, you probably won't get a whole lot out of high rep drop sets. But if you do 4 weeks of 5s then try some negatives, you will get a boost in the hypertrophic signal by flushing the tissue with lactic acid and oxygen radicals.

One last suggestion, I would suggest a full 2 weeks of SD if you do 4 weeks of 5s and then negatives with added drop sets. It will simply take a little longer to unadapt after that. Don't sacrifice the usefulness of SD as well as the 15s in order to "train heavy" all the time. It's an easy trap to fall into, and adding drop sets won't protect you from the inevitable plateau.

34.1. The 15s in HST

Before you give up completely on the 15 rep range, try lowering the weight... The 15s will accomplish what they are designed to even if the weight isn't that heavy. It just has to burn like the "dickens". So, slow down the pace, squeeze and stretch, and try to enjoy them. You should feel tired afterwards, but there isn't any real benefit (size wise) from killing yourself.

The 15s are designed to condition your tendons for the upcoming heavy loads. During the first 2 weeks of 15s, you are only going for intense burning. You want the kind of burn that starts small but then by the end of the set you can hardly bear it. Do whatever it takes to both get this burn, as well as increase the weight every workout.

Manipulate the tempo, use hold-flex methods, or any other method to make the set "effective", meaning mechanically taxing on the muscle. But remember, fatigue is not the goal, a deep aching sensation in the muscle itself is the goal.

The "high rep" training is only there to prepare joints and tendons for future heavy loading. Flushing tissue with lactate stimulates angiogenesis and stimulates tendon growth. (Hunt TK, Hussain MZ. Can wound healing be a paradigm for tissue repair? Med Sci Sports Exerc. 1994 Jun;26(6):755-8.) The 15s are designed simply to flush all tissues and joints (as far as possible) with lactate to encourage angiogenesis for blood flow and tendon growth to better endure subsequent heavy loads (e.g. 5s and negatives)

You will adapt to HST quite quickly if you follow the method closely. It will take about 2 weeks to adapt. I have been watching closely at least 10 people using HST training. Some are doing it natural others are using "assistance". Every person has complained of the 15s "kicking their butt". It burns too much or they feel "fried". Then, when they get to the 10s 2 weeks later they are singing my praises.:) Even if they don't understand why they are doing them they will benefit from it later. Whole body workouts are demanding, especially when reps are high. Keeping the over all volume in check will be your key to success.