Muscle Building Nutrition

Serious lean muscle gains, without the bodyfat – scientifically proven

"This information provides you with EVERYTHING you need to know about nutrition and bodybuilding supplements to build serious lean muscle mass - quickly. Read it and use it, because all you have to do to gain quality weight is to put it into action. Follow the guidelines here, train hard and results are GUARANTEED"

-Will Brink

What the professionals are saying about this ebook…

I commend Will Brink on his efforts to debunk sports nutrition supplements. Will's **Muscle Building Nutrition** is a must read!"

– Lee Labrada, Founder of Labrada Nutrition, www.labrada.com, Former world champion professional bodybuilder, IFBB Mr. Universe, top 4 placed in the Mr.Olympia for seven consecutive years.

"It is with great enthusiasm I have written a chapter to accompany Will's superb **Muscle Building Nutrition**. Combine Will's nutrition and supplement information with my training tips and advice, and success is virtually guaranteed."

– Charles Poliquin, www.charlespoliquin.net Charles is recognized as one of the World's most successful strength coaches, coached Olympic medalists in 12 different sports.

What other people are saying about this ebook…

"The best read ever on the subject of gaining lean muscle. I can now say that after several weeks of getting used to the meal planning and food calculations that I now know the calorific value and nutritional content of everything I eat. I can also now pick up any food, look at the label and instantly know what it all means. ***The end result has been 10lbs of rock solid muscle gained in just over 1 month simply by training less and eating more and better.*** In my now 2 years of training I have never felt more on target, and never looked better."

- Mark A. White, Brisbane, Australia

"Until you understand these principles you can never really gain muscle. I trained for more than 3 years with hardly any results, then gained more lean muscle in the next 6 months using information than in the previous 3 years. ***If I had known this stuff earlier I could have literally saved 3 years of training.*** "

- Thomas Rogerson, Phoenix, Arizona, US

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"...the most respected information on muscle building available anywhere today..."

Disclaimer

Will Brink Bio

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The information contained in this ebook is not intended as medical advice, nor should it be used as medical advice. The information found in this book is provided solely for informational purposes.

About The Author

(For a complete bio please take a look at this page

http://www.brinkzone.com/about.html)

William Brink is a contributing consultant, columnist, and writer for various health, bodybuilding, and medical publications. He is a well-known trainer who has worked with many high-level athletes ranging from professional bodybuilders, Pro golfers, and fitness contestants to Olympic hammer throwers.

He is a consultant to major companies and a judge for the National Physique Commitee (NPC). Will is often invited to speak on the benefits of weight training and sports nutrition at conventions and medical symposiums. He is the author of *Priming the Anabolic Environment*, which can be found at any bookstore, and his new E-Book, *Diet Supplements Revealed*. In addition to his own writing, he regularly co-authors articles with notable scientists on various subjects relating to health and fitness. Will's methods have been so effective he has appeared on numerous radio and television programs including the Atkins Radio Show. He has been invited to lecture on the benefits of supplements, weight training, nutrition and fat loss at universities and conventions in New York, Boston, Atlanta, Canada and other locations around the U.S.

NOTE:- If you enjoy Will's writing then you can sign up for his free "BrinkZone" ezine which will runs from his personal website http://www.brinkzone.com/

To sign up for the free ezine use the sign up form that you'll find on this page http://www.brinkzone.com/home.html

Introduction

This ebook is broken into two major sections. **Section I** deals with the major theme of the book, which is how to gain quality weight and **Section II** covers supplements sold for gaining muscle, increasing strength or some other function that interests bodybuilders and other athletes.

Section I covers the exact steps to follow to realize your goals: adding muscle mass with a minimum of bodyfat. The reader will quickly learn this is not yet another "you can gain 100lbs of monster muscle with my never seen before secret nutrition plan passed down from generations of eastern monks who developed this system over 2000 years ago" or some such nonsense.

This plan was not smuggled out of an eastern block country during the cold war. Nor was it given to me by aliens or even invented in a super secret lab in the bowls of the CIA designed to make super soldiers.

This section is planted solidly in modern nutritional science, combined with good old-fashioned common sense, real world experience and years of practice with hundreds of different bodybuilders and other athletes. Although it looks great in advertisements trying to sell you their "techno functional ultra repartitioning sub micron weight gain plan," the CIA is not needed to gain quality weight.

Gaining quality weight is a process of obtaining proper knowledge about the foods needed, following the right ratios of those foods, deciding on the calories required and being methodical with your plan.

Consistency, as much as anything, is why some people get the results they want while others fail. Of course, being consistent with a poor plan and a lack of knowledge regarding calories needed, macro nutrient ratios, etc. is a sure route to failure.

In this section, you will be given all the foundational knowledge needed to set up a highly effective plan for gaining quality weight, while leaving the bells and whistles of those over-hyped weight gain plans to the suckers… err, I mean people, looking for the easy way to success without doing any hard work. Success in any endeavor in life worth undertaking requires hard work. Anyone who tells you otherwise is full of it.

Of course, no nutritional plan designed to gain quality weight will be of any real use without an equally well thought out exercise plan that involves weight training. Without weight training, no plan designed to add muscle will do anything but add blubber to your frame. Excess calories, no matter how well designed or thought out, without giving the body a stimulus (i.e. weight training) for synthesizing new muscle, will only result in an increase in bodyfat. Combine the information in Section One with a well thought out weight training plan, be consistent with both and results will be yours.

Section II covers most of the supplements currently on the market sold to bodybuilders and other strength training oriented athletes. Though I have attempted to cover virtually all the supplements sold as bodybuilding/sports nutrition supplements, it would be impossible to cover them all. Dozens come out on an almost a weekly or monthly basis.

Most are a rehash of the same old junk that didn't sell well before. Also, there is an overlap with many supplements. For example, carnitine is often sold both as a bodybuilding supplement and as a diet supplement, whereas the "andro" supplements are generally kept exclusively in the bodybuilding arena.

Other supplements such as CLA also have cross over into both weight gain and weight loss markets, as the supplement is supposedly able to both add muscle and reduce bodyfat. I do not cover supplements sold exclusively for weight loss, such as ephedrine. This book is about gaining weight, not losing it. People interested in supplements for losing weight should refer to my book **Diet Supplements Revealed** – see this website for full information http://www.aboutsupplements.com

Although you will be much more knowledgeable about the supplements sold to bodybuilders and other athletes after reading Section Two, it does not mean you will be happier for it.

Many people get angry when their knowledge bubble gets burst. They are much happier living in ignorance over a topic than having the vale lifted from their eyes exposing the often-ugly truth. And the truth is (drum roll) most of what people buy for bodybuilding supplements in an attempt to add muscle are crap, junk, BS, and other expletives I could use.

Sorry, but that's the way it is. It's also been my experience that people tend blame the messenger for the message. Don't get mad at me if you find out that one of your favorite supplements is a product of marketing (read lacking in any real science) and contrary to the ads they run, will not "add mounds of muscle until your buddies don't even recognize you." Short of an Anadrol enema, no nutritional supplement is going to do that for you. As the man said, "*no one ever went broke underestimating the intelligence of the American public."*

However, using Section Two to make educated decisions regarding the supplements you buy, will result in a potentially huge savings in money (quickly justifying the cost of this book) and will definitely help you gain the quality weight you seek.

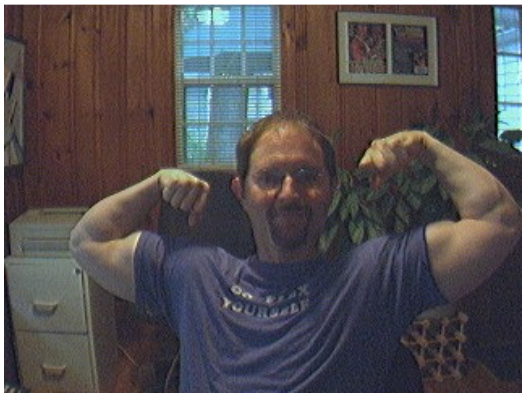
With that introduction to sections one and two, let's begin…

Section I

"Anabolic Nutrition"

By Will Brink © 2002 BCG

"Will Brink is one "guru" who practices what he preaches…
that's always reassuring to know.."



To most people, understanding nutrition is only slightly less confusing than understanding Einstein's theory of relativity. A new book or article comes out weekly espousing the latest greatest way of eating.

What this chapter concerns itself with is giving the reader a foundational understanding of nutrition with the goal of optimizing your body's anabolic environment. What does that mean exactly?

Bodybuilders and other athletes have come to use the term "anabolic" to mean the building of muscle. This is only partly true. For example, physiology texts book will normally define anabolic or "anabolism" as the phase of metabolism in which simple substances are synthesized into the complex materials of living tissue or a

process by which larger molecules are formed from smaller ones (Hole, W.J., 1990).

What does this mean to the reader in plain English?

When you are in an anabolic state you rarely, if ever, exclusively build muscle. It is unavoidable that some bodyfat will be added to the equation.

Total beginners and people using copious amounts of various drugs (i.e. anabolic steroids, growth hormone, etc.) can put on almost exclusively Lean Body Mass (LBM) at times, but it's the exception not the rule. The trick is to maximize, as much as possible, adding LBM while minimizing the addition of bodyfat. That is the ultimate goal of this chapter; to be low in jargon and high in useful "real world" information to maximize gains in muscle, while minimizing gains in body fat.

There are three major factors that will dictate whether or not a person will gain muscle mass: genetics, form of exercise (i.e. weight training), and diet.
It's been debated for years as to which of the three is the most important for gaining lean body mass (muscle!).

For example, many professional bodybuilders have been quoted as saying they regard nutrition as the single most important factor to their success. It's debatable as to which of the three is the most important, and in fact, it's irrelevant.

Without any of the three being optimized, gains in lean body mass (LBM) will be minimal or non-existent. At the very least, the gains in LBM will be sub optimal at best.

Unfortunately, we have essentially no control over the first, which is your genetics. A well known quote in bodybuilding circles is, "the most important way to guarantee success in bodybuilding is to pick the right parents!" In truth, modern science is not far away from being able to turn "on" certain genes that are responsible for a variety of functions in the body.

This development would lead to more LBM – such as increasing protein synthesis via up-regulating the production of some hormone or growth factor – but that is some years off and not the focus of this chapter.

The focus of this chapter is to lay the foundation for proper nutrition when the goal is increasing LBM while minimizing increases in bodyfat. When done reading this chapter, the reader will understand the fundamentals of setting up a proper diet for gaining lean mass, macro nutrients, some basics on metabolism, calculating protein, carbs, fats and total calories, basic effects of foods on hormones, etc.

What will be covered:

- The macro-nutrients (protein, carbohydrates, and fats) - It's important to know the basics of what you are eating before you learn why you are eating them!

- Where does the food go? - Briefly outlines the basics of how food is utilized in metabolism

- Calorie Calculations - Quickly outlines how to calculate calorie intakes for active people trying to gain LBM

- Macro-nutrient ratios - Figuring out how much protein, carbohydrates and fats are needed and in what ratios for your individual requirements for gaining lean mass. Understanding the effects of different macro-nutrients on the metabolism.

The Basics of Macro-Nutrients

There are two general classes of nutrients: macro-nutrients and micro-nutrients. As mentioned previously, macro-nutrients include proteins, carbohydrates and fats. Micro-nutrients include vitamins, minerals and other assorted compounds.

This chapter concerns itself with macro-nutrients. Another cat egory to keep in mind is referred to as an "essential-nutrient." As the name infers, the definition of an essential-nutrient is anything the body cannot synthesize itself and therefore must be obtained from the diet.

We need to eat an assortment of vitamins, minerals, approximately nine to eleven amino acids and two fatty acids to stay alive and healthy.

Interestingly, there is no such thing as an essential-carbohydrate (but we'll have to discuss that at another time and place). Understanding the basics of the macro-nutrients is important as a fundamental knowledge of what we eat every day only ads to your ability to make proper choices. Proper choices means the right amount and types of proteins, carbs and fats in the right ratios.

Proteins:

There are approximately 20 or so amino acids that can make up a protein. Eight of them are considered essential and the body cannot make them on its own (the definition of an essential-nutrient) thus they are required from our diet. Technically, the non-essential aminos can be made from the essential aminos. There are also amino acids considered "conditionally" essential under certain conditions and or populations.

If you link several aminos together you get a peptide. Keep linking peptides together and you get a protein. The shape of the individual amino acids and resulting proteins is quite unique and highly specific, so I won't go into great detail here. Suffice it to say, amino acids are the structural unit of a protein molecule.

Proteins have many different roles in the body besides simple muscle. Protein, or more appropriately amino acids, is the only macro-nutrient that supplies nitrogen to drive lean tissue growth (anabolism). Although athletes usually focus on the

effect that protein has on skeletal muscle, it is equally important for people to understand that there are other disposal sites of amino acid nitrogen in the human body.

In simple terms, these include structural proteins, DNA, RNA, phospholipids, enzymes, immune function and bile acids to name a few. Bottom line? There are many uses for protein in the body unrelated to just building muscle.

Side Bar 1 -- Are "high protein" diets bad for you?

By Will Brink

One of the more pervasive ideas about the foods that we eat is the notion that protein intakes above the Required Daily Allowances (RDA) are a health risk. This dire warning about higher than recommended protein intakes has been around for decades, but is it true?

It has been debated for longer than I care to remember. Many of the studies that suggested higher protein diets may be a risk factor for increased rates of bone loss and may cause "stress" to the kidneys, have been shown to be false, having been replaced by more extensive and accurate studies.

Interestingly, recent research has in fact shown potential health uses for higher protein intakes. Other studies continue to suggest that higher protein intakes during a diet may be superior to other diets for fat loss, though the use of high protein diets for weight loss is still a highly contested issue in nutritional and medical circles.

One recent review study that examined the above issues called, "Optimal Intakes of Protein in the Human Diet" came to some interesting conclusions on the issue of protein and its potential health uses and safety issues.

The study outlined an extensive body of recent data showing that high protein diets may in fact be beneficial for reducing blood pressure and stroke mortality (Millward, D.J., 1999). Though some early studies

appeared to show higher protein intakes caused an excretion of calcium, which would ultimately lead to bone loss, recent studies have debunked that assertion. On the matter of bone loss, the review paper concludes, "for bone health the established views of risk of high protein intakes are not supported by newly-emerging data, with benefit indicated in the elderly."

Interestingly, a large body of research is now showing that the elderly may in fact require higher intakes of protein that is currently being recommended (Campbell, W.W., 1994).

Regarding the potential for protein to stress the kidneys, though research suggests that people with pre-existing kidney disease avoid high protein diets, no data has ever shown kidney function to be compromised in healthy adults and the above review study confirms this finding. A recent study that examined the renal (kidney) function of athletes who follow a high protein diet– that is protein intake well above the US RDA – found no negative effects of a higher protein intake on the kidney function of these athletes (Jacques, R., 2000).

So what's the take-home from the above? It is arguable whether or not athletes require additional protein to maintain their lean muscle mass and or maintain it, though most modern research appears to confirm they indeed should eat additional protein.

The point being, regardless of whether or not athletes need additional protein, higher protein intakes do not appear to pose any health hazards to

healthy active people. And higher protein intakes may in fact have health uses of their own as has been found in a plethora of emerging research.

End of Side Bar 1.

We need protein to build or regenerate skeletal muscle. However, many people don't understand the other functions protein has within the body, as alluded to above.

Upon digestion, amino acids from ingested proteins enter what is called the "free amino acid pool." The amino acids can then be diverted to different areas of the body for utilization depending on what the body needs. For example, some amino acids are used as an energy source through their conversion to glucose, using a process called gluconeogenesis (Mathews, 1990).

Others are used as a substrate for protein synthesis of many different tissues. Protein can also be converted to fat, though this is a very inefficient process in humans and is not a major source of bodyfat, contrary to what you may have been led to believe by some nutritional "authorities."

Protein is also a very thermogenic fuel substrate in the body, meaning that its digestion, metabolism and storage require a great deal of energy, which is released as heat. Have you ever wondered why you may feel hot after a large protein meal? This could be the reason.

In fact, it has been shown that ingesting large amounts of protein can account for upward of 20 percent of daily energy expenditure (Robinson, S.M. et al., 1990). This means that as much as 20 percent or more of the calories from protein you eat are lost as heat and can't be stored as fat on your glutes or hips! From a thermal, hormonal, and biochemical point of view, protein is the least likely macro-nutrient to be converted to bodyfat.

Fats:

Fats are deceivingly simple molecules. Fats are just atoms of carbon linked together in a chain. Assuming nothing is attached to either end of the chain (a free fatty acid) you will find a carbon surrounded by hydrogen (CH3) on one end, and on the other end you will find a few oxygen (COOH or COO-).

Surrounding all the carbons are hydrogen atoms. Now what gives various fats most of their biological character is the length of the chain and the number of double bonds. The more carbons the longer the chain. A double bond is what you get when you take away a few hydrogen and the bond "doubles up" on the carbon (see picture). These double bonds are very important and dictate (along with the length and shape) what type of fat it is and effect it will have on the body.

For example, a fatty acids chain with no double bonds is said to be "saturated" and is known as a saturated fat. These are fats that are hard at room temperature. Although much maligned, saturated fats do have a place in the diet of athletes as will be explained later in this chapter.

Put a single double bond in the fat and it is a "mono" unsaturated, and so on to the "polyunsaturated" fats as you make more double bonds.

Olive oil is an example of monounsaturated fat, and oils such flax, corn, soy bean, etc. are examples of polyunsaturated fats, as they have multiple double bonds. The more unsaturated a fat is the lower melting point it has and these fats are liquid at room temperature.

Highly unsaturated fats such as the "fish oils" EPA and DHA actually remain liquid at very low temperatures. This is why cold water fish have high levels of these lipids (fats).

Saturated fatty acid:
CH3-CH2-CH2-CH2-CH2-COOH (caproic acid)
Unsaturated:
CH3-CH2-CH2-CH2-CH2-CH=CH-CH2-CH=CH-CH2-CH2-CH2-CH2-CH2-CH2-CH2-COOH (linoleic acid)

Like the essential amino acids, the body has two essential fatty acids it cannot make itself – due to a lack of the necessary enzymes – so they must be supplied by the diet and are aptly called the "essential fatty acids" or EFA's.

The two EFA's are linoleic acid (LA) and alpha-linolenic acid (LNA). LA is known as an "Omega-6" fat and LNA is known as an "Omega-3" fat. Minimum requirements for the essential fatty acids are 3-6% of daily calories for LA and 0.5-1% of daily calories for LNA.

As with many vitamins and minerals, it is difficult to get optimal amounts of unprocessed essential fatty acids (especially the Omega-3 fatty acids) from our heavily processed food supply. The term "Omega-3 fatty acid" should ring a bell for the reader.

Fish oils are a well publicized Omega-3 fatty acid, which has been shown to have many benefits (Harris, W.S., 2001). Although early research told us we need a bit more LA than LNA, in practice I find that a diet higher in LNA gets the best results for athletes looking to build muscle with minimum increases in bodyfat.

Americans tend to get their fats from saturated fats, rancid fats and highly processed fats (which contain byproducts such as trans fatty acids), thus, giving fats a bad name. EFA's are not to be avoided as a "bad fat" because all fats are not created equal.

From a general health standpoint, EFA's are involved in literally thousands of bodily processes essential to our health and general well being. Immunity, aging, hormone production and hormone signaling... well, you get the point. As one would expect, EFA's have been found to have many health uses including

cholesterol reduction, possible cancer prevention and treating inflammatory conditions (Rose, D.P., 1992, Robinson, D.R., 1989, Serhan, C.N., 2000)

In particular, the Omega-3 fatty acids are anti-lipogenic (block fat storage), anti-catabolic, anti-inflammatory and they increase beta oxidation (fat burning!), improve insulin sensitivity, increase thermogenesis (Clarke, 2000) and a whole lot more positive effects we don't have the space, time, or need, to cover in this chapter. Recent research has found that EFA's, in particular the Omega-3 lipids, control gene transcription (Clarke, 2000). Omega-3 lipids appear to have the unique ability to enhance thermogenesis and thereby reduce the efficiency of body fat deposition.

For the more technically adept: Omega-3 lipids play essential roles in the maintenance of energy balance and function as fuel partitions in that they direct glucose toward glycogen storage and direct fatty acids away from triglyceride synthesis and assimilation, aiding fatty acid oxidation (fat burning).

EFA's exert their effects on lipid metabolism and thermogenesis by up-regulating the transcription uncoupling proteins, and increasing the encoding for genes producing enzymes involved in fatty acid utilization, while down-regulating the transcription of genes encoding for enzymes involved in lipid synthesis, such as fatty acid synthesis.

A lack of EFA's, in particular the Omega-3 EFA's, appears to be one of the dietary factors leading to the development of obesity and insulin resistance seen in Syndrome X. Syndrome X being process where by the body becomes resistant to

insulin and a long list of health problems are the result, such as weight gain, heart disease, high blood pressure and full blown diabetes (Reaven, G., 2001).

Of particular interest, the body makes something called prostaglandin – as well as other highly unsaturated compounds – from both of the essential fatty acids. Prostaglandin is a highly active short-lived hormone-like substance that regulates cellular activity on a moment to moment basis.

Prostaglandin is directly involved with regulating blood pressure, inflammatory responses, insulin sensitivity, immune responses, anabolic/catabolic processes and hundreds of other functions known and yet unknown (Kelley, D.S., 2001). The long and the short of all this, without going into a long and boring biochemical explanation: Omega-3 fatty acids are responsible for forming the anti-inflammatory prostaglandin and Omega-6 derived prostaglandin are responsible for making many of the pro-inflammatory prostaglandin (in addition other products derived from EFA's of which there are many).

Obviously, it's a lot more complicated than that, but hey, I only have so much space to write and I see that glassy look in your eyes that tells me it's time to stop with the jargon...

It is probably easy to see from just reading this section that the metabolism of EFA's is quite complicated. Needless to say, the proper use and understanding of EFA's is important to maximizing your anabolic environment while keeping bodyfat to a minimum.

Although simple and much maligned, fats are involved in literally thousands of functions in the human body from hormone production to immunity to brain function and countless others. Every single cell in our body is surrounded by a lipid-layer and our brains are made mostly of lipids. Some additional information on fats and their functions in the human body, as it related to health and performance, will be covered later in this chapter.

Carbohydrates:

Carbohydrates or sugars are made primarily of carbon, hydrogen and oxygen atoms that cyclize into a ring. Carbohydrates can be "simple" or "complex" by the number of rings you hook together and the way in which they hook together. Though the rings can be slightly different, their common theme is that of the ring structure as their final shape.

Similar to amino acids and fats, when you link the simple units (the sugars) together you get carbohydrates with different properties. You can link glucose units together to get a glucose polymer and in fact the body stores units of glucose linked together in the liver and muscle called "glycogen," a term most people are familiar with.

You can also link different kinds of sugars to get different products. For instance, if you combine glucose with fructose you get sucrose (table sugar). If you combine glucose with galactose you get lactose (milk sugar) and so on.

Link a bunch of sugars together and you get polysaccarides. Combine two sugars together like the previously mentioned lactose and you get a disaccharide. Of course, by themselves they are call monosaccharides. Are you starting to see a repeating theme here?

Link a simple unit together with other units and you get a product the body can do all sorts of things with. Linking units together gives you a product (fats, carbs, and proteins) and breaking down the products into units (ultimately) gives you energy.

So simple yet so complex.

You will notice I have not mention the "essential carbohydrates" because there is no such thing! Though the body runs best on an intake of some carbs in the diet, the body can make its own carbohydrates from protein and other non-carbohydrate substrates as mentioned in the protein section.

Going in reverse from digestion, the body breaks down complex carbohydrates into simple carbohydrates and ultimately blood sugar (glucose) which can go onto be used for many different functions, such as the production of ATP (the body's universal energy molecule). Depending on the carbohydrate and other factors, different carbohydrates will have different effects on blood sugar; in particular how fast blood sugar rises and falls (Gin, H., 2000).

The ability of a carbohydrate food to raise blood sugar quickly or slowly is called the glycemic index (GI). The GI was developed to track what foods effect blood sugar at different rates.

Interestingly, many carbohydrates that are considered "complex" have been found to raise blood sugar rapidly while a few "simple" carbohydrates don't have a dramatic effect on blood sugar. GI rating of a food is based on how much blood glucose rises after consuming a carbohydrate food over a 2-hour period. This is compared to a reference, which is glucose, a simple sugar.

Some GI scales now use white bread as the reference, but we will use the glucose scale in this chapter. For instance, if you consume 50 grams of glucose (yuk), you will get dramatic elevation in blood sugar. If you eat say 50 grams of carbs found in the form of oranges, your blood glucose would probably rise approximately 44% as high as compared to glucose.

So, the GI rating for oranges would be 44 on the glucose scale. Using white bread as the reference carbohydrate, it would be a different number. Capich?

Below is a partial list of the GI. There is no hard science to what is considered a low or high GI food per se, but a good guide is low is below 50, intermediate is between 50 and 75 and high GI foods are 75 and above on the scale.

Pasta	
brown rice pasta 92	spaghetti 40
linguine, durum 50	spag. protein enriched. 28
macaroni 46	vermicelli 35
macaroni & cheese 64	vermicelli, rice 58

Fruits	
apple 38	kiwi 52
apricot, canned 64	mango 55
apricot, dried 30	orange 43
apricot jam 55	papaya 58
banana 62	peach 42
banana, unripe 30	pear 36
cantaloupe 65	pineapple 66
cherries 22	plum 24
dates, dried 103	raisins 64
fruit cocktail 55	strawberries 32
grapefruit 25	strawberry jam 51
grapes 43	watermelon 72

Legumes	
Lentils 28	lentil 30
Soybeans 18	navy 38
Baked beans (canned) 48	pinto 42
baby lima 32	split peas 32
chickpeas 33	soy 18
kidney 27	

Grains	
barley 22	millet 75
brown rice 59	rice, instant 91
buckwheat 54	rice, parboiled 47
bulger 47	rye 34
cornmeal 68	sweet corn 55
couscous 65	white rice 88

Dairy Foods
milk, full fat 27
milk, skim 32
ice cream, full fat 61
yogurt, low fat, fruit 33

Breads
white bread 70
wholemeal bread 69
pumpernickel 41
dark rye 76
sourdough 57
heavy mixed grain 30-45

Breakfast cereals	
All Bran Soy' n Fibre 33	Rice Crispies 82
Raisin Bran 61	Cheerios 83
Froot Loops 69	Puffed Wheat 80
Special K 69	All Bran 42
Grape Nuts 75	Porridge 46
Corn Pops 80	
Cornflakes 84	

Snack foods
Mars Bar 65
jelly beans 80
chocolate bar 49

What is the significance of Glycemic Index and what are it's drawbacks?

The GI's importance relates to blood sugars affects on the hormone insulin, which is the primary hormonal mediator of fat storage, among the hundreds of functions of insulin.

Among its hundreds of different functions, the body uses the hormone insulin to control the amount of sugar (glucose) in the blood, help pull amino acids into the cells and turn on protein synthesis in lean tissues, and is directly linked to regulating bodyfat storage.

Problems with the body's ability to regulate blood glucose appear if insulin does not properly bind to its receptors on the membranes of the cells or if, for other reasons the cells do not readily accept blood sugar.

As already indicated the general name for the failure of normal amounts of insulin to maintain blood sugar (i.e., glucose) within acceptable levels is insulin resistance. When insulin does not bring blood sugar down after meals, the body secretes higher amounts of insulin until serum glucose levels eventually fall.

Not surprisingly, diets and nutrients, which reduce the amount of insulin required by the body, also appear reduce the tendency toward excessive weight gain, especially in insulin insensitive people (DeFronzo, R.A., 1991).

Understanding the GI allows a person to keep a steady and predictable blood sugar level which can lead to possible improvements in bodyfat levels, energy levels, etc.

For the diabetic (the original reason the GI was invented) it can mean the difference between life and death.

Side Bar 2 - The Glycerol Story: is it a carb?

Glycerol (1,2,3 -propanetriol) is a nutrient that has gotten some attention in the bodybuilding magazines as a supposed "plasma expander" and is hocked as having some ability to increase the fullness of muscles.

It's also added to MRP bars for its mild sweet taste and gives the bar good texture similar to fat. Glycerol is used in the food industry to improve moisture, palatability and as a sweetener.

Over the past few years, there has been a great deal of confusion over exactly what glycerol is and what it is not. Is it a carb? A fat? Can it increase performance? First, let's get to the basis of what glycerol is as it's defined chemically. Glycerol is an integral component of the triglyceride molecule. As most people who have taken a basic nutrition or biology course will tell you, glycerol forms the backbone of the triglyceride molecule, which is one of several ways the body transfers fat around in the body.

Most people also know that high triglyceride levels are a risk factor for heart disease. Does that make glycerol a fat? Not exactly! If you break up a triglyceride, you will get three free fatty acids and glycerol (hence the reason it's called the back bone of a triglyceride).

Now that you've liberated glycerol from the clutches of fatty acids, what does glycerol become? A fat? A carbohydrate? Or maybe it really doesn't

fit into any neat category. This is where things have gotten messy and why there is so much rampant confusion, leading some less than ethical supplement companies to make wild claims about glycerol.

So what exactly is glycerol you ask? If you go by how chemistry books define carbohydrates and glycerol, you'll see that fitting glycerol into the carbohydrate category is not going to happen. I won't bore you with the details, but you won't find glycerol defined as a carbohydrate in any biochemistry textbooks (Lehninger, A.L., 1993).

Glycerol is defined as a naturally occurring trivalent alcohol. Similar to carbohydrates, glycerol oxidation yields 4.32 kcals per gram. So even though the number of calories in carbohydrates and glycerol are the same, structurally, they aren't the same. Besides, proteins and carbohydrates have a similar caloric value also, but they sure as heck are not the same!

So if glycerol is clearly not a carb, what about the people making a big deal out of its conversion to glucose? Does glycerol act like a carb from its conversion to glucose (blood sugar)?

The big question is whether or not glycerol contributes to the formation of glucose, via a process called gluconeogenesis. The basic answer is no! For example, if you starve yourself for 3-4 days, then glycerol might contribute a bit to glucose production (about 22% of total glucose production).

But if you don't starve yourself on a regular basis – and no one should if

they can avoid it – glycerol contributes much less than 5% of total glucose production (Baba, H., et al., 1995).

When the body is starved for both calories and carbohydrates, under the right conditions, it will convert certain non-carbohydrate substrates to glucose, such as glycerol, certain amino acids, etc., but this is not major source of carbohydrates (glucose) under normal conditions. Under normal conditions, like when a person is eating normally (i.e. not starving themselves) you can consume enough glycerol to fill an elephant, but you don't get large changes in blood glucose and insulin.

For instance, in a study published in the "European Journal of Applied Physiology," on six healthy, non-obese men – 32 years of age on average - during exercise to exhaustion on a cycle ergometer (73% of V02max). The men either ingested glucose, glycerol or placebo. The ingestion of glucose (1 gram per kg body weight, equal to 70 grams for a 150 lb person) 45 minutes prior to exercise produced a 50% increase in plasma glucose, as well as a 3-fold increase in plasma insulin at zero minutes of exercise.

On the other hand, glycerol consumption (1 gram per kg body weight) 45 minutes prior to exercise produced a 340-fold increase in plasma glycerol; but resting levels of plasma glucose and insulin did not change (Gleeson, M., et al., 1986).

Is there any use to glycerol in the diet? Possibly. A Dr. Jose Antonio suggests that substituting glycerol for high-glycemic carbohydrates could

minimize the plethora of health problems associated with eating cookies and cakes and other very high GI foods. As Dr. Antonio points out, "glycerol has little if any effect on resting plasma glucose and insulin at rest even after taking whopping doses."

Is glycerol a legitimate ergogenic aid? Because of glycerol enables you to retain more fluid, some scientists theorize that taking exogenous glycerol might help performance. This is based on the fact that if you keep yourself well-hydrated, then you'll be able to train harder and longer, particularly in hot environments.

Some studies have found mild improvements in endurance athletes given glycerol (Wagner, D.R., 1999; Montner, P., et al., 1996.) but studies have been mixed with some finding no effect. As with all science, there isn't a unanimous consensus on glycerol's effects. Some sports nutrition companies sell glycerol to bodybuilders as a "plasma expander" as glycerol can pull fluids into the vascular system temporarily and may enhance the pump you feel in the gym or when stepping on stage.

So far, the feedback on such a strategy is mixed with many bodybuilders reporting a crushing headache after ingesting large amounts of glycerol.

End Side Bar 2

In as much as the hormone insulin is well known for its ability to store glucose in muscle, increase protein synthesis and possibly increase muscle mass, it has

predictably gotten the attention of bodybuilders and other athletes. In fact, it is sometimes said that insulin is a primary anabolic hormone produced by the body.

Some researchers feel that insulin is almost as important to lean muscle tissue as anabolic hormone testosterone and growth hormone (GH) and we know insulin has direct effects on IGF-1 binding proteins (IGFBP's) and directly mediates some of the effects of IGF-1.

Unfortunately, insulin certainly has its down sides. Of course, most people know that insulin metabolism out of control will make a person rather fat, since insulin is a primary hormonal mediator of fat storage.

Insulin resistance increases the number of calories stored as fat and increases the amount of fat produced by the liver from carbohydrates. It gets worse. It turns out that insulin plays a big role in whether we produce our own fat from carbohydrates. And if we are making even a little fat, we turn off our ability to burn fat because the body does not make new fat and burn already stored fat at the same time.

Of course, the concept of "insulin management" for adding new muscle to the hard training athletes frame is all the rage with various bodybuilding magazines, supplement companies and nutritional guru types. If you can manage insulin via the GI correctly, you can add new muscle without adding a great deal of bodyfat and this has been the goal of proper insulin management.

It's obvious that athletes and bodybuilders are far more aware than the general public of the importance of insulin, hence the popularity of insulin potentiating compounds such as chromium and vanadyl sulfate.

Some bodybuilders have chosen to go the Kamikaze route by injecting insulin directly, but it does not take a rocket scientist to realize how dangerous this practice is. Can you say "coma?" Also, many bodybuilders who play with insulin injections end up looking more like the Michelin Man than a bodybuilder.

One thing should be clear by now: proper insulin management is of paramount importance whether for athletes looking to add new muscle without adding bodyfat as well as non-athletes trying to avoid a host of medical ills (Sone, H., et al., 2001). Athletes want to improve their insulin/blood sugar metabolism because they know it can lead to increases in lean mass, glycogen storage in muscle and decreases in bodyfat. Avoiding future medical problems is certainly not a bad motivator either.

What are the drawbacks of the GI? For one thing, many people hold it up as the holy grail of dieting, the be-all-end-all of nutrition. It's not. It is however another useful tool in the fight against bodyfat. Many things can alter the GI of foods.

For example, the GI is figured out in isolation that is each food is tested alone to figure out its GI number. Makes perfect sense from the research point of view, but rarely reflects how people really eat. Mixing different foods together - the way most people actually eat - can have dramatic effects on the GI of the food in question. Fat, fiber, protein, cooking times, etc. can all affect the GI of a food or a meal for that matter.

Want to lower the GI of a rice cake for example? Smear a tablespoon of peanut butter on it.

So, understanding the overall importance of the GI can be a useful tool in getting the most out of a diet plan for gaining muscle with minimum bodyfat, but it is far from the last word in nutrition.

Research looking at the effects of GI on performance and bodyfat.

Researchers compared the effects of four different meals using different GI rated carbs. The diets contained 1 gram of carbohydrates per kg bodyweight fed 1-hour before cycling to exhaustion. For a 200 pound person, that would be 90g of carbohydrates (200 divided by 2.2 = approx 90).

The meals were made up of lentils (a low GI food), baked potato (a high GI food), glucose (the reference GI food) and water, which of course has no GI rating as it does not affect blood sugar.

One interesting find of the study was the lentil group burned more fat during exercise than the glucose or potato groups and lasted longer on the bike test than the other groups (Thomas, D.E. et al, 1991).

Several studies have found low GI foods eaten prior to endurance exercise results in more fat burned and improvements in performance (Burke, L.M., et al. 1998). One study found women who consumed a moderate glycemic food 45 minutes

before an exercise test lasted 16% longer when fed low GI foods (Kirwan, J.P., et al, 1998). Though it should be noted however that not all studies have found this effect of GI on performance.

Body Fat and the GI.

As most people are probably aware, Americans are eating less fat but are fatter than ever! One likely culprit is the fact that most people have replaced fat with high GI foods such as "low fat" cookies, cakes, rice cakes and other high GI foods.

Some research has even found the GI of food can actually alter the eating behavior all day long. One recent study examined how the GI affected eating behavior in obese teenage boys (Ludwig, D.S., et al., 1999).

The boys consumed either a high, medium or low GI meal at breakfast and lunch. They then measured how much the boys ate for a 5-hour period after lunch. Each of the meals contained the same number of calories.

Amazingly, the study found food intake was 53% greater after the medium GI meal and a whopping 81% greater after the high GI meal when compared to the low GI meal.

As one would expect, insulin levels were dramatically higher after the high GI meal. The study showed that a single high GI meal could effect how many calories a person will eat many hours later. The reason for this is most likely the effect of the high GI meal on blood sugar (Roberts, S.B., 2000).

As mentioned, the study found the insulin levels of the high GI meal were much higher than the other meals. When insulin rushes in to lower blood sugar after a high GI meal, the effect can be low blood sugar shortly after, thus the body senses the low blood sugar sending out the hunger signal.

Eating low to moderate GI carbs throughout the day keeps steadier blood sugar levels and thus the body senses that adequate food and carbohydrates are coming in. The feedback pathways controlling hunger and appetite (no they are not the same thing) is incredibly complex and beyond the scope of this chapter. Suffice it to say, blood sugar levels and blood sugar levels effects on insulin is one key feedback mechanism the body uses to sense incoming nutrients diverting those nutrients where needed.

There are numerous studies that find eating high GI foods is associated with greater bodyfat levels (Morris, K.L.,1999) and some animal studies have found feeding high GI foods to animals causes them to gain bodyfat. When you understand the role of insulin in human metabolism, it does not take a PhD in biochemistry to see why this would happen.

One thing is clear, the GI of the carbs you eat will be a factor in how much bodyfat is ultimately produced from the meal and the spike in insulin you will produce (Pawlak, D.B., et al, 2001; Marques-Lopes, I., et al, 2000; Ludwig, D.S., et al, 1999).

You know those low fat cakes you were so happy about? Throw 'em out! One important caveat to remember. Calories also matter and although it may be possible to eat greater amounts of low GI carbs vs. high GI carbs without problems, it's far from a free for all excuse to stuff oneself with carbohydrates.

The body can only 'burn' and store so much carbohydrates as glycogen. After that, increased body fat will be the result. The trick is to eat the correct amount – and types – of carbs to fill glycogen levels and fuel workouts and daily activities, while making up the other calories in healthy fats and proteins, as will be covered shortly.

The GI and Health

As expected, the GI has also been found directly involved with the risk of heart disease and other diseases, such as type 2 diabetes. Eating high glycemic foods can by itself increase your risk of coronary heart disease. In fact, carbohydrates classified by their glycemic index, rather than as either simple or complex, were a better predictor of coronary heart disease (Liu, S., et al, 2000).

To sum up the effects of low GI carbohydrates:

- Eating low GI foods prior to exercise may increase the amount of free fatty acids in the blood therefore increasing fat burning (beta oxidation for you propeller heads).

- Eating low GI foods may result in less food eaten later in the day via improved appetite suppression.

- Eating low GI foods may be healthier for you metabolically due to stable insulin levels and a possible decreased risk of heart disease.

- Eating low GI foods may, in the long run, promote lower body fat levels and a leaner, more muscular physique.

- Low GI means a smaller rise in blood sugar and can help control established diabetes and may improve blood sugar metabolism of people with Syndrome X. (most likely due to in an improvement in the body's sensitivity to insulin)

Is There a Role for High GI carbs for Bodybuilders and other Athletes?

After all the high GI carb bashing I just did, the reader might think there is no place for them in the bodybuilders diet. This assumption would be wrong.

As the expression goes, "there is a time and place for everything" and there is one key time and place for high GI carbs, immediately following workouts.

Following workouts the body preferentially shuttles glucose into the liver and muscles replacing lost glycogen via both insulin dependent and non-insulin dependent glucose transport mechanisms (Gautier, J.F., 2001).

This is the key time to take advantage of the one thing high GI carbs do well: raise blood sugar and insulin quickly. Post workout, the catabolic (muscle wasting) hormone cortisol rises.

Drinking a post workout drink consisting of high GI carbs and fast acting proteins is perhaps the best way to prevent the post workout effects of cortisol due to the sharp rise in insulin which is known to counter act the effects of cortisol (Kraemer, W.J., et al, 1998).

Some bodybuilders will eat a high GI meal such as a bowl of white rice or corn flakes in skim milk, and drink a protein shake consisting of whey with it or mix a carb drink with a few scoops of protein powder.

Interestingly, studies have found a better insulin response when carbs and protein is mixed together post workout over carbs alone (Ivy, J.L., 1998). Specific grams of carbs per kg of bodyweight formulas exist for post workout carbohydrate and proteins recommendations (Burke, L.M., 1997), though 75-100g of high GI carbs and 30-50 grams of protein is the norm with most athletes and will suffice.

These numbers would of course be subtracted from the days total for carbs, proteins, and calories (see below). In a nut shell:

- High GI foods can help refill liver and muscle glycogen stores immediately following exercise and may reduce the catabolic effects of cortisol post workout.

Where Does the food Go? Understanding the Energy Balance Equation

Before we get to setting calories and figuring out amounts for proteins, fats and carbs, it's important to get an understanding of where the calories go when we eat.

Understanding what happens to the calories in metabolism helps us make smart decisions as to what we should be eating for a particular goal, such as losing or gaining weight.

There is a strong synergism between the foods we eat and our performance, muscle mass and bodyfat levels. People debate (make that fight!) about every aspect of nutrition: high carb vs. low carb, high proteins diets, high fat diets vs. low fat diets and so on.

Regardless of which diet a person follows, one element always remains a constant however, which is the concept of energy balance. The energy balance equation can be summed up as:

- Energy Intake = Energy Expenditure + Energy Storage.

It does not matter if your goal is to lose, maintain or gain bodyweight. Everything ultimately revolves around this simple equation. The type and ratios of macro nutrients we eat matters as well as the total number of calories.

Brink's Universal Law of Nutrition states: "Total calories dictate how much you lose or gain, and macro nutrient types and ratios dictate what you lose or gain."

To better understand energy balance we must first be familiar with the components of energy expenditure. Total daily energy expenditure (TDEE or the average number of calories one oxidizes or "burns" in a day) can be partitioned into three components:

- Resting metabolic rate
- Thermic effect of a meal
- Energy expenditure of physical activity

(a) **Resting Metabolic Rate (RMR)** - RMR accounts for up to 75% of TDEE and is associated with the energy cost of maintaining physiological homeostasis.

This includes the energy cost of maintaining body temperature, cardiac output, respiration, nervous system function and other non-voluntary activities.

This component of energy expenditure is determined primarily by lean body mass and is also influenced by body fat levels, gender and physical fitness. Therefore, the greater the amount of lean body mass that you have at any given body weight will increase your caloric expenditure at rest compared to a less lean counterpart of the same weight.

How Do I Increase My RMR?

The reader may be thinking, "how do I increase my RMR?" Considering the fact that RMR is a major contributor of your metabolism, increasing RMR to increase

calorie burning to keep the fat off makes sense. When it comes to altering your RMR, nothing beats weight training.

As mentioned above, It's a little known and under appreciated fact that the more muscle you have the more calories you burn and a higher resting metabolic rate (RMR) is the result (Jorgensen, J.O., et al, 1998).

As you can plainly see, resistance training is essential to losing fat and maintaining lean body mass (muscle). In fact, it's just as important as aerobics if not more so. The truth is if a person has limited time for either weight training or aerobics, I would recommend the weight training over the aerobics any day. Several recent studies have found that resistance training maintains resting metabolic rate (RMR) better than aerobics (Bryner, et al, 1999).

As well studies have shown resistance training is far superior to aerobics for maintaining the metabolically active tissue we need (muscle!) for a superior fat burning metabolism while trying to gain muscle mass.

Your metabolism is the rate at which your body oxidizes (burns) calories to live. About 10 percent of your total daily energy expenditure is used to convert the food you eat into fuel or blubber (fat). Another 20 percent or so is accounted for by exercise and the everyday physical activities of life. I don't believe these figures are written in stone, but you can get an idea of where the calories you eat are going at least.

However, the biggest block of energy is consumed by your resting metabolic rate (RMR), which accounts for up to 75 percent of your daily expenditure. Your RMR is basically the amount of energy used to fuel essential functions such as temperature regulation, breathing, blood circulation and so on.

With the RMR accounting for this big a chunk of your daily calories, it behooves you to focus on the RMR as a key spot to manipulate. Can the RMR be altered? Of course! Your RMR is ultimately controlled by your genetic makeup; but age, gender and body composition also plays an important role. Altering your body composition by increasing your muscle mass and decreasing bodyfat will increase RMR.

For example, people who are naturally blessed with a higher RMR will burn up to 200 calories more each day, even when they perform identical activities.

Weight lifting is the only exercise that has been proven to keep a person's metabolism elevated over long periods of time. Resistance training does burn approximately the same number of calories as if you went for a run or hopped around in an aerobics class. But the calorie burning and metabolism raising effects of weight training continue far after the activity has ended.

Aerobic exercise can never offer that benefit. After aerobic exercise, RMR returns to normal within an hour or so, resulting in the consumption of a few additional calories. Big deal. After weight lifting, RMR remains elevated for up to 15 hours! Bottom line, weight training builds muscle which is far more metabolically active than fat.

Back to the TDEE...

OK, back to the energy equation and understanding TDEE.

(b) **Thermic Effect of a Meal (TEM)** - TEM is the energy increase that takes place after you eat a meal containing protein, carbohydrate, fat and alcohol.

The increase in energy expenditure is due to the cost of digestion, absorption, mobilization and storage of these macro-nutrients. On average this component comprises approximately 10% of TDEE however – and perhaps most importantly – the thermic response to ingested foods is driven primarily by the ratio of macro-nutrients.

That is to say, depending on the ratio of carbs, fats and proteins in a given meal, the thermic effect of the meal can vary widely. While both protein and carbohydrate will illicit notable and significant thermic responses, fat does not. This is one of several reasons why higher fat diets have been blamed for increased bodyfat levels over the years.

However, as mentioned throughout this chapter, the effects fats have on bodyfat is a complicated issue as certain fats are helpful for reducing bodyfat, blocking fat storage, increasing beta oxidation, etc. Though the effect of fat on TEM is important to know, it's even more important in my view to remember not all fats are created equal in this regard or their effects on metabolism.

To conclude TEM, it can be stated that TEM varies according to the mixture or ratio of macro-nutrients eaten at a given meal and can be manipulated – to either increase or decrease TDEE – by differing dietary composition. This information will come in handy and will make more sense when we look at calorie breakdown of the macro nutrients in the later section of this chapter.

(c) **Energy Expenditure of Physical Activity (EEPA)** - EEPA is the most variable component of TDEE. Translated, it's up to us to be either couch potatoes or gym rats! EEPA is composed of both involuntary (i.e., shivering) and voluntary muscular activity, such as exercise.

As mentioned previously, it has been shown that even under sedentary conditions total energy expenditure can fluctuate enough to make a difference in the long run.

EEPA is influenced somewhat by body weight and composition. Meaning, a heavier person will require more energy than a lighter person and a leaner person will require more energy than a fatter counterpart of the same weight for the same activity and intensity.

However, EEPA is primarily driven by an individual's desire and ultimate performance of activity, which is how hard they bust their butt on a particular activity.

Putting the TDEE Together

Finally, we can now equate a person's caloric needs as:

TDEE = RMR + TEM + EEPA

The TDEE can help us not just to understand what our metabolisms do with the foods we eat, but help us to fine tune our diets to achieve our goal of either gaining weight or losing it. If TDEE exceeds calorie intake, you lose weight. If calorie intake exceeds TDEE (i.e. you are eating more calories than you are 'burning') you will gain weight.

The real question is what will that gained weight be? Fat? Muscle? Water? What you gain or lose is dependent to some degree on the ratio of macro-nutrients, exercise choice and genetics.

Calculating Calories for Quality Gains.

There are several methods for calculating calories specific to the needs and desires of the individual, in this case men and women who want to pack on quality weight (i.e. muscle) as a result of their hard work in the gym.

Some formulas are a tad on the complicated side while others are quite simple. Ultimately, we will depend on the simple calorie calculations as our guide in this section.

It should be noted however that the more complicated formulas tend to be the more accurate. The more complicated formulas for figuring out calorie intakes based on the person's gender, activity levels, etc. are below.

The first formula is probably the most commonly used. It's known as the Harris-Benedict formula (Krause, 2000). It differs for male/female. It goes like so:

(Formula 1)
Women REE = 655 + 9.56(Wt in kg) + 1.85(Ht in cm) - 4.68(age)
Male REE = 66.5 + 13.75(Wt in kg) + 5(Ht in cm) - 6.78(age)

The REE is then multiplied by a physical activity factor and a Thermic Effect of Food factor (10%) to determine TEE

An Abbreviated version for persons of normal height/weight goes like so:

Female REE = weight (kg) x 0.95cal/kg x 24hours
Male REE = weight (kg) x 1 cal/kg x 24 hours

(Formula 2)
A new validated formula (Vinkin, A.G., et al, 1999) also used in healthy adults aged 18-71 goes like so:

TEE = 7.377 - (0.073 x age) + (0.0806 x wt) + (0.0135 x Ht) - (1.363 x gender) For males use 0, for females use 1 (gender)

The Simple method!

Ok, the reader is now thinking, "it can't be that complicated to figure out how many calories I need to gain quality weight!" The reader would be correct. I just wanted to show some of the methods commonly used to get exact figures for calories. A much simpler, albeit potentially less fine-tuned method for calculating calorie needs goes like so:

- 20-25 kcal x wt (kg) for weight loss
- 25-30 kcal x wt (kg) weight maintenance
- 30 - 35 kcal x wt (kg) for slight weight gain
- 35 kcal x wt (kg) for greater weight gain
- 45 kcals x wt (kg) for weight gain in active people.

Readers note: Although the above figures - and following diet related information- could be used to lose weight, I would not consider it an optimal strategy for losing fat and preserving muscle; the goal of any weight loss plan.

This ebook and its information are intended for those interested in gaining quality weight. If you are interested in losing weight, I highly recommend you read my ebook Diet Supplements Revealed, which contains more in depth information regarding weight loss.

Go to: http://www.aboutsupplements.com for more information.

To use this method you simply convert you weight in pounds to kilos and multiply times the goal (in this case weight gain). In case the reader has not brushed up on their metric weights, a kilo weighs 2.2lbs.

So, say you weigh 200lbs. 200 divided by 2.2 = 90.9 kilos. Might as well round to 91 kilos to make life easier, no? 91 X 45 (the upper end of the calorie intake) = 4,095 calories (kcals). That's 4,095 kcals for our 200lb person (or 91 kilo) example who lifts weights 3-5 days per week and perhaps does 2-4 days per week of aerobics.

Now, that number is not written in stone. For example, the reader could start out using the 35kcals per kg figure and see if that is enough calories to start gaining weight while lifting weights and doing other activities.

In my experience however, that won't be enough calories. Another method may be to start at the 35kcals per kg figure and add 500kcals per week until weight gain occurs.

People will have to make their own decisions regarding calories. For example, if you are naturally lean and have had trouble putting weight on in the past, you may want to start at the higher calorie intake of 45kcals per kg.

On the other hand, if you are a person who carries more bodyfat than you want or have always had an easy time gaining weight in the form of bodyfat, you may want to start at the lower calorie intake of either 30 or 35 kcals per kg.

For the remainder of this chapter, we will work with the higher number of 45kcals per kg and our 200lb (91kg) example. Now, don't think you are going to eat 45kcals per 2.2lbs of bodyweight from boiled chicken and white rice as many of the bodybuilders in the magazines claim to do (hint: I have been with many a pro bodybuilder who virtually lived at Taco Bell in the off season!).

Anabolic nutrition requires anabolic foods, and it's virtually impossible to eat 4000 plus calories per day or what ever calorie amount you end up with without the help of protein powders, MRP's and other calorie dense foods (e.g., think pizza and a few cheese burgers!). To sum it up:

- To figure out your caloric needs you take your weight in kilos and multiply it times the goal above (e.g., lose weight, maintain weight, gain weight) to

get the number of total calories per day you would eat to gain quality mass. Capich?

Figuring Macro Nutrient Ratios for Quality Gains.

Now that we have the approximate calories figured out for making consistent gains in weight, we need to figure out the macro-nutrient breakdown.

That is, we have to figure out how much protein, fat and carbs a person needs within the context of their caloric intake, as figured above. The best way to go about that goal is to (a) figure out protein requirements, followed by (b) fat requirements, and (c) carbohydrate requirements. Following this "a, b, c format" makes the process easy to understand and follow.

Side Bar 3

The Athletes and Healthy Persons' Food Pyramid

By Will Brink

Most people are aware of the USDA Food Pyramid, where potatoes are treated like healthy vegetables and people are told to eat 6-11 servings per day of starches from breads, pasta, and white rice. It's a pyramid where all fats are created as equal, seemingly all bad and beans are some how with the protein group.

In short, it's a well intentioned pyramid that has led to a great deal confusion and even fatter Americans. I would like to briefly suggest a food pyramid for bodybuilders and other athletes.

My pyramid (see picture below) employs a more in-depth rating system over that of the standard pyramid. For example, the regular pyramid ignores the fact that not all carbs are created equal (due to their fiber content, etc) putting breads and pasta in the same category as healthier low GI carbs such as sweet potatoes, oatmeal, legumes and others.

It makes the incredible blunder of lumping all fats in the same section (i.e., saturated, trans fats, mono unsaturated, etc.) and puts beans in with the meats and eggs section. Beans might be high in protein (for a plant based food) but how beans ended up in with the meats and eggs section is a mystery to me.

In truth, the standard pyramid invites an increase in bodyfat (up to 11 serving per day of breads, pasta and rice!) and other potential problems from the overly high carbohydrate intakes, most of which would be based on heavily processed carbs of the average American diet.

Furthermore, the standard pyramid ignores nutritional supplements altogether. In my view, that's an oversight and a mistake. No matter what a person's diet is like, supplements can and should play a role in optimal health and performance and therefore should be included. That's why I have given them their own position in what I consider a pyramid designed with optimal health and performance in mind.

Finally, the standard USDA pyramid ignores alcohol, which is ubiquitous in our society. Although not a "food" per se in the classic sense, I think a proper pyramid should be set up to help people lead a healthy life regarding what ever they put in their mouth on a regular basis and give them a quick reference to look at to keep track of that goal.

In short, a pyramid that ignores booze, supplements, differences in carbs and differences in fats, etc., is an incomplete pyramid in my view and only leads to fatter, less healthy and nutritionally confused people. Another important point to understand regarding the standard USDA pyramid is that the rankings and groups in that pyramid were not made exclusively on science, but politics.

It's well known that the positioning of many key foods was altered after

those industries lobbied heavily to have them moved to a more favorable location on the pyramid. My attempt with this side bar is to rectify that situation. People that want to see the standard pyramid as a reminder should see: http://www.nal.usda.gov:8001/py/pmap.htm

Based on what you have read from the above and looking at the visual representation of the pyramid, the "new and improved" pyramid should be pretty self explanatory.

Click here to jump to the pyramid (which is on a separate sheet below this side bar so that you can print it out for quick referral.)

Starting from the bottom:

• Lean/non-processed proteins:
Good sources: skinless chicken, fish, lean cuts of red meat, protein powders, lean ground beef, turkey breast, low far cottage cheese, etc

• Healthy fats and EFA's:
From unprocessed oils such as flax oil, hemp, fish, olive, etc.

• Hi fiber low GI carbs:
Such as found in whole grains, oats, brown rice, beans, yams, lentils (see GI list for more carb choices)

Middle:

• **Fresh fruits and vegetables** (Needs no explanation)

• **Multi vitamins**, anti-oxidants and performance supplement such as whey protein, creatine, glutamine, etc. (for athletic types)

Middle/top:

• **Saturated fats**

Such as found in high fat cuts of red meat, pork, butter, cheese, sausages, whole milk and ground beef

• **Moderate/high GI, low fiber carbs**

Such as pastas, white rice, white potatoes, breads, bagels, processed breakfast cereals, instant oatmeal

Top:

• **Alcohol**

Red wine appears to be the healthiest (no more than two drinks per day for men and one for women)

• **Sweets/ hi GI carbs**

Such as cookies, cakes, soft drinks, candy, fruit juices, etc. (note: There is a specific application for high GI carbs post workout, but as part of the normal diet, should be limited)

• Unhealthy/bad fats

Such as processed vegetable oils, trans fats, fried foods, rancid fats, etc. These unhealthy fats can be found in any fried food such as potato chips, French fries, and foods containing the words "partially hydrogenated" on the labels. Most margarine, though sold as a healthy alternative to butter, may in fact be even worse for our health due to their containing trans fats from partially hydrogenated oils.

With the above pyramid (*you can see the image below on a separate page so that you can print it out for easy reference*), a person should have a much easier time constructing a healthy eating pattern based on a more in-depth examination of the foods and other nutrients we all eat (or should be eating!).

It allows for a more targeted and intelligent approach making proper food choices. Of course, the amount of each will depend on many factors and will depend on activity levels, exercise choices, age, goals and other variables beyond the scope of this section.

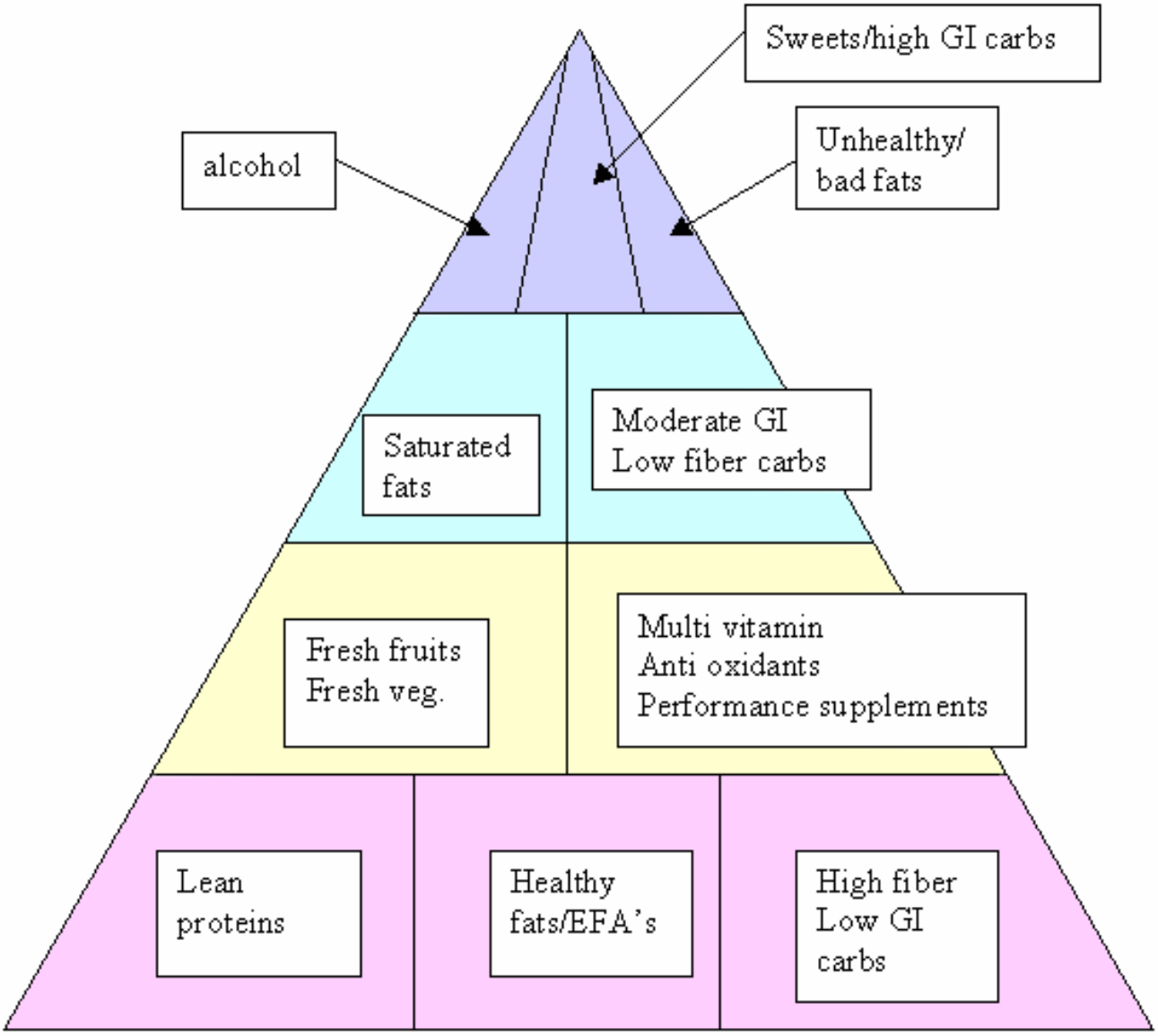
For example, a person who was a marathon runner could indeed eat up to 11 servings per day of carbohydrates recommended in the USDA pyramid. But someone who is more sedentary would be best to stick to the low end of the scale at 6 servings and might be better off with a higher intake of EFA's and protein.

The same would be true for strength athletes as well. Bottom line is the actual ratio of macro-nutrients (i.e. proteins, fats and carbs) and total calories necessary is relative and depends on some of the variables mentioned above.

Which foods the person should rely on to achieve those goals, can easily be figured out from The Athletes and Healthy Persons Pyramid, a.k.a. The Brink Pyramid For Optimal Health and Performance, if you will ☺

End Side Bar 3

The Athletes and Healthy Persons' Food Pyramid, By Will Brink



Protein requirements:

As most people that workout are well aware, the one gram of protein per pound of bodyweight rule has been the main stay advice for protein intakes for decades. But is it correct?

Main stream nutritionists and medical doctors have warned of dire consequences from such intakes of protein, which we know is total bunk (see side bar "Are High Protein Diets Bad For You?" for more info). They also maintained for decades that athletes didn't need additional protein above the RDAs.

For the past half century or so scientists using crude methods and poor study design with sedentary people have held firm to the belief that bodybuilders, strength athletes of various types, runners, and other highly active people did not require any more protein than Mr. Potato Head... err, I mean the average couch potato.

However, In the past few decades researchers using better study designs and methods with actual athletes have come to a different conclusion altogether, a conclusion hard training bodybuilders have known for years. The fact is that active people do indeed require far more protein than the RDA to keep from losing hard earned muscle tissue when dieting or increasing muscle tissue during the off season.

In a recent review paper on the subject by one of the top researchers in the field, Dr. Peter Lemon stated, "*...These data suggest that the RDA for those engaged in*

regular endurance exercise should be about 1.2-1.4 grams of protein/kilogram of body mass (150%-175% of the current RDA) and 1.7 - 1.8 grams of protein/kilogram of body mass per day (212%-225% of the current RDA) for strength exercisers" (Lemon, P.W., 1996 and Lemon, P.W.,1995).

Another group of researchers in the field of protein metabolism has come to similar conclusions repeatedly. They found that strength training athletes eating approximately the RDA/RNI for protein showed a decreased whole body protein synthesis (losing muscle jack!) on a protein intake of 0.86 grams per kilogram of bodyweight.

They came to an almost identical conclusion as that of Dr. Lemon in recommending at least 1.76g per kilogram of bodyweight per day for strength training athletes for staying in positive nitrogen balance/increases in whole body protein synthesis (Tarnopolsky, M.A., 1992).

This same group found in later research that endurance athletes also need far more protein than the RDA/RNI and that men catabolize (break down) more protein than women during endurance exercise (Phillips, S.M., 1993). They concluded, "*In summary, protein requirements for athletes performing strength training are greater than sedentary individuals and are above the current Canadian and US recommended daily protein intake requirements for young healthy males*."

Now my intention of presenting the above quotes from the current research is not necessarily to convince the average athlete that they need more protein than Joe

Shmoe couch potato, but rather to bring to the reader's attention some of the figures presented by this current research.

How does this information relate to the eating habits of the average athlete following the one gram per pound of bodyweight rule? Well let's see. Given that scientists like to work in kilograms (don't ask me why) we have to do some converting.

Recall that a kilogram weighs 2.2lbs. So, 200 divided by 2.2 gives us 90.9. Multiply that times 1.8 (the high end of Dr. Lemon's research) and you get 163.6 grams of protein per day.

What about the people recommending the RDA as being adequate for athletes?

The current RDA is 0.8 grams of protein per kilogram of bodyweight: 200 divided by 2.2 x 0.8 = 73 grams of protein per day for a 200lb person. So who was closer to the resent recommendations by Lemon et al? Well let's see! 200g (what bodybuilders have recommended for a 200lb athlete) - 163g (the high end of the current research recommendations for a 200lb person) = 37 grams (the difference between what bodybuilders think they should eat and the current research).

How do the RDA pushers fair? Hey, if they get to call us "protein pushers" than we get to call them "RDA pushers!" Anyway, 163g – 73g = (drum roll) 90 grams!

So it would appear that the bodybuilding community has been a great deal more accurate about the protein needs of strength athletes than the average nutritionist who still believes the RDAs are good for anything but wall paper.

So should the average bodybuilder reduce his protein intake a bit from this data?

No! As with vitamins and other nutrients, you identify what looks to be the precise amount of the compound needed for the effect you want (in this case positive nitrogen balance, increased protein synthesis, etc).

Then add a margin of safety to account for the biochemical individuality of different people, remembering the fact that there are low grade protein sources the person might be eating and other variables.

So the current recommendation by the majority of bodybuilders, writers, coaches and others of one gram per pound of bodyweight does a good job of taking into account the current research and adding a margin of safety. In my view one thing is for sure, a little too much protein is far less detrimental to the athletes goal(s) of increasing muscle mass than too little protein.

The truth the matter of course is that many strength training athletes exceed the one gram per pound of bodyweight rule and are often closer to 1.5 to 2 grams of protein per lb of body weight.

There are no particular reasons the reader can't eat higher intakes than one gram per lb of bodyweight if they so desire, but we will stick to the one gram per lb of BW for this chapter.

To finish this section – not to mention my rant – our 200 pound fictional athlete would be eating 200 grams of protein. If you recall, protein and carbohydrates contain approximately 4 calories per gram and fat contains approximately 9 calories per gram. This means our 200lb friend will be using up 800 calories (200 X 4 = 800) of his 4,095 kcals per day diet.

This is approximately 20% of total calories coming from protein. (Of course, if the person was getting 1.5 to 2 grams of protein per lb of BW as some do, that % figure would be higher).

Partial List of Proteins

<u>Good Protein Sources:</u>
Lean red meats
Skinless chicken
Sea food/fish of all kinds
Low fat cottage cheese
Eggs
Protein powders (whey, casein, soy, etc.)
MRP's
Skim milk
Low fat ground beef (90% lean or above)

Sources of Protein to Avoid:

Luncheon meats

High fat ground beef

Ham

Cheese

bacon

sausage

whole milk

Fat Requirements

Fat. The very word sends a shiver up the spine of the leanest athlete. Without a doubt, fat is the most misunderstood and maligned of nutrients.

Most people – including educated people who should know better – take a "fat is fat and should be avoided" approach to eating. Nothing could be further from the truth, especially when trying to put on quality mass.

Are all fats created equal and should we avoid fat if trying to gain lean mass? The answer to both questions is a resounding no! It's interesting to note that people have no problem accepting the fact that there are different types of carbohydrates that have different effects on the body as described above.

The terms "simple" and "complex" or "high glycemic" and "low glycemic" get thrown around all the time when referring to carbohydrates. The same holds true for proteins.

Terms such as "complete" and "incomplete" proteins or "high biological value" as well as other terms are applied to proteins when ever we read an article on the topic.

People seem to have no problem understanding and accepting that there are large differences in the types and quality of carbohydrates and proteins they eat, but often think of all fats as being equal, without any unique effects of their own.

"Fat is fat," they will say. They are told to avoid all fats and to consider fat as the enemy of the athlete or the person trying to shed some weight. As briefly outlined previously, fats have just as many biochemical differences and effects on the body, as do carbohydrates and proteins.

There are many different types of fats, such as mono unsaturated, saturated, poly unsaturated, Omega-3, Omega-6, as well as many others. Within this group are even more lipids (fats) such as alpha-linolenic (ALA), linoleic (LA), EPA, DHA, GLA, CLA and so on and so on. The idea that a "fat is a fat and all fats are bad for you and should be avoided" is of course ridiculous advice and is based on outdated research and shear ignorance of the topic.

There is no doubt that certain fats such as saturated and trans fatty acids should be avoided or limited if peak performance, long term health and/or weight loss is the goal.

On the other hand, a great deal of recent research is showing that higher fat intakes, of the right types of fat, do in fact have a place in the athletes diet as well as the average person concerned with long term health, weight loss and performance.

So, the trick to the average reader concerned with such issues should to learn to see fats as a group of lipids that have their own unique effects on the body. We can then shed the old notion that fat is the enemy of the athlete, because it's simply not true.

With that in mind, we will continue to outline the fat requirements for this chapter when an optimized anabolic environment for growth is the goal.

As most people are aware, hormones such as testosterone, growth hormone, insulin like growth factor-1 (IGF-1) and insulin are major anabolic -muscle building - hormones.

It's well known that a particular hormonal milieu is needed to increase muscle mass and decrease bodyfat in response to exercise. For example, a weight lifter with inadequate testosterone levels will find it virtually impossible to add muscle mass even though he is weight training and eats well.

A good diet and training regimen is essential for increasing strength, muscle mass and performance. Yet without adequate anabolic hormone levels, you are essentially spinning your wheels. This known fact has been responsible for some athletes turning to synthetic versions of anabolic hormones, such as anabolic steroids and man made growth hormone as well as other compounds. Perhaps, what are overlooked by many people are the effects the macro-nutrients (carbohydrates, fats and proteins) have on the production of anabolic hormones.

Testosterone is generally considered the king of anabolic hormones, especially in men. Anything that can positively and safely effect testosterone levels is considered a plus for athletes concerned with building muscle and increasing strength.

Although essential for increasing muscle mass, testosterone has many functions in the human body ranging from libido to immunity to depression. So an increase in testosterone levels can have many positive applications.

This is particularly true for men and women (yes women need testosterone too!) who suffer from low levels of this essential hormone.

Side Bar 4

Vegetarians vs. meat eaters: The debate continues…

If there is one topic that gets people in the sports nutrition arena hot under the collar, is the age old vegetarian versus meat eater debate. In particular, the debate is focused on whether or not vegetarian diets are equivalent and adequate to diets that include meat when it comes to adding muscle mass.

Outlining the entire debate of both sides of the fence is beyond the scope of this little side bar. I am going to stick to the debate regarding veggie diet vs. meat containing changes in muscle mass rather than the larger picture of whether or not vegetarian diets are inherently healthier than diets that contain meat and vise versa.

In a nut shell, vegetarians maintain that meat is not essential for building muscle and a diet of mixing complimentary foods such as beans and rice is adequate. Lacto-ovo vegetarians (vegetarians that include milk products and eggs) further maintain that the inclusion of milk and eggs, being highly bio available complete proteins, is more than adequate for athletes trying to build muscle and maintain peak performance.

On the omnivore side (omnivore meaning people that eat a wide variety of foods including meat) maintain meats such as chicken, beef and others are by nature more anabolic for a variety of reasons. So who is right?

This debate has not been adequately looked at in the research but we do have some data that lends credence to the omnivore's position. For example, several studies have found that meat containing diets are superior for testosterone production than strict vegetarian diets.

As most people know, testosterone is an essential hormone for increasing and maintaining muscle mass while keeping bodyfat low. It's also essential for libido and mood in both sexes, but particularly important for men.

One recent study called, "Effects of an omnivorous diet compared with a lacto-ovo vegetarian diet on resistance-training-induced changes in body composition and skeletal muscle in older men" looked directly at this debate (Campbell, W.W., 1999).

The researchers wanted to find out if an omnivorous (meat-containing) diet was superior to a lacto-ovo diet on the retention of muscle mass of older men put on a weight training routine.

Nineteen men aged 51-69 years old were enrolled in the study that ran 12 weeks. 9 men ate their normal meat containing (omnivorous) diet, providing 50% of total dietary protein from meat sources such as pork, chicken, fish and beef. Another 10 men followed a lacto-ovo type vegetarian diet for the duration of the study with both groups following a weight training schedule.

The study found that although the strength increases between groups were

roughly the same, they found whole-body changes in skeletal muscle size differed significantly between groups. The study found whole-body muscle mass increasing in the omnivorous group while actually decreasing in the lacto-ovo group. Apparently, the meat eaters gained muscle over the 12 weeks while the lacto-ovo eaters lost muscle mass. Ouch!

The authors concluded that, "*consumption of a meat-containing diet contributed to greater gains in fat-free mass and skeletal muscle mass with resistance training in older men than did an a lacto-ovo diet*." Is this a slam dunk against the vegetarian diet as it relates to the claim that is just as good as a meat containing diet for increasing muscle mass?

No, but it does lend a small measure of proof that for optimal levels of anabolic (muscle building) hormones and increases in muscle mass, omnivorous diets may have an edge.

More research is clearly needed to confirm the theory however. Truth be known, my bet would be in favor of the omnivorous diet if optimal muscle mass is the goal.

However, there is still some debate over which of the two diets is healthier and that has to be factored into peoples' choices as to which diet is best suited for them.

End Side Bar 4

Although high carbohydrate low fat diets have been all the rage for the past decade or so, it may be particularly hard on testosterone levels. It appears high carb low fat diets are not the best way to optimize testosterone production.

For example, one study examined 30 healthy male volunteers who were switched from their customary diet which supplied 40% of energy as fat was replaced for 6 weeks with a diet containing significantly less fat (25% of energy).

The study found a statistically significant drop in serum testosterone levels (from 22.7 +/- 1.1 nmol/l to 19.3 +/- 1.2 nmol/l), free testosterone and other androgens (Hamalainen, E., et al, 1984). This study also found that a higher ratio of saturated fat to poly unsaturated fat was positively correlated with higher testosterone levels.

For example, one study that had two groups eating approximately the same ratios and amounts of carbohydrates and fats, found a "mixed" diet that included animal products resulted in higher testosterone levels than a lacto-ovo vegetarian diet (Raben, A. et al, 1992). Several other studies appear to confirm the effects of dietary fats on testosterone levels, as well as other dietary variables (Dorgan, J.F., et al, 1996; Volek, J.S., et al, 1997; Tegelman, R., et al., 1992; Habito, R.C., 2001).

However, there is a ceiling of how much fat should be eaten to achieve optimal testosterone levels. Studies suggest that 30% of calories from fat appears to be as much fat as is needed, as diets higher than 30%-40% showed no extra advantage. The lesson here is for optimal hormonal production of anabolic hormones in athletes, adequate fat is essential.

Knowing that information, we will set up the fat requirement of our anabolic diet with fat comprising 30% of total calories. Continuing with our 200lb friend eating 4,095 kcals per day. 30% of 4,095 = 1229 (1228.5 to be exact) calories per day from fat, or 136.5 grams of fat per day (1228.5 divided by 9, the number of calories in a gram of fat).

The One Third Rule

Now that we have the total amount of fat figured out, we need to decide on what type of fat, as different fats have different effects on health, testosterone levels, etc.

As research has made clear, some saturated fat is needed for optimal testosterone production. What I suggest to people is they follow the one third rule: one third of your fat allotment should come from unprocessed poly unsaturated fats with high Omega-3 contents (e.g. flax, hemp, Udo Choice, fish oils, etc).

Another third can from mono unsaturated fats (e.g. olive oil, avocados, etc.). While the final third should come from saturated fats, which are already found in red meat, whole milk, butter, etc.

This ratio allows for optimal testosterone production, quality weight gain and performance, without sacrificing your health in the process. I have found this to be a highly successful strategy for quality muscle gains with minimal bodyfat increases (though body fat is still dependent on other factors such as total calories, activity levels, genetics, etc).

If you divide the total fat grams per day (136.5) by 3 you get 45.5 grams of fat. That's 45.5 grams from high Omega-3 EFA rich oils, 45.5 grams from mono unsaturated fats, and 45.5 grams from saturated fats, all divided over the days eating (see below for how to divide up the days eating).

Below you will find that each meal requires roughly 23 grams of fat per meal. One table spoon of flax oil mixed in a protein drink (14 grams) and one half table spoon of olive oil (7 grams) over a salad and the naturally occurring saturated fat in say an 8 ounce piece of red meat will cover our 200lb fictional athlete.

You will notice that the above does not follow a perfect 1/3 rule for fats, but different meals can have different ratios of fats as long as the total for each is met each day. Not to mention that life is too short to sit around trying to get it perfect with each meal!

Good sources of fats:

Udo's Choice Oil and other oil blends (source of 0-3 and 0-6 EFA's)
Flax (high in LNA, an 0-3 lipid, has LNA and LA in a 4:1 ratio)
Hemp (good source of EFA's, 0-6, 0-3, and GLA)
Fish (caps or whole, good source of EPA and DHA)
Olive oil (good source of mono unsaturated "neutral" fats)
Avocados (good source of mono unsaturated fats)
Non-processed vegetable oils (unprocessed source of O-6 oils LA). Will always be found in refrigerated section of health food stores.

Sources of fat to limit:

Butter

Saturated fats (from high fat cuts of red meats, pork, etc)

Whole milk

Sources of fat to avoid:

Processed vegetable oils found on super market shelves

Margarine (contains trans fats)

Fried foods of any kind (contains just about everything bad or you!)

Any food with the words "partially hydrogenated" on the label!

Carbohydrate Requirements:

Figuring out carbohydrate requirements is the easy part. It's what ever is left over after you have figured out protein and fat requirements.

In our continuing example, that would be approximately 50% of calories, protein is taking up 20% and fat is taking up 30%.

So, 4,095 calories divided by 2 = 2,047.5 calories from carbohydrates. 2,047.5 divided by 4 (the number of calories in a gram of carbohydrates) = 512 (511.75 to be exact) grams or carbohydrates.

This is more than sufficient to fuel tough workouts and refill liver and muscle glycogen after exercise in a 200lb moderately lean person. Choose carbohydrates from the moderate and low GI lists above and eat meals consisting of high GI carbs immediately post-workout.

Simple no? Of course, the carb numbers would be different if the person was eating more protein (thus leaving less percentage of carbs from the total calories) or weighed less or more or was using the lower calorie values in the calorie chart.

Dividing the Days Calories

Finally, we get to put all our hard work together into a final diet structure. The optimal way to keep steady blood sugar and a steady availability of nutrients to the body is to divide the calories into 5-6 meals per day.

Divided by 6, continuing our 200lb example eating 4,095 kcals, that would be 683 (682.5 to be exact), calories per meal. Each meal would consist of approximately 34grams of protein (20% of 683 = 137 calories and 34 grams).

Each meal would consist of approximately 205 calories from fat which is approximately 23 (22.75 to be exact) grams of fat, per meal. Finally, each meal would consist of 85 grams of carbs from 341 calories.

Finally, the steps needed to construct an anabolic oriented diet for gaining quality weight:

(1) Decide on the number of calories needed based on your body weight in KG X the numbers found in the Simple Method (the example used through out the ebook was bodyweight in KGs X 45kcals).

(2) Decide on the grams of protein needed, which is 1g per lb of bodyweight.

(3) Decide on the fat content of the diet, which is 30% of the total calories calculated, based on number one above. Follow the one third rule as outlined in the fats section.

(4) Decide on carb content of the diet, which is simply the amount of calories you have left to fill after you figure out your protein and fat needs. This would be total calories, calories from protein and fat = carbs. Using the 200lb example in the ebook, that came out to approx 50% of calories for our 200lb example. Dividing that number by 4 (carbs contain 4 calories per gram) gives you the grams per day of carbs per day.

(5) Choose from the recommended foods from the protein, fats and carbs lists.

(6) Divide the above into 5-6 meals per day.

(7) Train hard and gain quality weight! ☺

Side Bar 5

The thirty gram rule exposed.

By Will Brink

It has been a long debated topic how much protein a person can digest at any one time. Nutritionists and doctors have maintained for decades that, "people can only digest 30 grams at a time of protein and any additional protein is wasted." So say the powers that be.

Now, I wish I could examine the study or research they are basing this advice on so I could dispute it but I can't.

Why you ask? Because in all my years of searching the medical data banks, talking to researchers and falling asleep in the medical library after hours of reading, I have been unable to find exactly where this advice comes from or what it's based on.

At one time, I went so far as to offer a reward to anyone who could show me a recent study that showed that 30 grams of protein was the upper limit anyone could digest, regardless of age, weight and activity levels.

Why is it 30 grams? Why not 28 or 35? Are we saying that the digestive and absorptive ability of a 285 pound 23 year-old football player is the same as a 50 year-old 115 pound woman?

Now digestion is a very complex topic. Many people think you eat some

protein, it mixes with some acid or something, gets broken down into amino acids, gets taken up into the body and everyone is happy.

I wish it were that simple. As with all foods, the breakdown of protein starts in the mouth with the simple chewing of food and the exposure to certain enzymes.

In the stomach, food mixes with enzymes and other factors such as lipase, pepsin, intrinsic factor and of course HCL (stomach acid). It moves onto the small intestine and then the large intestine. The small intestine is considered the major anatomical site of food digestion and nutrient absorption and is made up of section such as the duodenum, jejunum, and the ileum.

Pancreatic enzymes (chymotrypsin, trypsin, etc.), bile salts, gastrin, cholecystokinin, pepidases, as well as many others factors are released here. The large intestine is composed of the ascending colon, transverse colon, descending colon, and the sigmoid colon, which all play a part in absorbing the nutrients we eat.

Sound complicated? It is. Believe me; I am leaving out a great deal of information so you won't fall asleep!

Suffice it to say digestion is a very complicated thing and there are many places along the chain of digestion that can both enhance and degrade a person's ability to absorb the foods we eat. There is no reason to think that among this complicated process that there are not wide individual

differences in a person's ability to digest and absorb protein. For some person who is inactive, elderly and for what ever reason lives with compromised digestion, 30 grams of protein at one sitting might very well be too much for them to handle.

By the same token, assuming a 220lb healthy athlete is unable to exceed 30 grams of protein in one sitting is neither proven by medial science nor even logical in my view.

So what if the 30 grams rule turns out to be true? If we examine some of the more recent studies on the protein requirements of athletes done by researchers from both the United Sates and Canada, we come to some recommended protein intakes that far exceed the RDAs (Lemon, P.W., 1995, 1996; Tarnopolsky, M.A., 1992).

Some times by as mush as 225%! As mentioned in the chapter, some researchers came to the conclusion that protein intakes for athletes should range from approximately 1.2 grams of protein per kilogram of bodyweight, for endurance athletes and up to 1.8g of protein per kg for strength training athletes.

For a 200 pound bodybuilder – a strength training athlete – that would be approximately 164 grams of protein per day. Assuming that 30 grams of protein is the most anyone can digest, absorb and utilize, this person would have to split his intake into about five meals (164 divided by 30 = 5.47).

So, given the advice by many people that 30 grams is all anyone can digest at a single sitting, it appears a person can achieve the goal of 30 grams of protein per meal even with the higher intakes recommended in the modern research. Assuming they are willing or able to eat five meals per day!

However, if you happen to eat more than that per meal as recommended in this book, I don't think you have anything to worry about. I won't tell anyone.

End Side Bar 5

How do you go about figuring out the calorie, protein, fat and carbohydrate content of a breast of chicken or a couple of eggs or any other food? Easy, any book store will have an inexpensive calorie counting book with the facts and figures needed for each food.

There is also software that can be of great help. I use software called, "Diet Balancer" but there are many others. At first, figuring out the break down of foods is time consuming, but within a short time it's fast and easy.

There is not a single high level amateur or pro bodybuilder today who does not know right down to the gram what he puts in his or her mouth. And this chapter gives the reader the tools needed to pack on the quality muscle with a little work on your end. Happy hunting!

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Section II

Bodybuilding/Muscle Building Supplement Review Guide.

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"Andro" supplements
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SP

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"Andro"

It's too bad I have to start this guide with perhaps the most potentially confusing and controversial supplement on the list, but it starts with the letter A so I am stuck with it.

For most people who have been following the sports nutrition scene, the "andro" products are virtually old news.

The notoriety of andro all began with baseball player Mark McGuire using androstenedione (which had nothing to do with his breaking the homerun records BTW), the first andro product to hit the market.

As most people are aware by now, "testosterone boosting" supplements such as the andro supplements continue to be a hot topic of debate. I recently attended a conference where andro was called everything from benign to an evil scourge destroying sports.

As with so many supplements (i.e. ephedrine), the andro products are caught in something of an expected controversy. Advertisers claim they are the next best thing to anabolic steroids for gaining muscle mass while detractors feel they push the limit of a natural and safe supplement.

Research to date has been mixed, with some studies finding they do have an impact on testosterone levels with minimal side effects reported, while others have found little to no effects.

Much of the contrasting results found in the studies are due to methodological flaws (i.e., dose used, length of study, etc.) and or perhaps, the andro supplement being tested is just not an effective supplement for its intended use.

Another important point to remember is, it's one thing to show a spike in some hormone (in this case testosterone or nandrolone) but it's an altogether different thing to show that spike increased muscle mass or strength.

One does not necessarily follow the other. A few small studies have found some changes in LBM and or strength, but the majority of studies to date have not. So, the real value of the andro supplements for increasing muscle mass or performance is currently being debated.

What are andro supplements? In simple terms, the andro products are one enzymatic step away from the hormone testosterone (or nandrolone if the andro in question starts with the term "nor") and when ingested a percent of the supplement converts to testosterone, as well as other hormones either directly or indirectly.

Levels of the hormone stay elevated for a few hours or more then decline rapidly. Even on the front lines, in the gyms, there is no real consensus on andro products, with some users feeling they genuinely help build muscle while others find no

effects. Of course, many factors, such as type of andro, dose, length, etc., must factor into this equation as to why we see such wide ranging opinions.

This becomes even more complicated when you add in not only the fact that there are many different andro products on the market, but there are also many different delivery systems from topical sprays to sublingual tabs and others.

Over the last few years, a long list of different andro products have sprung up, from 4-androstene-3, 17-diol, to 5-androstene-3, 17-diol to 19-nor-4-androstene-3,17-diol, and 4-androstene-3,17-dione, to name a few. In addition to those, there is now 1-androstene-3beta, 17beta-diol (1-AD) and 1-Testosterone (1-Test).

The list is long and confusing to anyone but a biochemist who really knows their steroid biochemistry and it's only getting longer and more confusing with the introduction of even more andro products recently hitting the market.

Explaining all the andro products on the market would take a book and is beyond the scope of this review.

As most people should have noticed by now, most of the andro products often end in either "dione" or "diol." Diones and diols use different enzymes to convert to testosterone.

The first andro products to hit the market were diones. In later research, diones were found to be fairly inefficient at converting to testosterone, and could convert directly to both DHT (an androgen that may accelerate conditions such as male

pattern baldness and prostate enlargement) and estrogens, which can cause a host of problems in men.

Problems manifesting in bodyfat to causing gynecomastia a.k.a. "bitch tits. Along came the diols, which appear to be far more efficient and converting to testosterone (three fold greater response in blood levels over that of androstenedione according to some in-vitro research).

Another apparent advantage of the diols is they don't convert directly to either DHT or estrogens, and this should a major advantage over the diones. One thing to keep in mind however is large scale research in human populations is lacking to hash all this out and get to the bottom of what the above really means in terms of muscle mass, performance, testosterone levels and potential side effects. I would still consider it a "buyer beware" situation until more is known.

As the reader can see, this is a complicated and confusing topic. The effective dose of the different andros can vary depending on both the andro in question and the delivery route and may even vary person to person. Some basic issues can be identified however:

- Andro supplements are steroids. However, the term steroid is simple a chemical nomenclature for any organic fat-soluble compound composed of four joined carbon rings formed naturally or synthetically, and including bile acids, adrenocortical and sex hormones, sterols, and vitamin D. It also includes DHEA and many compounds, so no blanket statements can be

made, regardless of the hysteria regarding the term steroid the media portrays.

- Certain andro products can have steroid side effects such as bitch tits and hair loss (from the conversion of the andro to estrogens and or DHT) but this depends very much on the andro in question.

- Andro products may or may not have steroid like effects on muscle mass and performance, but this again depends on the type of andro and the dose. Both issues have yet to be fully examined in the research.

- Most users find the Diols work better than the Diones and the higher the dose the more effective they are (300mg per day to as high as 3000mg plus are common). Some companies "stack" both diones and diols in a single formula in hopes there will be some added effect, but there is no direct data to show this idea has any advantages. In theory it may make some sense as the diols and diones use different enzymes, but it's an unknown at this time.

- Andro products can have steroid related side effects such as male pattern baldness (MPB) and bitch tits, a reduction in natural testosterone production, facial hair growth (in women) while using andro, etc., but again, it will depend on the andro in question and the dose used.

As with all drugs, the three D's applies: Drug, Dosage and Duration. There is also

genetic individuality to consider as each person has genetic differences in how they will react to any compound, including andro supplements. For example, a man with no genetic predisposition for MPB probably does not have to worry about losing hair regardless of the andro product being used. Where as a man with a history of MPB and or familial history of MPB, could very likely notice an increase in MPB. (Readers note: although steroids of all kinds can have side effects-both the prescription only and legal variety-the side effects have been greatly exaggerated by the media)

As the reader can see, only general advice can be given about andro supplements at this time due to the many types of andro supplements and complexity of the issue.

With reservations I have to give the andro supplements a thumb's down as a group. This does now mean however that the reader, doing some research into the topic, could not come to a different conclusion regarding a particular andro supplement.

Andro Addendum!

Due to the introduction of the latest andro supplements 1-AD and 1-Test, I will now partially reverse what I said above, attempting to not add even greater confusion to the issue. 1-AD and 1-Test (1-AD converts in the body to 1-Test FYI) appear to have some real advantages over all the other andro products on the market. 1-AD and 1-Test appear to be the most effective "pro steroids" for legal sales.

Apparently they are:

- Orally active (unlike other oral steroids which are deactivated unless chemically modified)
- Don't Aromatize to Estrogens
- Extremely potent (according to some research, over 7 times more androgenic than testosterone)
- Occur naturally in the human body (e.g. DHEA, testosterone, androstenedione, etc.)
- May work at lower doses than other "andro" products on the market

Many people are reporting steroid like effects at doses as low as 300mg per day. However, it should be noted that yet again, there is no research to date looking directly at these two andro products and their effects on muscle mass or strength in healthy athletes. With that comment kept in mind, I give these two andro products a slightly hesitant thumb's up (legal, ethical, and moral issues not withstanding).

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Arginine

The supplement that gets my vote for biggest come back of the decade is arginine. A decade ago it had a brief day in the lime light with athletes as a supplement that might stimulate growth hormone.

However, its use as a GH releaser never materialized into new muscles for users, so it quickly fell out of favor. Recently however, there has been a resurgence of interest in arginine by athletes and supplement companies. This is due to recent findings showing a long list of possible uses with arginine, ranging from possible protection from heart disease, reducing cholesterol, to increasing blood flow.

The reason for this surge of interest in arginine by researchers is its connection to a molecule called nitric oxide (NO). NO is the new super star molecule with researchers as it appears to play a role directly or indirectly in almost every aspect of human physiology.

Arginine is a key component of the NO production pathway (arginine serves as the substrates for the nitric oxide synthase enzyme, which produces citrulline and NO from arginine) which is essential for a cascade of reactions involved in vasodilation and cardiovascular function.

Recent data suggests arginine may have some legitimate uses regarding health and well being. For example, the lining of artery walls called the endothelium needs to dilate and contract effectively. NO is essential to this function and several studies

have found arginine supplements at 8-20 grams per day restored endothelial vasodilation in the coronary arteries and may improves overall blood flow which is important for people suffering from ischemic issues.

Another study suggested that arginine supplementation greatly improved penile function in men with penile dysfunction as NO is essential for blood flow involved in getting an erection.

Arginine has shown a very good safety profile to date and appears to have virtually no toxic effects. From an athletic/muscle building point of view, things become much less clear. Early studies suggested arginine could increase growth hormone levels, but in truth (a) these effects were found using very high doses and were intravenous and (b) short lived spikes in GH don't appear to have any positive effects on muscle mass or performance in healthy athletes anyway. Also, NO is a messenger molecule related to virtually just about every pathway in the human body one way or another.

Therefore, simply raising NO will have both positive and negative effects, most of which are not known at this time. It may be shown that the improved blood flow might increase oxygen saturation of tissues making it a good candidate for endurance athletes or a pre workout supplement for bodybuilders, but that has yet to be proven.

Unfortunately the data that has examined effects in athletes is lacking and some supplement companies are far overstating arginine's potential role in muscle growth or performance. From a health perspective, arginine may have some real

direct uses for people with high cholesterol, coronary artery disease, ischemic (meaning a reduced blood flow and oxygen delivery to tissues) and even men with erectile dysfunction. As for athletes, the jury is still out but arginine is one of those supplements to keep a close eye on for sure. At this time, I would not recommend it to athletes however for increasing either muscle mass or performance. For that use, it gets a thumb's down.

BCAA's

In the world of amino acids, the structural "building blocks" of proteins, there are several classes and types of aminos. For example, we have the essential amino acids, the non-essential amino acids, the conditionally essential amino acids and the branch chain amino acids (BCAA).

The essential amino acids are deemed as such because the body cannot manufacture them and they must be supplied by the diet. The non-essential amino acids can be made from the essential amino acids, and thus don't have to be supplied by the diet for survival, though many non-essential amino acids play essential roles in health and metabolism in their own right.

The conditionally essential amino acids, so named because during certain periods, such as infancy or certain metabolic states, can be considered essential for that period of time. The branch chain amino acids (so named because they branch off another chain of atoms rather than form a straight line as other amino acids do) are leucine, valine and iso-leucine.

The BCAA's are the amino acids that are primarily used (oxidized) during exercise and make up to one third of the amino acids in muscle tissue. It has been known for a long time that BCAA's play a critical role in the turn over of lean body tissues (muscle) and is muscle sparing (i.e. anti-catabolic) in a variety of muscles wasting states. Of the three BCAA, L-leucine appears to be the most important to

preserving hard earned muscle mass; intense exercise and certain disease states have been shown to eat up a great deal of L-leucine.

So far so good! On the research front, some studies have found the consumption of BCAA before endurance exercise may decrease the rate of protein degradation and may have a sparing effect on muscle glycogen degradation and depletion of muscle glycogen stores.

However, leucine supplementation at 200 mg per kg of bodyweight prior to anaerobic running exercise (sprinting) did not improve performance.

Truth is, research to date with BCAA's and performance has been contradictory at best. One of the major drawbacks of the BCAA's as a supplement is dosage. It takes very high doses to see any ergogenic effect, assuming there are any ergogenic effects to be had, as studies are still limited and or contradictory.

Although BCAA's supplementation may or may not be effective, it is cost prohibitive when one factors in the amounts needed. The good news however is that proteins, in particular whey protein, is very high in BCAA's and this may be yet another reason whey is the so popular with athletes and so impressive in the research.

As amino acids relating to the functions they play in the body, they get a thumb's up from me, but as a supplement they get a thumb's down at this time. It's far more cost effective to use a high BCAA content protein supplement than take BCAA's supplements in capsule form due to the high doses needed.

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Mero A. "Leucine supplementation and intensive training," Sports Medicine 27/6 (1999), p. 347-58.

Colostrum

Colostrum is another supplement that has recently made a comeback as a possible ergogenic aid to athletes. Its first appearance in the sports nutrition world some years ago was met with severe skepticism by scientists and thus colostrum faded from the scene quickly.

Colostrum's recent reappearance into the sports nutrition and health markets is based on the fact that the processing and production of colostrum has come a long way in the last few years and researchers have taken a second look at this milk based supplement.

Colostrum – also called foremilk – is a thin, yellowish fluid secreted by the mammary glands of mammals in the very first week of lactation. It's rich in immunoglobulins, anti-microbial peptides, minerals and multitude of growth factors conferred to the infant (in humans) or calf (in cows and other animals).

It is believed by some that this extremely nutrient rich product can confer its benefits to adult humans. However, colostrum suffers two major criticisms by scientists.

(1) Various growth factors such as insulin-like growth factor 1 (IGF-1) are extremely delicate to processing and early colostrum products were generally

found to have no active growth factors in them. Modern processing techniques appear to have greatly improved that problem.

(2) It has been argued that the adult human body does not receive the benefits of colostrum because the stomach pretty much destroys the delicate peptides during digestion. However, this long held "fact" of digestion has recently been revised and it appears that human digestion is far more complex than recently believed.

From a medical standpoint, properly made colostrum looks promising for diseases that affect the gastrointestinal tract. Several studies have confirmed colostrum's potential to help people with various diseases affecting the digestive tract.

Challenging the long held belief that peptides can't make it through the adult human digestion in tact is a recent study that found colostrum increased the salivary Insulin Like Growth Factor one (IGF-1) levels of athletes. Nine male sprinters were fed a colostrum product for 8 days.

The study found statistically significant changes in the IGF-1 levels of the athletes tested via saliva testing. Another recent study presented by Dr Richard Kreider and co workers at the 2001 Experimental Biology conference found the addition of colostrum to the diets of 49 well trained athletes increased both bodyweight and bench press strength.

Does this mean that athletes should run out and buy Colostrum? Probably not; the first study was a small study that needs to be followed up by larger studies and the latter study has yet to be published in a peer reviewed journal.

However, it appears that newer versions of colostrum may, in fact, have benefit to athletes and appears to have clear uses in certain medical conditions.

How much benefit and at what dosage has yet to be determined. I think colostrums is worth keeping an eye on and maybe useful for various pathologies of the digestive tract, but at this time, it gets a thumb's down from me. However, it might be worth a try just for the heck of it. Optimal doses are unknown at this time.

Playford, Raymond J., Christopher E. Macdonald and Wendy S. Johnson. "Colostrum and milk-derived peptide growth factors for the treatment of gastrointestinal disorders," American Journal of Clinical Nutrition 72/1 (2000), p. 96-105.

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Chromium Picolinate

Of all the nutrients that are sold for weight loss and increases in muscle mass, I can't think of a nutrient that has had a rockier track record in the research than chromium picolinate (CP).

Traditionally, sellers of CP tend to pay attention only to the research that showed this popular supplement could help with fat loss while increasing lean body mass (LBM).

The truth be known (which is the purpose of this here section!), CP has had quite a checkered past as it relates to the effects of CP on bodyfat, muscle mass and performance in different groups of people. Early research gave glowing reports of CP and showed significant reductions in bodyfat, with increases in muscle in college age athletes given CP supplements.

However, as recently as 1987 no less than six studies showed CP supplementation - using various populations of people ranging from the old to the young who took various doses of CP - found no effects on muscle mass or bodyfat. In fact, one study found that older women (age range 54-71) given high doses of CP and put on a strength training regimen gained less muscle than the group who did not receive the supplement!

On the flip side, a more recent study looks very promising for CP as a weight loss aid. A double blind placebo controlled study of 122 over weight people, given

400mcg of CP for 90 days, lost over six pounds of bodyfat which was almost twice what the placebo group lost in bodyfat. So how do we come to grips with all the conflicting research on chromium picolinate as a product used for weight loss and increases in muscle?

The bottom line is this: it is well known diets high in sugar, exercise and other factors drain the body's stores of chromium. It is also fairly well established that a large proportion of Americans do not take in sufficient amounts of chromium in their diets and we know that much of the foods people eat have been stripped of their chromium due to modern processing techniques.

Understandably, some research shows that a large proportion of people are chromium deficient. Finally, it is well established that chromium is an essential nutrient to human health and is critical for the regulation of proper blood sugar metabolism.

So, chromium is a nutrient that we should strive to get from a good supplement and from our food. For there is no doubt that people deficient in chromium will get positive effects from ingesting chromium.

Whether or not people not deficient in chromium will get any effect from additional chromium is questionable. So, make sure to get sufficient chromium in your diet from a variety of sources (i.e., multi vitamins, whole grains, etc.), remembering, that to view any chromium supplement as a miracle fat loss supplement or muscle building/ergogenic sports aid would be premature at best.

For general health, CP gets a thumb's up, but for gaining muscle or increasing performance, it gets a thumb's down.

Preuss, H. G. and R. A. Anderson. "Chromium update: examining recent literature 1997-1998," Curr. Opin. Clin. Nutr. Metab. Care 1/6 (1998), p. 509-12.

CLA

As readers of this ebook may recall, we have looked at the topic of lipids/fats in sports nutrition, fat loss, etc. and come to the conclusion that not all fats are "bad" and some may help performance, bodyfat levels and strength. Conjugated Linoleic Acid (CLA) may very well be just such a fat. CLA is found predominantly in dairy products and it appears to be a fatty acid with some unique effects on the metabolism of animals and (hopefully) people.

Several in vitro (test tube) and animal studies have shown it has powerful antioxidant properties as well as impressive anti-cancer properties. It has been shown to modulate insulin like growth factor binding proteins (IGFBP's) in mice and may also improve insulin sensitivity.

It has been shown to suppress the growth of certain lines of human breast cancer as well as several other cancers. Animals subjected to various cancer causing chemicals and fed CLA appear to fair much better than those not getting CLA. Some studies with CLA also point to this lipid as a possible immune enhancer.

"This is all very interesting and wonderful, but I want to know what it can do for athletes?" the reader is thinking. Well, being this is a sports nutrition oriented book we will stick to that angle. Perhaps more relevant and interesting to athletes, CLA has been found to be the best thing for building muscle and losing fat in mice and rats since they slipped anabolic steroids in their mouse food!

A substantial number of studies has confirmed that animals (the aforementioned squeaky things with red eyes) add lean body mass in the form of muscle and lose bodyfat when fed CLA, making CLA a true anabolic agent in rodents.

"Ok," we are all thinking, "lots of things work on mice and rats but this doesn't seem to do a thing for us higher animals lifting weights." That is true. And like many supplements, the human data is lacking; yet growing steadily. The good news is we have a few notable human studies. The bad news is they continue to be conflicting in their findings.

Pertaining to building muscle, research was presented at a large conference in Lahti, Finland recently by a Dr. Lowery. The study fed 24 novice bodybuilders 12 grams of a product containing 7.2 grams of CLA or placebo (vegetable oil) while completing a 6 week program of bodybuilding exercises.

The study found the group getting CLA had an increase in strength and arm girth (their arms got larger) but did not add bodyfat leaving the researchers to conclude, "apparently, CLA acts as a mild anabolic agent in novice male bodybuilders." One recent study found that CLA supplementation at 3-4 grams per day caused an almost one inch reduction in waste size and a loss of body fat of 2-4 lbs in overweight subjects over a 12 week period.

However, a pilot study using weight lifters found no differences in body weight, fat, or muscle mass over a 30 day period. Another small study with ten subjects, receiving 3-4 grams of CLA versus 10 subjects getting a placebo for three months, found similar results.

Yet another study of 17 healthy women getting 3 grams of CLA versus placebo (sunflower oil) for 64 days, found no statistically significant differences between the two groups. CLA can be found as different isomers (i.e., cis-9/trans-11 and trans-10/cis-12 isomers) and recent research suggests different isomers are responsible for different effects, such as anti-cancer, anti-obesity, etc.

Although some of the findings with CLA in people have been exciting and interesting, there continues to be too many conflicting studies. Though it may turn out to be a worthwhile supplement for athletes, far more human research is needed for definitive conclusions but CLA is a supplement to keep an eye on.

For increasing muscle mass or improving performance, it gets a thumb's down until more human research is done. As a fat loss agent, it may be worth a try but again, research is conflicting at best. At this point, even though I am giving it a thumb's down for building muscle, I consider it one of those "might be worth a try" supplements.

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Banni, S. and E. Angioni, et al. "Decrease in linoleic acid metabolites as a potential mechanism in cancer risk reduction by conjugated linoleic acid," Carcinogenesis 20/6 (1999), p. 1019-24.

Park, Y. and J. M. Storkson, et al. "Evidence that the trans-10, cis-12 isomer of conjugated linoleic acid induces body composition changes in mice," Lipids 34/3 (1999), p. 235-41.

Creatine

There is almost no one on the planet that has not heard of Creatine at this point. Yet it's surprising that so much confusion, misinformation and disinformation still exists.

What is Creatine? During short maximal bouts of exercise such as weight training or sprinting, stored adenosine triphosphate (ATP) is the dominant energy source. However, stored ATP is depleted rapidly. To give energy, ATP loses a phosphate and becomes adenosine diphosphate (ADP). At this point the ADP must be converted back to ATP to derive energy from this energy producing system.

Creatine is stored in the human body as Creatine phosphate (CP) also called phosphoCreatine. When ATP is depleted, it can be recharged by Creatine phosphate. That is, the CP donates a phosphate to the ADP making it ATP again. An increased pool of CP means faster and greater recharging of ATP and therefore more work can be performed for a short duration, such as sprinting, weight lifting and other explosive anaerobic endeavors.

The above was of course an immensely over simplified review of an exceptionally complex system, but the basic explanation is correct. To date, research has shown ingesting Creatine can increase the total body pool of CP which leads to greater generation of force with anaerobic forms of exercise, such as weight training, sprinting, etc.

Other effects of Creatine may be increases in protein synthesis and increased cell hydration, though researchers are still elucidating the effects.

Creatine is formed in the human body from the amino acids methionine, glycine and arginine. Certain foods such as beef, herring and salmon, are fairly high in Creatine but a person would have to eat pounds of these foods daily to equal what can be found in one teaspoon of powdered Creatine from a supplement. The average person's body contains approximately 120 grams of Creatine stored as Creatine and Creatine phosphate.

Early research with Creatine showed it can increase lean body mass and improve performance in sports that require high intensity intermittent exercise such as sprinting, weight lifting, football, etc.

Creatine has had spotty results in research that examined its effects on endurance oriented sports such as swimming, rowing and long distance running, with some studies showing no positive effects on performance with endurance athletes.

Whether or not the failure of Creatine to improve performance with endurance athletes was due to the nature of the sport or the design of the studies is still being debated. But one thing is for sure; the research is stronger in the high intensity short duration sports.

Creatine can be found in the form of Creatine monohydrate, Creatine citrate, Creatine phosphate, Creatine-magnesium kelate and even liquid versions.

However, the vast majority of research to date showing Creatine to have an effect on muscle mass and performance used the monohydrate form and most Creatine found in supplements is in the monohydrate form.

Recent findings with Creatine have confirmed previous research showing it's a safe and effective supplement. More recent research has focused on exactly how it works, and has looked deeper into its potential medical uses.

Several studies have shown it can reduce cholesterol by up to 15% thus may be of use in with wasting syndromes such as HIV. It has also been shown to correct certain inborn errors of metabolism, such people born without the enzyme(s) responsible for making Creatine. Creatine is also being looked at as a supplement that may help with diseases affecting the neuromuscular system, such as muscular dystrophy (MS) and others.

A plethora of recent studies suggest Creatine may have therapeutic applications in aging populations, muscle atrophy, fatigue, gyrate atrophy, Parkinson's disease, Huntington's disease and other mitochondrial cytopathies, neuropathic disorders, dystrophies, myopathies and brain pathologies.

As for safety, some have suggested that Creatine might increase the need for extra fluid intake to avoid potential dehydration and muscle pulls. Still, Creatine has not been shown to increase either dehydration or muscle pulls in the research. In some people, Creatine may increase a byproduct of Creatine metabolism called creat*inine*, which is a crude indicator, but not a cause of kidney problems.

Some doctors have mistakenly thought that high creatinine levels (in athletes using Creatine) are a sign of kidney problems, but that is not the case.

Creatinine is not toxic to the kidneys and most doctors are not aware that Creatine may raise creatinine levels with no toxicity to the kidneys. People with pre-existing kidney problems might want to avoid Creatine due to the effects it can have on this test, though Creatine supplementation has never been shown to be toxic to the kidneys and the vast number if studies to date have found Creatine to be exceedingly safe.

It's interesting to note that there has been a concerted effort by many groups and ignorant medical professionals to portray Creatine as being some how poorly researched (flatly untrue) and unsafe for long term use.

They systematically ignore the dozens of studies that exist showing it's both safe and effective, and even more bizarre; ignore the recent studies that are finding Creatine may help literally thousands of people with the aforementioned diseases. This is unscientific, unethical and just plain immoral in my view.

One question that often comes up regarding Creatine is whether or not the loading phase is required. Originally the advice for getting optimal results was to load up on Creatine followed by a maintenance dose there after. This advice was based on the fact that the human body already contains approximately 120 grams of Creatine (as Creatine and Creatine phosphate) stored in tissues and to increase total Creatine stores, one had to load for several days in order to increase those stores above those levels.

The idea also seemed to work well in practice with people noticing considerable increases in strength and weight during the loading phase. All was not perfect however as many people found the loading phase to be a problem, with gastrointestinal upset, diarrhea and other problems. At the very least, loading was inconvenient and potentially expensive.

The need for a loading phase was a long held belief, but is it really needed to derive the benefits of Creatine? The answer appears to be no as both research and real world experience have found the loading phase may not be needed after all. A 1996 study compared a loading phase vs. no loading phase 31 male subjects.

The subjects loaded for 6 days using 20 g/day and a maintenance dose 2 g/day for a further 30 days. As expected, tissue Creatine levels went up approximately 20% and the participants got stronger and gained lean mass. Nothing new there! And, not surprisingly, without a maintenance dose Creatine levels went back to normal after 30 days.

Then the group was given 3g of Creatine without a loading dose. The study found a similar – but more gradual – increase in muscle Creatine concentrations over a period of 28 days. The researchers concluded, "a rapid way to Creatine load human skeletal muscle is to ingest 20 g of Creatine for 6 days.

This elevated tissue concentration can then be maintained by ingestion of 2 g/day thereafter. The ingestion of 3 g Creatine/day is in the long term likely to be as effective at raising tissue levels as this higher dose."

A more recent study done in 1999 found that 5g of Creatine per day without a loading phase in 16 athletes significantly increased measures of strength, power, and increased body mass without a change in body fat levels (whereas the placebo group showed no significant changes).

The researcher of this 1999 study concluded, "these data also indicate that lower doses of Creatine monohydrate may be ingested (5 g/d), without a short-term, large-dose loading phase (20 g/d), for an extended period to achieve significant performance enhancement."

So, if you have suffered through the loading phase in the past thinking it was the only way to maximize the effects of your Creatine supplement, it appears you can rest assured you don't have to go through all that hassle. A 3-5gram per day dose over and extended period of time will probably do the same thing.

For increases in strength, LBM, and performance, Creatine gets an enthusiastic thumb's up.

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Chrysin

The potentially negative effect of the "female" hormone estrogen has been the buzz with athletes lately. Increased estrogen may lead to increases in bodyfat and other maladies athletes want to avoid (Gyno, etc.) and many supplement companies have attempted to capitalize on this new found concern over excess estrogen levels.

For example, some research suggests that supplements such as androstenedione and a few of the other "andros" may increase estrogen levels by converting to estradiol (a powerful estrogen). Androgens such as testosterone and androstenedione convert to estradiol via and enzyme called "aromatase." Drugs or natural compounds that can block this enzyme are therefore called "anti-aromatase" agents.

Basically, there are two ways to affect estrogen. You can block the receptor site, or you can inhibit the enzyme (i.e. aromatase) that converts "male" hormones into "female" hormones (i.e. estrogens).

When a molecule fits into the receptor but does not send an estrogenic signal it is called an "antagonist" meaning it prevents or "blocks" estrogen from getting to the receptor but does not in itself act as an estrogen. Hence the term "estrogen blocker."

When something can lock into the receptor and does act as an estrogen, that is activates the receptor to one degree or another, it's called an "agonist." So, an antagonist fits into a receptor (thus blocking something else from occupying that receptor) but does not activate the receptor and an agonist fits into the receptor in question (in this case an estrogen receptor) and does activate the receptor to one degree or another.

This is exactly how the drug Tamoxifen works when treating breast cancer. It can fit into the estrogen receptor but does not activate it thus preventing estrogenic effects in the tissue in question.

Thus, Tamoxifen is an "estrogen antagonist." In truth, it's a bit more complicated then that as Tamoxifen is in fact both an estrogen antagonist or agonist depending in the tissue in question, which means it has mixed antagonist/agonist effects, but never mind…

So, what the reader should take away from the above is, you can block the effects of estrogen by either blocking the receptor it fits into, or inhibit the enzyme the body uses to convert androgens into estrogens. Got all that?

Chrysin has been marketed as just such an anti-aromatase, or enzyme inhibitor. Chrysin is sold alone, or often added to andro supplements, in hopes it will prevent any estrogen production that may result from taking andro products. Chrysin is a bioflavonoid similar to other flavonoids such as Quercetin.

There are many different types of flavonoids with a wide range of effects. In vitro (test tube) research has shown Chrysin is a powerful inhibitor of the aromatase enzyme and may have other health uses.

There in lies the problem. To date, no solid studies using Chrysin outside a test tube have been done. That is, no studies in walking, talking, human beings have been carried out to show that Chrysin indeed has this effect and at what doses are needed to reduce estrogen levels. Most troubling perhaps is the fact that bioflavonoids such as Quercetin, and possibly Chrysin, are notoriously difficult to absorb during digestion and very little gets through.

So, a large question still remains about whether or not Chrysin will be of any use as an estrogen reducing supplement in hard training athletes or what the actual dose is needed.

Only time and more research will tell. In truth, I have yet to see anyone who derived any benefit from this supplement. For reducing estrogen in athletes it gets a big thumbs down.

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Carnitine

L-Carnitine is often referred to as an "amino acid like" substance. The body synthesizes Carnitine from the amino acids L-Lysine and L-methionine. High levels of carnitine can be found in animal meats, especially red meats, from cows, lamb and sheep. Carnitine has many functions in the human body, but is best known for its ability to shuttle long chain fatty acids across the membrane of cells so they can be burned (oxidized) for energy by the mitochondria.

Mitochondria are often referred to as the "power house" of cells where energy is produced. The actual process of how carnitine shuttles fatty acids to the mitochondria is fairly complex and detailed. Suffice to say, it involves several enzymes and steps before the fats you want to burn end up being utilized by the mitochondria. So, the carnitine shuttle system is essential for the body to be able to burn fats as energy and this is why companies sell carnitine as a "fat burner."

Studies that have focused on weight loss in people using carnitine as a supplement are few and conflicting. There are far more studies that look at carnitine as a sports and energy enhancing supplement, with some studies suggesting carnitine may help endurance athletes.

In animals, some studies have found increases in the use of fat for energy with high dose carnitine supplementation, but human studies are mixed, with some showing effects on endurance while others find no effect.

The difference may be dose and or the nutritional status of the athletes being tested. Doses used are generally high, in the multi gram range (2000mg-5000mg) and higher.

Carnitine does appear to have real health uses and is even listed in the Physicians Desk Reference (a.k.a. the PDR) for certain pathologies involving the heart.

Many alternative doctors swear by it for that use. Carnitine may also help reduce cholesterol and increase HDL cholesterol, the "good" cholesterol.

Although it may very well have potential health benefits in certain people, carnitine's performance improving and "fat burning" abilities are questionable until more conclusive research is carried out. People who wish to try carnitine will need to use at least 500 milligrams (mg) or more several times daily, with some studies using 5g to 6g (5000mg-6000mg) or more, daily.

Carnitine is a very safe supplement with no known toxic effects, which is often found as an ingredient in weight loss formulas. People would be wise however to check the dose in such formulas as higher doses are clearly needed for any effect.

For general health and other uses, carnitine gets a thumb's up, but for building muscle it gets a thumb's down. For possibly improving endurance, it may be worth a try, albeit an expensive try if you follow the doses used in the studies.

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Calcium

As most people are well aware, calcium is a mineral needed for healthy strong bones. What many people may be unaware of is calcium's essential role in hundreds of other bodily processes from nerve transmission to enzyme activation and the functioning of muscle tissue.

Calcium works in conjunction with other minerals such as potassium and sodium to allow muscles to contract as well as keep blood in the proper PH. Without calcium, you would not even be able to lift your head up much less lift a weight.

Special pumps change the concentration of calcium, sodium, and potassium ions (known as Ca2+, na+, and K+ respectively) in different compartments of muscle tissue to make it contract (generate force) and relax. To get slightly technical: at the level of the muscle cell, ATP is used up quickly in an attempt to satisfy energy requirements.

As by-products of exercise build up, it's believed to disturb the delicate balance between Na+/K+, Ca2+ resulting in fatigue. Ionic regulation is critical to muscle contraction and metabolism needed for optimal muscle function during exercise.

Training enhances K+ regulation in muscle and blood and reduces the rate of fatigue. Both endurance and strength training induces an increased muscle Na+, K+ pump concentration, usually associated with a reduced rise in plasma [K+] during exercise. Although impaired muscle Ca2+ regulation plays a vital role in

fatigue, less is known about its actual effects on training. Ok, enough technical talk.

There are other things that take place both inside and outside the muscle that add to fatigue, but that's for another place and time as the explanation would be bor---, overly detailed. Interestingly, it has been found that athletes increase their rate of calcium loss in sweat from prolonged endurance sports, and increase their loss in urine after intense weight training.

It's also well established that most Americans fail to get even minimum intakes of calcium in their diet. Most athletes should be getting at least 1000mg per day of calcium from food and/or supplemental sources, with female athletes needing even more.

Athletes should attempt to pay special attention to their calcium intakes and make sure to eat foods such as dairy products, leafy greens, cabbage, legumes and dairy based protein based supplements. For example, though there are many forms of whey proteins (i.e. concentrates, isolates, ion exchange, etc) well made whey containing high amounts of calcium.

One 20g scoop of whey can have as much as 120-150mg of highly bioavailable calcium per serving in fact, as well as other bone building nutrients.

Calcium gets a thumbs up for general health and possibly performance, but no solid data exists showing calcium has ergogenic effects above and beyond amounts needed for general health.

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Ecdysterone

Recently, plant sterols, in particular Ecdysterone based supplements, have been making a come back. Some may recall plant sterols such as Beta Sitosterol, Diosterol, Gamma Oryzanols, Smilax, Stigmasterol and other plant sterol products were heavily marketed some years back.

They dropped out of favor with athletes due to the fact they didn't work in increasing muscle mass and lacked any hard science to justify their use. As is common, a compound will pop up, get a lot of press in the magazines, then disappear for a few years where it will pop up again after people have forgotten it didn't work the first time.

Ecdesterone appears to be the latest plant sterol of choice. A plant sterol Is basically a compound derived from plants that has structural similarities to that of human steroids such as testosterone or other hormones.

Ecdysterone is in the phytoecdysteroids family of which there are approximately 200 plant steroids related in structure to the invertebrate steroid hormone 20-hydroxyecdysone.

Though similar in structure as steroids found in humans (i.e. testosterone) close does not cut it in reality. As the saying goes, "other than horse shoes and hand grenades, close does not count." What this means is that a steroid hormone has a

very specific lock and key fit to its receptor and just because something looks like the same key does not mean it will fit the lock.

As a rule, western scientists have generally dismissed plant sterols as having any anabolic (muscle building) effects in the human body and consider the sale of such products as a scam and snake oil.

However, researchers in places like Japan, Russia and various eastern block countries have had a much more positive view of Ecdysterone and have come to the conclusion that they do have biological effect in humans and might be useful to athletes. Several Russian scientists I know, and various athletes, swear by certain products whose main ingredient are plant sterols, in particular, Ecdysterone.

Though there is little doubt that most plant sterols have no anabolic effects in humans, does that mean all plant sterols have no effects in humans? Did we throw out the baby with the bath water by deciding all plant sterols had no effects in people? It's possible.

There is some research on Ecdysterone (beta-ecdysterone) that suggests it may increase protein synthesis in people and has been shown to improve performance in athletes.

It has also been shown to increase protein synthesis in some animal's models. However, it should be clearly noted that this research is from the aforementioned countries and has never been confirmed by western research, which is considered far more stringent. Not to mention the fact that animals are not people.

So what's the bottom line? At this time I see no reason to start running to the store to buy Ecdysterone or any other product containing plant sterols for anabolic purposes.

However, it might also be wise to not close the door on this topic and be prepared to keep an open mind to the possibilities that some plant sterols could, in particular Ecdysterone, be found to have some beneficial effects in humans. Much more research is needed however.

Truth be told regarding this writers feelings on the matter, I would not be holding my breath... For building muscle, ecdysterone gets a thumb's down at this time.

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Glutamine

The 'non-essential' amino acid glutamine has been getting a great deal of attention over the past few years in sport nutrition publications and scientific journals and for good reason. Though it might not be considered "essential," glutamine appears to have many potential benefits for people interested in gaining new muscle and/or preserving that hard earned muscle.

Glutamine is required for countless functions in the human body from immune system function to liver function to gastrointestinal integrity, to name only a few. Supplement companies have taken to adding glutamine to various products and athletes have taken to adding glutamine to their diet.

For example, it is well known that low plasma glutamine levels are associated with a loss of lean body mass (muscle) and intense exercise is known to reduce glutamine stores. One study attempted to directly link glutamine levels with lean tissue loss.

The study divided 34 healthy men into three groups. One group did intense aerobic work (running) another group did intense anaerobic work (weight lifting and sprinting) and the third group was sedentary (AKA couch potatoes).

The authors of this study found that the greatest loss of muscle was found in those men who had the lowest baseline glutamine levels, which demonstrates just how

important this amino acid is for maintaining hard earned muscle tissue. Plain and simple, the harder you train the more glutamine you drain!

Because if its potential effects on the immune system, the use of glutamine may also help to prevent over training syndrome (OTS) in athletes who train too long and too hard. Several studies have suggested glutamine levels may be indicators for OTS.

Another interesting effect of glutamine is it may increase growth hormone levels (GH). One study took nine healthy subjects and fed them two grams (2000mg) of glutamine dissolved in a cola drink. Eight out of the nine subjects responded to the oral glutamine intake with a four fold increase in growth hormone (GH) output.

This study was particularly interesting because: (a) the glutamine was given orally and not by intravenous administration like so many studies and (b) the study only used two grams of glutamine. Most studies that showed any effect on GH used very large doses and were given directly into the veins of the poor participants.

That only two grams of glutamine taken orally had such an effect of GH bodes well for the use of glutamine by athletes. Whether or not a short spike in GH will lead to new muscle is another question however, and in truth, short lived spikes in GH in healthy young athletes does not appear to effect muscle mass.

Finally, glutamine may be useful in replenishing glycogen stores in muscle after intense exercise. Glycogen is stored in muscle cells for energy and other functions such as cell volume.

As most athletes know, glycogen is rather important stuff to have around when you want to perform well. The researchers took six healthy volunteers and made them exercise at 70-140% of maximal oxygen consumption (a fancy way of saying they worked 'em real hard!) to deplete their muscle glycogen stores.

They found that the glutamine enhanced glycogen storage after the intense bout of exercise. Exactly how glutamine improves glycogen storage is not clear. It might some how improve the uptake of glucose into muscle directly, or it might be that the glutamine is itself being converted into glucose and then being stored as glycogen in the muscles.

The authors of the study seem to suggest the latter. Either way, this might just be one more amazing benefit of this amino acid for athletes. Although no one have ever exploded with muscle from the simple addition of glutamine to their diet, glutamine gets a thumb's up as a general health improving supplement that appears to have applications for athletes. 5-20 grams per day of glutamine added to a post workout shake is the norm.

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Ginseng

Ginseng has been used in the Orient for centuries as an "adaptogenic" plant based supplement. The concept of an adaptogen basically means that it helps the body adapt to higher levels of stress.

The ailments Ginseng is claimed to treat range from nervous disorders, anemia, poor libido, wakefulness, forgetfulness and confusion, nausea, chronic fatigue and angina, to name a few.

Exactly how ginseng supposedly accomplishes all this is unclear and still being investigated. In animals, ginseng appears to have positive effects on the cardiovascular system, central nervous system, endocrine system, metabolism, and immune system. However, several recent reviews that examined the data on ginseng concluded, that while studies with animals show that ginseng (or its active components) may have positive effects on health and performance, there is generally a lack of controlled research demonstrating the ability of ginseng to improve performance in humans.

The general consensus regarding the effects of ginseng in humans is that most studies suffer from methodological problems such as inadequate sample size and lack of double blind, control and placebo designs. However, Germany's Commission E, which is responsible for developing guidelines for herbs, has found that ginseng is useful for a wide variety of problems, such as fatigue and

improving mental concentration. Europeans seem to have a much better handle on the uses of ginseng than the US.

To the reader, the above may seem confusing or contradictory. The reason for the contradictory information may be due in part to the type of ginseng being used, the quality of the ginseng being used, the amount of the ginseng used, and the aforementioned study design problems.

For example, there is American ginseng, Indian Ginseng, Siberian ginseng and Korean ginseng, all reported to have different effects. Also, many ginsengs on the market are known to be lacking in the active ingredient in ginseng, known as "ginsenosides."

One study found that over 85% of ginseng products on the shelves contained virtually no gensenosides. This makes ginseng something of a confusing supplement for athletes, but not a supplement without potential merit.

By some accounts with users, ginseng seems to increase stamina, concentration and resistance to stress, as well and improvements in endurance. One recent study found 350mg of ginseng extract improved the reaction time (psychomotor performance) of soccer players over a six week period.

Some studies have found ginseng has powerful anti-cancer and anti-oxidants properties as well as an ability to improve blood sugar metabolism. One recent study found ginseng was able to treat some men with erectile dysfunction!

This may be due to ginseng being possibly able to effect nitric Oxide (NO) production in men, as NO is essential for obtaining an erection.

The use of ginseng continues to grow with current sales estimated to be approximately 300 million dollars annually. There is clearly a need for research dealing with the efficacy of ginseng.

This research needs to take into account basic, fundamental design considerations if there is to be any hope of establishing whether or not ginseng actually has a place in an athletes supplements regimen. It's hard to imagine a billion Chinese could be totally wrong about ginseng however...

What is the optimal dose? Different extracts contain differing amounts of the active ingredients. Different products contain different doses. General recommendations are commonly 50-100mg per day of an extract containing at least 7%-10% ginsenosides 2-3 times per day.

Some experimentation may be needed however. What about building muscle? There is not a drop of solid data to support such a use for ginseng. So, an athlete looking to build muscle or increase performance, ginseng gets a thumb's down.

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HMB

Most people involved with sports nutrition and sports nutrition supplements has heard or read about Beta-hydroxy beta-methyl-butyrate or HMB for short. HMB appears to be one of those classic supplements that looks great in the lab but has had a rocky track record with "real world" users. Let me back up a moment.

HMB is actually a metabolite of the amino acid L-leucine. L-leucine is one of three amino acids known as the branched chain amino acids or BCAA (isoleucine and valine being the other two).

It has been known for a long time that BCAA play a critical role in the turn over of lean body tissues (muscle) and is muscle sparing (i.e. anti-catabolic) in a variety of muscle wasting states. Of the three BCAA, L-leucine appears to be the most important to preserving hard earned muscle mass and intense exercise and certain disease states have been shown to eat up a great deal of L-leucine. So far so good!

The main drawback of L-leucine is the fact that you must use large amounts of this amino acid to get a positive effect making it both expensive and impractical. Many studies that showed benefits were in fact done intravenously and used as much as 5 grams per hour of L-leucine!

That my friend is a lot of leucine.

So, it was theorized there might be a metabolite of this ultra important amino acid that was responsible for many of the positive effects of L-leucine but could be taken in far lower doses and by mouth (as opposed to having a tube stuck in your arm). That metabolite appears to be HMB.

Animal research with HMB has been impressive. During stressful conditions, animals will often lose weight and/or become quite ill. Some even die. This of course can be quite expensive for any company trying to make a living from these animals in one way or another. When animals were fed HMB they found a large reduction in mortality rates, increases in muscle mass, and improvements in immune function in the animals fed HMB.

Several studies in humans have also looked promising. Studies using both trained and untrained subjects found increases in muscle and decreases in bodyfat in people ingesting just three grams (3000mg) of HMB per day.

The average was approximately 2-4 pounds of muscle put on with an equal amount of fat taken off over a four week period. The scientists also found that HMB positively affected several biochemical markers of intense exercise that would lead one to believe that there was a reduction of muscle wasting in people taking HMB. "So what's the problem," you ask? The problem has been mainly that what looked so promising in the research has not been fully realized in the real world, hence my introduction to this section.

Several follow up studies with HMB in people also failed to find any results. Feed back from real world users has been generally negative with HMB. Some seem to feel they have benefited from it while most found HMB a big waste of money.

Were the studies that found benefits flawed? Are some people not taking enough? Does it depend on the nutritional status of the person using it and/or how they train?

It's not known for sure at this time, but considering the costs of HMB and the fact there are other less expensive alternatives that clearly work (i.e., creatine) I see no reason for hard working athletes to spend money on HMB until a definitive answer can be found. At this time, HMB gets a thumb's down for building muscle, but if you want to give it a try, I will not hold it against you ☺

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Alpha-ketoisocaproate (KIC)

Much of what you read above about HMB will be found here in the KIC section. The reason for this is the two are directly related to each other. Most people are aware of the branch chain amino acids, leucine, isoleucine and valine, as explained above in previous sections. These three amino acids are essential components of high quality protein and are needed for the body to synthesize new proteins (muscle) in response to exercise.

The branch chain amino acids are the amino acids that are primarily used (oxidized) during exercise and are anti-catabolic during muscle wasting states. Of the branch chain amino acids, leucine appears to be the most important and intense exercise and certain disease states (both of which are quite catabolic) eat up a great deal of leucine.

It has been known for years–and has been shown in the research repeatedly–that leucine is a regulator of whole body protein turnover. The body's need for leucine (and the other branch chain aminos) goes up considerably during intense exercise and other stressful conditions. KIC is a metabolite (technically a catabolite) of leucine. Several companies make KIC and sell it as an anti-catabolic supplement.

People throw the term "anti-catabolic" around all the time in the magazines or in the gym, but what does it really mean? It is logical that we should briefly discuss

what anti-catabolism is before we can have a meaningful conversation about a (supposedly) anti-catabolic nutrient like KIC. Make sense?

Now the idea of building muscle up (anabolism) is nothing new to bodybuilders and other athletes. The idea of preventing lean tissue break down (anti-catabolism), thus having a net increase in muscle, is a fairly new concept. It has been discovered that decreasing muscle tissue breakdown can be just as important for gaining muscle as increasing protein synthesis (anabolism).

If protein synthesis out paces breakdown, you are said to be in an "anabolic" state and are building up tissue. If tissue breakdown (catabolism) exceeds anabolism, you are in a "catabolic" state (bad stuff!). If both processes are equal to each other, you are in homeostasis (making no gains Jack!) and are neither losing nor gaining any tissue, which is the state most people are in the majority of the time. OK, so far so good.

Body proteins are in a constant state of flux as both anabolic and catabolic processes take place constantly, a very delicate and complex system. Now if you can reduce the amount of tissue being broken down, you can change this balance toward more protein being stored (muscle) and the net effect is anabolic or anti-catabolic.

Raise your hand if I am making sense. A few years back, supplement makers and designers were constantly searching for natural anabolic compounds but generally came up short.

In the past few years, the smart companies and researchers have realized that it is easier (and just as beneficial) to influence catabolic pathways than anabolic pathways with the era of researching and designing "anti-catabolic nutrients" being born.

Clearly, building maximum muscle mass depends on both maximizing protein synthesis (anabolism) and minimizing protein breakdown (catabolism).

Scientists postulated that there must be a leucine metabolite downstream which was responsible for much of the beneficial effects of leucine. One of the important "downstream" derivatives of leucine appears to be KIC (and HMB as mentioned above).

Earlier research found that both leucine and KIC decreased muscle wasting (proteolysis), improved nitrogen retention, reduced glucose use by muscles and increased protein synthesis in animal tissues. Now before you run out and buy a golf-cart full of leucine, there is a catch.

The amount of leucine and KIC needed to achieve these fantastic results were quite large and were usually given intravenously. Five grams per hour of leucine and as much as sixty grams per day of KIC were not uncommon doses in these studies. That a lot of leucine and KIC!

Unfortunately, though KIC shows great potential promise as an anti-catabolic nutrient, there is scant human research with healthy athletes to prove it at this time.

For now, it remains more an interesting, albeit experimental nutrient for athletes to use. In the basic pathway it goes like so: Leucine -> KIC –> HMB. Considering the lack of human research in healthy athletes and the huge dosages that were used in the research to get an effect, KIC has to get a thumb's down for athletes looking to add new muscle until far more research is done on this (possibly) promising nutrient.

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7-keto-DHEA

As most people know, DHEA is claimed to help just about every ailment known to man kind, from depression to heart disease to cancer to weight loss.

The criticism of DHEA has been its potential effects on peoples' hormones, as DHEA can be converted into the sex hormones such as testosterone, estrogen, as well as others. Though research has been contradictory regarding DHEA's effects on hormones, most agree that it does have the potential for problems if used in high enough doses.

Researchers looked into the possibility that there may be a downstream metabolite of DHEA that was responsible for many of its potentially positive effects on health without the downsides mentioned above. That metabolite appears to be 3-Acetyl-7-oxo-dehydroepiandrosterone, or simply 7-keto-DHEA. 7-Keto-DHEA may in fact be more biologically active, that is have enhanced effects above that of DHEA, without the ability to alter hormone levels in the body of people using it.

In vitro (test tube) studies with 7-keto-DHEA appear to show it has no effects on steroid hormones and does not convert to sex hormones such as testosterone, estrogens, etc. One study that fed 200mg of 7-keto-DHEA to men ages 18-49 years old for four weeks found no effects on sex hormone levels. Interestingly, 7-keto-DHEA may have a more pronounced thermogenic effect (the process the body uses to convert stored calories into energy) than DHEA and a few animals' studies and in vitro studies have shown this.

However, no studies to date, in people, have looked specifically at the thermogenic effect of 7-keto-DHEA vs. DHEA. Some animal research has also shown improvements in memory and other cognitive functions. 7-keto -DHEA may also have positive effects on thyroid function.

One of the better known claims of DHEA is as a weigh loss agent, but studies using various doses of DHEA for weight loss have been disappointing for the most part.

As for 7-Keto-DHEA, there has been one recent study with people that looked at weight loss. The study fed 30 overweight women (15 acted as a control group and received a placebo) 200mg a day of 7-keto-DHEA for 8 weeks.

The study participants were put on a three-day per week cross training exercise program. The study found that the group getting the 7-Keto-DHEA lost 1.8% of their bodyweight – a little over 6lbs on average – vs. the placebo group, who only lost 0.57% of their bodyweight.

The study also found that the group getting the 7-keto-DHEA had increases in the thyroid hormone T3 without significant changes in testosterone, estradiol (estrogen), liver and kidney function tests, blood sugar vital signs, or overall caloric intake over the eight-week study.

There were no adverse effects reported throughout the study in the people getting the 7-Keto-DHEA supplement. The study concluded that, "200 mg of 7-Keto-

DHEA per day yields a significant reduction in both body weight and body fat." However, it's important to note that this is just one small human study and more research is clearly needed.

On paper, 7-keto-DHEA looks promising. We do have some human research regarding weight loss, albeit one study. The study is a compelling one however and appears to show 7-keto-DHEA has effects that are different from that of simple DHEA on weight loss, though more human studies are clearly needed.

It should also be a very safe supplement, though it probably will not be a supplement that improves athletic prowess. As people know, both DHEA and 7-Keto often get touted as being useful for building muscle or improving performance, but there is no data to show that with 7-keto and data with DHEA is conflicting at best.

For general health and possibly weight loss, 7-Keto gets a tentative thumb's up, but for increasing muscle mass, strength, or performance, it gets a thumb's down (as does DHEA) at this time.

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MCT

What if there was a fat you could eat that was not stored as bodyfat and would just be burned off as heat? Would this be the nirvana of fat loss supplements and free energy source for athletes?

Well the proponents of Medium Chain Triglycerides (MCT's) would certainly like us to believe that MCT are the answer to athletes and dieters dreams. Is it true?

Sort of. First we have to back up however and explain what an MCT is. Fats can come in different lengths (i.e. number if carbon atoms in the chain) and can be saturated or unsaturated. MCT's are technically a saturated fat with 8-10 carbon lengths, making it a "medium" length fatty acid.

MCT's can be produced from the fractioning of other oils, such as coconut oil. Long chain fatty acids on the other hand have 16, 18, or more, carbon lengths. Because of their shorter length, MCT's are processed differently in the body and can bypass many steps that long chain fatty acids must go through to be used as energy and stored as bodyfat. For example, long chain fatty acids must be transported to the power house of cells called the mitochondria via something called the carnitine shuttle system.

This system is one of several limiting steps in the amount and rate of fat that can be "burned" or oxidized for energy at any one time. MCT's on the other hand can bypass this shuttle system and can enter the mitochondria directly to be used as

energy. This is one of several reasons MCT's are considered less likely to be stored as bodyfat than long chain fatty acids.

Some studies in both people and animals suggests MCT's increase the thermic effect of food and increase daily energy expenditure (EE); which means the energy is lost as heat rather than stored as bodyfat. However, the few studies that have looked directly at the use of MCT's for weight loss in humans have been disappointing.

More often than not, studies that looked at MCT's for weight loss in humans have found no effects on weight loss. The reason is not totally clear but it may have to do with some of the positive effects of MCT's being offset by several negative effects on metabolism. For example, there may be an increased production of triglycerides and an increased release of the fat storage hormone insulin from ingesting MCT oils.

There are other possible drawbacks to MCT's. For example, MCT's don't contain fat soluble vitamins such as vitamin E, D, and K, nor do they contain any essential fatty acids (EFA's). MCT's do appear to have some genuine medical uses where digestion of fats and various liver problems exist, as well as having possible anti-catabolic (muscle sparing) effects in hospitalized patients.

Though MCT's may not be the nirvana of fat loss products and energy enhancers some people make it out to be, there may still be a place for this product in the athletes arsenal of supplements and some experimentation is recommended.

People who push MCT's as some sort of muscle building anabolic fat are feeding people a load of you know what.

For building muscle and or improving strength and performance, MCT's get a thumb's down at this time.

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Maca

Maca (Lepidium meyenii) is a root plant native to Peru. It grows at very high altitudes (13,000-14500 ft above sea level) on the Andean plateaus of Peru. It's considered a medicinal food with many uses.

Maca is similar to ginseng in that it's considered an "adaptogenic" plant based supplement. Like ginseng in Asia, maca has been used for centuries in South America going as far back as 8000BC during the Inca Empire. The concept of an adaptogen basically means that it helps the body adapt to higher levels of stress.

Adaptogens, as the concept goes, are compounds that have different effects on different people depending on their age, sex and hormonal status. Maca is said to be rich in calcium, magnesium, iron, B-vitamins, and trace minerals such as zinc, iodine, copper, selenium and manganese.

Maca contains several alkaloids that are said to "nourish" the endocrine glands, including the pituitary, adrenals, pancreas, testes and thyroid gland. Typical of adaptogenic substances, it is believed to have a wide range of effects that include increased strength and performance, increased sexual desire, improved mental acuity, improvements in people with chronic fatigue syndrome, as well as many others effects.

These effects are clinical observations in patients rather than the results found in controlled published studies. Unfortunately, there is scant published human

research that confirms these clinical observations by doctors in Peru and other parts of the world. There are however a few interesting animal studies regarding growth and sexual desire.

One study found that cooked maca, but not raw maca, increased the weights of several generations of mice. They also found the serum values of total proteins and albumin were statistically superior for the mice group eating cooked maca than that of the raw maca and control groups. Does this make maca a true anabolic agent? At least in mice, it appears so but further research is needed.

Another study in rats and mice examined maca's effects on sexual desire and erectile dysfunction. Interestingly, the study found the oral administration of a Maca extract enhanced the sexual function of the mice and rats. They concluded, "the present study reveals for the first time an aphrodisiac activity of L. meyenii, an Andean Mountain herb."

Is Maca a true aphrodisiac? Is it working through hormonal pathways? Does it increase testosterone in men? Is it a useful aid to athletes? Unfortunately, these questions can't be definitively answered at this time without solid human data to support the animal studies.

Maca is definitely a product to keep an eye on and may prove to be a worthwhile supplement to hard training athletes. However, due to its lack of any solid human data, it has to get a thumb's down. Might be worth trying for the heck of it, but I would not get your hopes up too high with this supplement.

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5-methyl-7-methoxy-isoflavone (Methoxyisoflavone)

Most people who follow sports nutrition or take supplements intended for the sports nutrition market, have probably heard of methoxyisoflavone or "methoxy" for short. Methoxy is a plant based compound in the family of compounds known flavanoids, which includes isoflavones, flavones, flavanones, naphthoflavones, as well as others.

This is a very large family of compounds, such as alpha-naphthoflavone, catechin, daidzein, equol, beta-naphthoflavone (BNF), quercetin, rutin, chrysin, genistein, Ipriflavone, baicalein, Quercetin, galangin, and biochanin.

Amazingly, there are far more of these compounds that I am not even listing! These plant based compounds have a great range of effects, ranging from anti-cancer, anti-oxidant and a thousand other potential uses still being elucidated by researchers as we speak.

A Hungarian company called Chinoin in the 70s originally studied Methoxy. The company has a patent on methoxy and lists its many effects on metabolism, including increased protein synthesis, increase lean mass, reduced body fat, promoted endurance, lowered cholesterol levels and an improvement in the body's ability to use oxygen.

The patent and the many subsequent companies now selling methoxy claim this plant-based supplement has anabolic effects, working through non-hormonal pathways. That is, it achieves the above without using/affecting hormones such as testosterone, growth hormone, etc. Sound too good to be true? Does to me too.

Bodybuilders and other athletes have come to use the term "anabolic" to mean the building of muscle exclusively. This is only partly true. For example, physiology texts book will normally define anabolic or "anabolism" as the phase of metabolism in which simple substances are synthesized into the complex materials of living tissue or a process by which larger molecules are formed from smaller ones.

What does this mean to the reader in English? It means that making new bone, or even fat, is in fact technically an anabolic endeavor.

Several companies have done research with the isoflavones and found they may increase bone mass in animals and people. Does this mean methoxy effects bone and not muscle? Well, there is very little research with methoxy on healthy active adults that looked at muscle mass, other than the old Hungarian research, so it's hard to tell right now.

Several isoflavones, including methoxy, have been shown to increase the weight of many animals, but again, that effect appeared to be mostly increases in bone density. It should be noted that there is a great deal of research going on right now with hundreds of different plant based compounds and the flavanoids are perhaps some of the most interesting and promising.

However, at this time, methoxy is far from the wonder anabolic supplement it's being portrayed as.

Is methoxy a waste of money? Perhaps not, but what its exact role is in sports nutrition remains unclear at best.

Considering the total lack of data showing any effects on muscle mass of healthy athletes, methoxy gets a thumb's down at this time.

Phosphatidylserine

Phosphatidylserine (PS) is supplement that has been found to hold great promise for people suffering from various pathologies that affect the brain, such as certain forms of dementia, Alzheimer's, and others. Early European studies showed phosphatidylserine could slow and reverse the rate of brain cell aging in laboratory animals.

PS also restored mental function in older animals to levels exceeding those found in some younger animals (although studies in humans with Alzheimer's disease were less impressive, PS still produced improvements in cognitive function). Research has shown that in addition to improving neural function, PS appears to enhance energy metabolism in brain cells. In the brain, PS helps maintain cell membrane integrity and may protect brain cells against the functional deterioration that occurs with "normal" aging.

PS is usual derived from soy. Brain tissue has been found to be especially rich in PS and it appears aging causes a decline in the PS content of cells throughout the body. So, it's no wonder that longevity groups and individuals concerned with brain function due to various causes have taken an interest in PS.

What does PS offer the athlete? One affect of PS may be its ability to reduce levels of the catabolic (muscle wasting) hormone cortisol after exercise. Two early studies done in Italy appeared to show that chronic intakes of PS reduced the release of cortisol after intense exercise. When the body senses stress, whether

physical and/or emotional, it releases cortisol as part of the "fight or flight" cascade that prepares us for short term survival. Prolonged stress from malnutrition, surgery, over training and sleep deprivation, as well as psychological stress, causes a systemic effect that includes increased cortisol secretion resulting in a decline in certain aspects of immune system and other problems.

As the reader can see, over long periods of time, high cortisol levels are detrimental to our over all health and muscle mass.

PS does suffer from one key draw back, which is its shear cost. The most recent study that found PS reduced post exercise cortisol levels, used 800mg per day with 10 well trained subjects who were intentionally over trained, found approximately a 20% reduction in post exercise cortisol levels.

The study also found post workout sourness reduced and general feelings of 'well being' increased in the group using PS. At 800mg doses used, it's an expensive proposition, but possibly worth the cost. However, the original studies out of Italy found PS lowered cortisol used only 50 and 75mg per day, so this may at least be a starting dose to try.

Another drawback is that PS has not been studied to see whether or not it would truly improve either performance or muscle mass in athletes, which is ultimately why an athlete would use such a product (well, perhaps a Chess master would use it for the potential cognitive effects).

PS is definitely one of those supplements to keep an eye on in this writer's opinion, but further study as it relates to athletes is clearly needed. As it related to its potential health uses, that looks more solid.

At this time, PS gets a tentative thumb's up for athletes but again, it's far from clear what effects it will have on muscle mass or performance or what the optimal dose is.

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Ribose

One fairly new supplement on the market being touted as the best thing since the invention of the squat rack is ribose. Companies marketing ribose claim everything from increases in strength and muscle to improvements in performance and health.

What is ribose? Ribose is technically a sugar. There are many sugars the body uses for a wide variety of functions.

Most people know the sugars such as glucose, sucrose, and fructose (blood sugar, table sugar and fruit sugar, respectively). For example, glucose can be found in some fruits and is the form of sugar found in the blood stream, hence the term "blood sugar."

Sucrose is often called "table sugar" as it is the common form added to many foods and is found in the sugar bowl on your table (sucrose is actually made up of glucose and fructose).

Fructose is often referred to as "fruit sugar" because it is found as the dominant sugar in fruit. There are however many other sugars the body uses for countless functions and/or is found in the foods we eat: pentose, xylose, galactose, mannose, ribose, and many others.

Ribose is wide spread among all organisms and is a constituent of ribonucleic acid (RNA) which carries our genetic code. However, ribose is involved in many other

functions in the body, including the production of high energy compounds the body uses to do work (i.e. exercise, etc.).

Data suggests that ribose may both serve as an energy source and enhance the production of compounds known as purine nucleotides. It is well established that high energy compounds such as ATP are reduced during and after intense exercise.

The body must resynthesize these high energy compounds during the post exercise recuperation phase and this is where ribose may come into play. By adding in an external dietary source of ribose in high enough doses, athletes may be able to recuperate faster from intense workouts and thus can improve performance and strength from the use of ribose. In studies where the normal synthesis of these high energy compounds is reduced by certain diseases or genetic problems, ribose has looked promising for helping people afflicted with such problems.

However studies looking at healthy athletes showing improvements in strength or performance are lacking with a few small studies completed. It stands to reason that ribose would be of help to both strength and endurance athletes, but how much help and at what dose has yet to be proven.

Several studies with athletes have recently been conducted, and the results look positive, albeit not overwhelming. For example, a recent study with 15 male bodybuilders examined exercise performance over a four week period.

The men were given 5g of ribose before they performed the bench press and 5g following the exercise vs. a group taking a placebo. The study found a statistically

significant increase in the number of repetitions performed in the bench press in athletes getting the ribose compared to athletes taking the placebo (5 subjects in the ribose group and 7 in the placebo group).

The number of bench press repetitions performed to muscular failure increased +29.8% ribose vs. +7.42% placebo ($p = 0.046$) over the 4 week period. Another relatively small study with 16 athletes receiving 10g of ribose and put through repeated sprints had an increase in mean power over 5 days of training (4.2% vs. 0.6%).

Findings also included greater peak power output at the last sprint session (11.4 watts/kg vs. 10.4 watts/kg, $p=0.05$ time) vs. a placebo group.

However, it's important to note that these are both small studies and neither have been published in a peer reviewed journal (see references).

So where does that leave us with Ribose? For one thing it's overly expensive. For another, it still suffers from a lack of large scale human studies that are published in peer reviewed journals showing it will increase LBM, strength or performance, but it does appear to help people with various pathologies.

It's also my understanding that there are several other studies either just completed or being completed and the results of those studies will be interesting to see. Hopefully they will confirm the limited studies we have. Finally, the optimal dose is unknown, but the studies above used 10g with most people using between 5-20 gram per day.

With some reservations, I am still going to give Ribose a thumb's up as my gut tells me this supplement does have uses for the athlete.

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on file at Bioenergy, Inc., 13840 Johnson Street N.E., Ham Lake, Minnesota 55304 USA.

Saw Palmetto

Serenoa reopens, AKA saw palmetto, has been a popular herbal extract for years with athletes and non-athletes alike. Advertised as the cure for almost everything from hair loss to benign prostate enlargement (AKA, BPH), Saw Palmetto is often added to many supplement formulas or sold alone.

For example, Saw Palmetto can often be found added to "andro" supplements claiming it will block any possible negative effects the andro supplement might cause due to its potential effects on peoples hormones, namely the "male hormone" testosterone. For non-athletes, Saw Palmetto has been a standard alternative treatment for BPH, an affliction that many men suffer from as they age.

The story goes like this: The "male hormone" testosterone converts to a more powerful androgen called dihydrotestosterone (DHT) via and enzyme called 5-alpha-reductase (5ar).

DHT is known to be a strong factor in the development of several problems many men face as they age such as the aforementioned male pattern baldness and BPH.

So, finding something that blocks the 5ar enzyme should reduce the amount of DHT and said male problems should be improved or avoided (FYI, this is also how the new drug Proscar works). Of course, it's a lot more complicated than that but hey, I only have so much space in this here section so the reader will have to cut me some slack.

Anyway, saw palmetto has often been sited as an herb able to block the 5ar enzyme and is often recommended to people losing their hair or suffering from BPH and/or is added to "andro" products to theoretically block any negative effects of such products. Sounds great, but is it true?

Will saw palmetto deliver this wonderful cure for all that bother men from their hair to their nether region? Maybe, maybe not. Several studies have suggested in certain cells that saw palmetto appears to block the 5ar enzyme.

However, in vivo studies, that is studies using either animals or people actually ingesting a compound, have generally failed to show saw palmetto reduced DHT system wide. There is no research that has directly looked at saw palmetto for hair loss in men (i.e. MPB) nor is there any research that has directly shown saw palmetto can reduce any potential side effects of any of the andro products.

So, it would seem premature to recommend saw palmetto for such problems until far more is known.

Regarding BPH that's where saw palmetto looks far more promising. Several studies using 320mg of saw palmetto extract per day have shown positive effects on BPH symptoms.

Though it is unclear exactly how saw palmetto improves the symptoms of BPH, there appears to be enough data and clinical evidence in favor of saw palmetto as a

treatment for men who suffer from an enlargement of the prostate that is not cancerous.

Whether saw palmetto blocks 5ar, blocks the uptake of testosterone and DHT into the prostate, or actually blocks certain pro inflammatory enzymes responsible for other problems in the formation of BPH, is not certain at this time.

Regardless, other than BPH, there is not enough research to add saw palmetto to andro products. For athletes looking to get some sort of anabolic advantage from SP, or avoid side effects from taking andro supplements, I have to give it a big thumb's down at this point. If you have an enlarged prostate, it might be worth a try.

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L-Tyrosine

The use of individual amino acids by athletes is a common occurrence (see: glutamine, arginine, and branch chain amino acids-leucine, lysine, and iso-leucine-sections) as well as others are popular nutritional supplements for a variety of reasons.

One amino acid that has not gotten a great deal of attention by athletes is the amino acid L-Tyrosine. L-Tyrosine is found in high amounts in protein foods and the body can make L-Tyrosine from amino acid phenylalanine, technically making it a "non-essential" amino acid.

This often overlooked amino acid plays many important roles in human metabolism. L-Tyrosine is a precursor or "building block" to the neurotransmitters responsible for maintaining metabolic rate. L-Tyrosine is the direct precursor to stimulatory neurotransmitters such as epinephrine and noropenephrine (i.e. adrenaline) as well as certain thyroid hormones and dopamine.

Due to the fact that Tyrosine is essential to the production of all the above stimulatory hormones and neurotransmitters, some consider it an amino acid with mild stimulant-like properties to the metabolism and mental focus. Some weight loss supplements contain L-Tyrosine in an attempt to supply this essential building block in hopes it will help maintain a higher metabolism.

Though Tyrosine has not been shown to be an effective weight loss agent on its own, several studies have shown it can improve the anorectic (appetite suppressive) effects of the herbal weight loss products containing ephedrine and caffeine and OTC diet drugs containing phenylpropanolamine.

Several studies done by the US Army showed soldiers given supplemental L-Tyrosine were more resistant to cold temperatures than those not getting the amino acid. One recent study found that 21 cadets, fed 2 grams of tyrosine a day then subjected to a demanding military combat training course, reduced the effects of stress and fatigue on cognitive task performance. So, tyrosine may be a stress fighting nutrient.

It's not uncommon that people are given advice on what to eat in regards to the foods amino acid content. For example, many people have probably heard at one time or another, "if you want to be more alert, eat a high protein food." This advice is probably due to the high L-Tyrosine content of the food. Conversely, people are also given advice that to relax, they should eat foods such as milk and turkey, which are high in the amino acid L-Tryptophan.

L-Tryptophan is a building block of the neurotransmitter serotonin known to help with sleep and relaxation. Some strength athletes have found that by taking 500 to 1000mg of tyrosine prior to exercise, they have more energy, but no studies to date have found this to be an effect of Tyrosine.

However, because it may be a mild stimulant and works at the level of the central nervous system, people using MAO inhibitors, pregnant women, people with high

blood pressure and people sensitive to stimulants, should probably avoid high doses of tyrosine.

For general mental focus and stress fighting, as well as pre-workout or mixed with the various weight loss agents, Tyrosine gets a thumb's up, but for any direct effects on anabolism (muscle growth) it gets a thumb's down.

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Taurine

Amino acids such as glutamine, arginine and perhaps tyrosine seem to get most of the attention in sports nutrition circles. One amino acid that may be being overlooked is taurine.

Taurine is a ubiquitous non-essential amino acid found throughout the human body, similar to glutamine. It's considered non-essential because the body can make taurine from the amino acids methionine and cysteine with the help of vitamin B6.

Taurine may be non-essential and ubiquitous in the human body, but that does mean taurine does not have some potentially interesting effects that athletes may benefit from. Although taurine is listed as being non-essential, it should probably be listed as conditionally essential, which means under certain circumstances, it becomes essential to the human body.

Much of taurine's exact role in human biology is still being elucidated, but what has been looked at is compelling. Taurine is intimately connected with cell volume, blood pressure, insulin metabolism, the ability of muscles to contract correctly and hundreds of other functions known and yet unknown.

For example, there is a steady decline in taurine levels as we age, which may lead to a host of problems. One study that rats fed taurine at 1.5% of calories found

taurine supplementation blunted age-related declines in serum IGF-1, an important anabolic hormone essential to muscle growth and protein synthesis.

Another study found that supplemental taurine in aging rats corrected the age-related decline in the ability of the rat's muscle to contract. The study suggested that an age related decline of taurine content could play a role in the alteration of electrical and contractile properties of muscles observed during aging and that supplemental taurine corrected the decline.

The study concluded, "these findings may indicate a potential application of taurine in ensuring normal muscle function in the elderly." This has very exciting possibilities in aging populations, but human trials are still lacking.

Another exciting area of research for taurine is its possible role in managing diabetes and improving insulin sensitivity. Several studies in both rats and humans suggest taurine can play a role in improving several indices of diabetes, such as insulin metabolism, high cholesterol levels and high blood pressure, as well as others and diabetics appear to be chronically low in taurine.

For example, one study found Taurine attenuated hypertension and improved insulin sensitivity in rats made insulin resistant by a high fructose diet. Treatment with 2% taurine put in the rats drinking water prevented the blood pressure elevation and attenuated the hyperinsulinemia (high insulin levels) in fructose fed rats and prevented the large spike in glucose levels in response to an oral glucose load.

The study concluded, "thus, taurine supplementation could be beneficial in circumventing metabolic alterations in insulin resistance." Several studies have found this effect in rats fed taurine and made diabetic.

One human study looked at the ability of taurine to prevent blood platelet aggregation or "sticky" blood cells in diabetics. This is important because "sticky" blood platelets are related to the development of heart attacks and is a particular issue to diabetics. The study found that supplemental taurine made the diabetic's blood aggregation or "stickiness" equal to that of healthy controls.

So what use does taurine have to athletes and healthy people? Well again, as is so often the case, human studies in healthy athletes are lacking, so it's difficult or near impossible to make solid recommendations at this time. Taurine might be a great supplement to healthy athletes or it may only work in those populations who chronically lack taurine in their tissues, such as the aging, diabetics and others.

One thing is for sure, as with pretty much all amino acids, multi gram doses will probably be needed for any effect and any product that sprinkles in a few milligrams will be of little use to the buyer.

It would be great if we had solid data showing some positive effects in athletes. And it would be nice if we knew what the effective dose was. Sadly, we have neither at this time. However, due to the shear amount of overall data we have, I am still giving taurine a tentative thumb's up as a "worth a try" supplement.

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Hansen, S.H. "The role of taurine in diabetes and the development of diabetic complications," Diabetes Metab Res Rev 2001 17/5 p. 330-46.

Tribulus terrestris

Tribulus Terrestris is considered a medicinal herb that has been used in many countries as a treatment for impotence and sterility. It's a plant that has been popularized over the years as a possible ergogenic for athletes.

Supplement companies have claimed it raises testosterone by raising lutienizing hormone (LH). The problem is that we have basically no modern research to go on with healthy athletes. Companies that sell Tribulus often have "in house" research that shows Tribulus raises testosterone but none of this research ever seems to see the light of day in Western peer reviewed medical journals.

There is in vitro (test tube) research that suggests tribulus may improve the motility, function and total sperm count of animals. And there is some old Bulgarian research with athletes that supposedly showed improvements in strength and performance, but no modern published data showing either increases in testosterone or improvements in performance in athletes. In high enough amounts, some studies have found tribulus to be toxic to animals, but of course many things are toxic at high enough doses that normally present no dangers at lower doses.

At this point, companies marketing tribulus would be better off funding a real study to validate this product as it relates to athletes and testosterone levels, rather than spending the money on advertising.

There was one recent study however that found some interesting, albeit conflicting, effects with tribulus. Fifteen subjects were randomly assigned to a placebo or tribulus (3.21 mg per kg body weight daily) group.

Body weight, body composition, maximal strength, dietary intake and mood states were determined before and after an 8-week exercise of periodized weight training and supplementation. The study found there were no changes in body weight, percentage of bodyfat, total body water, dietary intake or mood states in either group.

Muscle endurance increased for the bench and leg press exercises in the placebo group ($p < .05$; bench press +/-28.4%, leg press +/-28.6%), while the tribulus group experienced an increase in leg press strength only (bench press +/-3.1%, not significant; leg press +/-28.6%, $p < .05$).

According to this recent study, "supplementation with tribulus does not enhance body composition or exercise performance in resistance-trained males." Why the tribulus group got stronger in the leg press over the placebo group, considering the fact that it had no effects on LBM, fat mass, etc., remains unclear.

Does this mean tribulus is worthless to athletes? Perhaps not. It does mean that we don't have the kind of evidence we should have before making a recommendation on this supplement.

Word on the street from users is mixed and this could be due to the quality of the herb, the quantity used, the physical state of the user or the possibility that it just does not work.

The answer is unknown at this time. There is no doubt that as there are many herbs and compounds found within herbs that will turn out to be useful to athletes looking to improve strength, endurance and recuperation from tough workouts. And tribulus may turn out to be one of the herbs, but I would not hold my breath on that one.

So, where does this leave us? Personally, I would be cautious before parting with my money for the stuff. So far, the hype over tribulus far exceeds its worth to athletes. For increasing muscle mass or testosterone levels, tribulus gets a thumb's down at this time.

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Vitamin C

Most people know vitamin C (ascorbic acid) as a simple vitamin and antioxidant needed for optimal health. They would be right. Vitamin C is a water-soluble antioxidant in the human body and plays a wide variety of roles in metabolism, ranging from immunity to hormone production.

Vitamin C may also play additional roles above and beyond its simple role as an essential nutrient found in our diet and supplements.

Although exercise has been shown to improve antioxidant mechanisms, one well known side effect is that it raises oxidative stress and increases free radical production. Defenses can be overwhelmed over time and the risks of increased free radical production are well known, such as damage to DNA and a host of pathologies best avoided. When we factor in our various life styles and environment the issue of free radical production and oxidative stress is made more important.

Some studies have reported that supplementation with vitamins C and E, or antioxidant mixtures can reduce oxidative stress from intense exercise and trained athletes who received antioxidant supplements show evidence of reduced oxidative stress.

Like all things in life, there is always a flip side and exercise is no exception.

Though the benefits clearly outweigh the risks, we must acknowledge the potential down sides, or problems associated with exercise, and look for ways to minimize them. Although moderate exercise has been shown to improve immunity, extreme and prolonged exercise has been shown to suppress the immune system.

This is commonly called, "over training syndrome" or OTS, and is common with athletes who train too long, too hard and too often. OTS is also found in elite military groups such as the US Navy Seals who are forced to train under extreme conditions.

One study found that a group of runners who trained for a marathon but did not compete was much less likely to get upper respiratory infections than the runners who completed the race, showing how much such endeavors can take out of a person.

Vitamin C has been shown to reduce oxidative stress and suppress levels of the muscle wasting hormone cortisol, as well as prevent the decline in immunity after intense exercise.

However, not all studies agree on these effects of vitamin C or antioxidants in general on immunity. Athletes should not view taking additional vitamin C as a direct performance enhancer per se, but as a long term preventative nutrient essential to long term health. Without good health, clearly, performance will suffer.

So, indirectly, adequate vitamin C intakes are important for long term performance, although studies don't find positive effects on short term performance.

Exactly what the "optimal" intake of vitamin C remains to be elucidated, but there appears to be no health risks associate with taking higher amounts than the RDA recommend. Individual intakes of vitamin C can range dramatically, from 100mg per day to several thousand milligrams, with most studies looking at "high dose C" using between 200 and 1000mg per day.

Although there is not an optimal dose known at this time, 200-500mg daily of vitamin C added to an athletes diet is a common dose and should be adequate. For General health and well being, vitamin C gets a big thumb's up, but for direct effects on building muscle or improving performance, it has to get a thumb's down.

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Balakrishnan, S. D. and C. V. Anuradha. "Exercise, depletion of antioxidants and antioxidant manipulation," Cell. Biochem. Funct. 16/4 1998, p. 269-75.

Peters, E. M. "Exercise, immunology and upper respiratory tract infections," Int. Jour. Sports Med. Mar.18 Suppl. 1 (1998), p. S69-77.

Vitamin E

Most of what was said about Vitamin C above will be similar for Vitamin E. As with C, people are familiar with vitamin E (alpha-tocopherol, beta-tocopherol, etc.) as a simple vitamin and antioxidant needed for optimal health.

Vitamin E is the major fat soluble antioxidant in the human body and plays a wide variety of roles in metabolism, ranging from immunity to fertility to hormone production. As with all antioxidants, Vitamin E works in conjunction with other antioxidants such as Vitamin C, glutathione, selenium and beta-carotines, as well as key antioxidant enzymes such as superoxide dismutase, glutathione peroxidase and catalase.

As mentioned in the Vitamin C section: Although exercise has been shown to improve antioxidant mechanisms, one well known side effect is that it raises oxidative stress and increases free radical production.

Defenses can be overwhelmed over time and the risks of increased free radical production is well known, such as damage to DNA, reduced immunity, susceptibility to upper respiratory infections and other potential health problems best avoided. When we factor in our various life styles and environment (e.g., pollution, ozone, etc) the issue of free radical production and oxidative stress is made more important.

Some studies have reported that supplementation with vitamin E and/ or antioxidant mixtures, can reduce oxidative stress from intense exercise and trained athletes who received antioxidant supplements show evidence of reduced oxidative stress. Studies with Vitamin E that have looked directly at performance have been contradictory, with most studies finding no direct effects on performance.

Although moderate exercise has been shown to improve immunity extreme and prolonged exercise has been shown to suppress the immune system. This is commonly called "over training syndrome" or OTS and is common with athletes who train too long, too hard, and too often. OTS is also found in elite military groups such as the US Special Forces who are forced to train under extreme conditions.

Vitamin E has been shown to reduce oxidative stress. In particular, because Vitamin E is fat soluble, it helps to prevent something called exercise-induced lipid peroxidation.

For example, one recent study evaluated the effects of 5 months of Vitamin E (alpha-tocopherol) supplementation on physical performance during aerobic exercise training in 30 top-class cyclists. The study found the plasma Vitamin E concentration increased significantly in the vitamin E-supplemented group, whereas the placebo group showed a trend toward decrease.

The study also found statistically significant drops in biochemical indices of oxidative stress in the group getting the vitamin E. However, they did not find direct improvements in performance in the vitamin E group over that of placebo.

Some studies suggest Vitamin E can prevent the decline in immunity after intense exercise. However, it should be noted that not all studies agree on these effects of vitamin E or antioxidants in general on immunity.

Athletes should not view taking additional vitamin E as a direct performance enhancer per se, but as a long term preventative nutrient essential to long term health. Good health is after all a prerequisite for performance over the long run. Clearly, adequate vitamin E intakes are important for long-term performance, although studies don't find positive effects on short-term performance.

Exactly what the optimal intake of vitamin E is unclear at this time, but there appears to be no health risks associate with taking higher amounts than the recommend RDA. Individual intakes of vitamin E vary dramatically, with most studies using between 200IU to 800IU per day. Although there is not an optimal dose known at this time, 400IU to 800IU appears safe and effective.

For general health and well being, Vitamin E gets a thumb's up but for any anabolic or performance enhancing effects, it gets a thumb's down.

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Powers, S. K. and K. Hamilton. "Antioxidants and exercise," Clinical Sports Medicine 18/3 (1999), p. 525-36.

Balakrishnan, S. D. and C. V. Anuradha. "Exercise, depletion of antioxidants and antioxidant manipulation," Cell. Biochem. Funct. 16/4 (1998), p. 269-75.

Rokitzki, L and E. Logemann, et al. "Alpha-Tocopherol supplementation in racing cyclists during extreme endurance training," Int. Jour. Sport Nutr. 4/3 (1994), p. 253-64.

Whey

Whey protein has become a staple supplement for most bodybuilders and other athletes and for good reason: it's a great protein for a wide variety of reasons.

A growing number of studies has found whey may potentially reduce cancer rates, combat HIV, improve immunity, reduce stress and lower cortisol, increase brain serotonin levels, improve liver function in those suffering from certain forms of hepatitis, reduce blood pressure, and improve performance, to name a few of its potential medical and sports related applications.

One of whey's major effects is its apparent ability to raise glutathione (GSH). The importance of GSH for the proper function of the immune system cannot be overstated. GSH is arguably the most important water-soluble antioxidant found in the body.

The concentration of intracellular GSH is directly related to lymphocytes reactivity to a challenge, which suggests intracellular GSH levels are one way to modulate immune function. GSH is a tri-peptide made up of the amino acids L-cysteine, L-glutamine and glycine. Of the three, cysteine is the main source of the free sulfhydryl group of GSH and is a limiting factor in the synthesis of GSH.

Because GSH is known to be essential to immunity, oxidative stress, general well being, and reduced levels of GSH are associated with a long list of diseases, whey has a place in anyone's nutrition program. Reduced GSH is also associated with

over training syndrome (OTS) in athletes, so whey may very well have an application in preventing, or at least mitigating, OTS.

When we talk about whey we are actually referring to a complex protein made up of many smaller protein subfractions (peptides) such as: Beta-lactoglobulin, alpha-lactalbumin, immunoglobulins (IgGs), glycomacropeptides, bovine serum albumin (BSA) and minor peptides such as lactoperoxidases, lysozyme and lactoferrin.

Each of the sub fractions found in whey has its own unique biological properties. Up until quite recently, separating these subfractions on a large scale was either impossible or prohibitively expensive for anything but research purposes.

Modern filtering technology has improved dramatically in the past decade allowing companies to separate some of the highly bioactive peptides from whey, such as lactoferrin and lactoperoxidase.

Many of these sub fractions are only found in very minute amounts in cow milk, normally at less than one percent.

For example, though one of the most promising subfractions for preventing various diseases, improving immunity and over all health, lactoferrin makes up approximately 0.5 - 1% or less of whey protein derived from cow milk (where as human milk will contain up to 15% lactoferrin). Over the past few decades, whey protein powders have evolved several generations.

- First Generation whey protein powders: These early way protein products contained as low as 30-40% protein and contained high amounts of lactose, fat, and undenatured proteins. They were considered a "concentrate" and were used mostly by the food industry for baking and other uses.

- Second Generation whey protein powders: Many whey products sold today would be considered second-generation whey protein supplements. Most second-generation formulas are a mix of whey concentrates (WPC) and whey isolates (WPI). WPC's now contain as high as 70-80% protein with small amounts of lactose and fat.

  They generally contain as much as 90-96% undenatured proteins. Research has found that only whey proteins in their natural undenatured state (i.e. native conformational state) have biological activity. Processing whey protein to remove the lactose, fats, etc. without losing its biological activity takes special care by the manufacturer. The protein must be processed under low temperature and/or low acid conditions as not to "denature" the protein.

  Maintaining the natural undenatured state of the protein is essential to its anti-cancer and immune stimulating activity. Most second-generation whey products are mixed with an isolate (WPI) to bring up the protein content per serving. WPI's contain >90% protein contents with minimal lactose and virtually no fat.

  Many isolates sold that are touted by supplement companies are Ion Exchange isolates. This isolate is made by taking a concentrate and running

it through what is called an "ion exchange" column to get an "ion exchange whey isolate."

Sounds pretty fancy but there are serious drawbacks to this method. As mentioned above, whey protein is a complex protein made up of many sub fraction peptides that have their own unique effects on health, immunity, etc. Some of these subfractions are only found in very small amounts.

Due to the nature of the ion exchange process, the most valuable and health promoting components are selectively depleted. Though the protein content is increased, many of the most important sub fractions are lost or greatly reduced. This makes ion exchange isolates a poor choice for a true third-generation whey protein supplement, though many companies still use it as their isolate source.

- Third generation whey protein supplements: With the array of more recent processing techniques used to make WPI's - or pull out various subfractions - such as such ultra filtration (UF), micro filtration (MF), reverse osmosis (RO), dynamic membrane filtration (DMF), ion exchange chromatography, (IEC), electro-ultrafiltration (EU), radial flow chromatography (RFC) and nano filtration (NF), manufacturers can now make what appears to be optimal WPI's for health and disease prevention.

  Low temperature micro filtration technique now allow for the production of very high protein contents (>90%), the retention of important subfractions, extremely low fat and lactose contents, with virtually no undenatured

proteins.

As you would expect, these WPI's are more expensive than WPC or Ion Exchange isolates. Another fairly new development in is the ability to isolate out certain bio active sub fractions (peptides) on a large scale from whey proteins, such as lactoferrin or Glycomacro peptide.

This was not possible to do on a large scale just a few years ago but can be done today with modern filtering techniques employed by a small number of companies. This allows for a truly tailored protein supplement; the ability to add back in certain subfractions in amounts that can't be found in nature.

Take for example the subfraction lactoferrin. In many whey products, it is nonexistent due to the type of processing employed. The best whey products will contain less than 1% lactoferrin and more like .5% of this rare but important micro-fraction. Some companies are now able to add in a specific subfraction to get a truly "designer" protein.

Whey also has an exceptionally high biological value rating (though sellers of whey make FAR too big a deal of that fact) and an exceptionally high BCAA content (see BCAA section for more information).

Pertaining directly to athletes, some recent studies suggest whey may have direct effects on performance and muscle mass, but this research is preliminary at best. Some studies have found oxidative stress contributes to muscular fatigue.

As mentioned previously, GSH is the major intracellular water-soluble antioxidant in the body, which is involved in the recycling of other antioxidants. Twenty healthy young adults (10 men, 10 women) were supplemented with either whey or casein for 3 months. The researchers looked at:

- Muscular performance (as assessed by whole leg isokinetic cycle testing).

- Lymphocyte GSH levels (as a marker of tissue GSH).

As one would expect, they found no baseline differences in peak power or work capacity between the whey and casein groups. However, after treatment, a follow-up on 18 subjects – 9 who received the whey and 9 who received the casein (considered a placebo in this study) – were analyzed.

Both peak power and work capacity increased significantly in the whey group, with no changes found in the casein group. Lymphocyte GSH also increased by over 35% in the group receiving the whey with no change in the group getting casein.

The researchers concluded, "this is the first study to demonstrate that prolonged supplementation with a product designed to augment antioxidant defenses resulted in improved volitional performance."

As mentioned, due to whey's high biological value and its other properties, such as a high branch chain amino acids content, etc., it has always been theorized whey should be a particularly effective protein for gaining or preserving muscle mass.

This is one reason whey is the best selling protein on the market with bodybuilders. However, there was very little hard data that directly supported that theory and what did exist was often contradictory.

One recent study in animals however supports the role of whey as being potentially superior in this respect to other proteins. One recent study, looking directly at the effects of different pre-workout drinks and their effects on muscle mass and bodyfat, came to some very interesting conclusions.

One thing we have known a long time is the composition of the pre-exercise meal will affect substrate utilization during exercise and thus might affect long-term changes in body weight and composition. That is, depending on what you eat before you workout can dictate what you use for energy (i.e. carbs, fats and or proteins) which alters what you burn (oxidize) for energy.

The researchers took groups of rats and made the poor buggers exercise two hours daily for over five weeks (talk about over training!), either in the fasted state or one hour after they ingested a meal enriched with a simple sugar (glucose), whole milk protein or whey protein.

The results were quite telling. Compared with fasting (no food), the glucose meal increased glucose oxidation and decreased lipid oxidation during and after

exercise. Translated, they burned sugar over fat for their energy source. In contrast, the whole milk protein and whey meals preserved lipid oxidation and increased protein oxidation.

Translated, fat burning was maintained and they also used protein as a fuel source. Not surprisingly, the whey meal increased protein oxidation more than the whole milk protein meal, most likely due to the fact that whey is considered a "fast" protein that is absorbed rapidly.

As one would expect by the end of the five weeks body weight was greater in the glucose, whole milk protein and whey fed rats than in the fasted ones. No shock there.

Here is where it gets interesting! In the group getting the glucose or the whole milk protein, the increase in weight was from bodyfat, but in the whey fed group, the increase in weight was from an increase in muscle mass and a decrease in bodyfat.

Only the rats getting the whey before their workout increased muscle mass and decreased their bodyfat. The researchers theorized this was due to whey's ability to rapidly deliver amino acids during exercise, but there are probably other factors involved.

Is this the next big find in sports nutrition and populations (i.e. elderly, people with wasting diseases such as HIV, cancer, etc.) looking to preserve muscle mass and lose bodyfat?

Hard to say at this time being it was done in rats, but if it turns out to be true in humans-and there is no reason people can't try it now-it would indeed be a breakthrough in the quest to ad muscle and lose fat for any population concerned with adding and or preserving muscle mass.

It should be clearly noted however that even if additional research does find that whey plays a direct role in helping athletes add muscle, no one has ever exploded with new muscle from the simple addition of whey to their diet, regardless of what some supplement companies would have you believe.

If it does help with muscle mass or performance – and the data is far to preliminary to say that it does help – the effect will be subtle at best.

With that in mind, for general health and well being, whey gets a big thumb's up. For potential effects on muscle mass and performance, it gets a (very) tentative thumb's up at this time.

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ZMA

Recently a plethora of new products based on the minerals zinc and magnesium have popped up claiming to raise the anabolic hormones testosterone and IGF-1 and possibly improve performance in athletes. The claims are lofty, but are they true? The claims of such products rest on three basic premises.

- One: athletes are notoriously lacking in zinc and magnesium due to several factors ranging from poor diets to increased usage and excretion of these minerals.

- Two: zinc and magnesium are particularly important minerals in the production of anabolic (muscle building) hormones needed by athletes.

- Three: due to competition during digestion, even the inclusion of a multivitamin and other mixed mineral supplements will not correct the deficiency.

That's the basic contention of this zinc and magnesium based product in a nut shell, with some biochemical twists and turns I am leaving out due to space limitations and preserving the brain cells of the readers!

A fourth contention is that these new products are based on a particular form of zinc and magnesium (zinc monomethionine-aspartate and magnesium aspartate)

which are superior to less absorbable forms of the minerals. This brings us to ZMA.

Looking at premise number one, there is a decent body of research that has indeed shown that zinc and magnesium deficiencies are not uncommon in various athletes, such as football players, cyclists, bodybuilders and elite military groups.

Looking at premise number two, it is well established that these two minerals are needed in over 300 different enzymatic reactions and the production of testosterone is one of them. Examining premise number three, there are several studies that examined the issue of nutrient interactions and indeed found that certain minerals compete for absorption and so, may not get absorbed if taken together.

Several studies have found that even the addition of a multi vitamin to the diet of people did not increase the levels of zinc, magnesium and other minerals while the serum vitamin levels did go up. The authors theorized this was due to competition of the minerals in the multi vitamin.

So it would appear that different minerals need to be taken at different times and taking them all together may not be an optimal, or even effective strategy for increasing levels of these minerals in tissues.

The fourth contention regarding the forms of minerals is a bit more unproven in this writer's view. Though it is well known that there is a wide range of absorption between different forms of nutrients, especially minerals, so the concept is not far fetched.

This is the idea behind these new supplements, which is to supply highly absorbable forms of non-competing minerals (in this case zinc and mag) known to be essential for the optimal production of anabolic hormones. Though a variety of companies are now selling this product, the letters ZMA appear in the name or on the bottle if the product is using the patented ingredients.

We note the research done by a Dr. Brilla at Western Washington University. Dr. Brilla found the addition of 30mg of zinc monomethionine-aspartate and 450 mg of magnesium aspartate (the forms used in ZMA) daily to football players had a 32% increase in total testosterone, a 3.6% increase in IGF-1and improvements in strength levels of the group getting the supplement.

So, at this time, the general contention of the companies now selling this new zinc and magnesium based products appears to hold water, though future research needs to further elucidate these findings.

There is however one important caveat one should be aware of with ZMA or any such product. It will only work if there is a deficiency to correct and will not increase levels of anabolic hormones where no deficiency in these minerals exists. ZMA is not magic by any stretch. So, with that warning, I give this supplement a thumb's up, understanding the caveat above.

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Section III

A Word about "Diet Supplements Revealed"

I want to take a few minutes to tell you about another ebook I have written, which sooner or later should also form part of your library. The ebook is called "Diet Supplements Revealed" and you can find full information on this website: http://www.aboutsupplements.com/

This ebook deals specifically with dieting and losing fat, it also has a very detailed guide which covers the "diet supplements" currently being sold. So if you're looking for more information about **diet supplements** – which are not covered here in this **muscle gain supplement** section – then this is the place to go.

The ebook "Diet Supplements Revealed" is not about the newest 'cutting edge' supplements pushed over the internet, most of which are either dangerous or totally unproven, but about the many diet supplements you have read about but still can't figure truth from fiction.

It's not for the extreme hardcore bodybuilders who think they know everything or the 'expert' who wants a science lesson. It's for the rest of the world who is tired of being manipulated by advertising, ridiculous claims, and books that are mostly endless recipes.

I'm certain that you'll benefit hugely from the information in "Diet Supplements

Revealed" which has now become something of a legend on the Internet as it is one of the most downloaded ebooks ever published in the health and fitness field.

Here's the website again for more information: http://www.aboutsupplements.com/ -- and for the record "Diet Supplements Revealed" is also published digitally for me by Internet Publications, so you can expect the same fabulous customer service and support that you will have experienced with this ebook.

Thanks. Will Brink.

Section IV

Muscle Building Nutrition - Conclusion

After reading Section I and II of Muscle Building Nutrition, the reader is now well equipped to design the optimal diet for gaining size, and make educated decisions about which supplements are worth using and which are shear hype.

No doubt, some people may need to read this book twice and continue to use it as a reference. I do my very best to supply all the information a person needs to make progress in their bodybuilding endeavors, but I always expect the reader to meet me half way.

Applying this information will take some work, thought and effort on the part of the reader to get the most from this book. Anyone who tries to sell you a book, or a course, etc., who claims it will take no work on your part is a liar who is leading a fool.

For me, if I have taught the reader something and made them think, I have done my job. However, not everyone likes to have to think. What can I say, you can't make all the people happy all of the time, but I do my best. The bottom line is, I have used these nutrition strategies with many high level bodybuilders and others strength athletes of all kinds, and it has yet to fail them.

I look forward to hearing from people after they read and follow the instructions in this book, not to mention all the money they will save when they realize how many products on the market are really just marketing hype.

So what do you do after you have optimized your nutrition and supplement regime for gaining LBM after reading sections I and II? Your final job of course is to set up a resistance training program that will take full advantage of the diet and supplement information found in Muscle Building Nutrition.

The fact is, most people get results from their workouts in spite of what they do in the gym, not because of it! Of course, when I wanted to add a section to this book that covered routines and tips for gaining LBM in the most efficient and scientific manner, I approached Charles Poliquin.

In my opinion, Charles is the pre-eminent strength coach in the US, perhaps the world. Charles has put together a list of tips, advice, and routines, that will pack on mass- if applied correctly and combined with the diet info from sections I and II- that could make you the envy of everyone in the gym.

At the very least, you will make the type of progress you have always wanted and your genetics will allow, which is all anyone can ask for. Although Charles's chapter covers virtually everything a person needs to set up an effective plan for gaining LBM, there is always more to learn. After reading his section, I highly recommend you visit his site at: http://www.charlespoliquin.net and seriously consider reading some of his books, videos, CDs, etc.

Armed with the Anabolic Diet information from Section I, the supplement information from Section II, and Charles's training information (which now follows) in the bonus chapter, it's virtually impossible for you to fail. So get to work!

As always, train to gain, not just maintain!

Will Brink

SPECIAL BONUS REPORT BY CHARLES POLIQUIN

MASS GAINING TRAINING PROGRAMS

Introduction by Greg Elder, Managing Director of Internet Publications.

This special report has been written only for owners of Will Brink's superb ebook "**Muscle Building Nutrition**" (http://www.musclebuildingnutrition.com). If you have obtained this ebook and you are not an owner of Muscle Building Nutrition then please email us a admin@aboutsupplements.com to inform us.

The author of this report - **Charles Poliquin** - is probably the biggest and most respected name in strength coaching in the world today. He has worked with many Olympians and his advice has meant incredible results for many years for many athletes. Below you will find a more detailed bio about Charles, which I have included so that you can clearly understand the tremendous value of this report.

We consider this report to be the perfect companion to "**Muscle Building Nutrition**" because you now have two of the keys you need to sculpture the physique of your dreams – The correct nutrition and supplement knowledge from Will and the key principles to mass training from Charles.

The remainder you need to put in yourself. Time, dedication, devotion and determination. If you add these ingredients to the knowledge you have invested in NOTHING can stop you.

Make no mistake these two authors, Will Brink and Charles Poliquin, are the very best in their chosen field. We are very proud to be able to offer you such outstanding information.

You cannot hold any more potent muscle building information in your hands.

Best of luck and I'll see you in the gym.

Greg Elder
Managing Director, Internet Publications.

Internet Publications are Publishers of:

Muscle Building Nutrition and Supplements Review, by Will Brink
Build serious lean muscle in record time with a proven muscle building nutrition plan and discover exactly which bodybuilding supplements will actually help you pack on the muscle, by sports nutrition and supplements expert - http://www.musclebuildingnutrition.com

Diet Supplements Revealed, by Will Brink
Learn which supplements burn fat fast & which are no more than hype - and discover a scientifically proven, totally personalized fat loss diet all within the next 10 minutes - http://www.aboutsupplements.com

CHARLES POLIQUIN – Bio

Charles Poliquin is a native of Ottawa, Canada. While completing graduate studies in Exercise Physiology in Canada, Charles began coaching athletes, a career move that has resulted in hundreds of medals, wins and personal bests of many elite athletes. He is known worldwide for producing faster athletes. When a country wants a Gold medal, they come to Charles.

Coach Poliquin has been hailed as the most successful strength coach in the world. He has spent years-researching European journals (he is fluent in English, French and German) and speaking to other coaches and scientists in his quest to optimize training methods. He has perfected the art of writing routines that produce results, and his books and courses are the culmination of his theories and knowledge.

Charles Poliquin has lectured extensively on practical and theoretical aspects of physical conditioning in eight different countries and in 3 different languages. Charles has also written over 500 articles for various web sites, magazines and journals. His work has been translated in 7 different languages. English, Swedish, German, French, Italian, Dutch and Japanese.

Applied Background

Charles Poliquin is recognized as one of the Worlds most successful strengthcoaches, having coached Olympic medalists in twelve different sports including the US female track and field for the Olympics 2000.

His current clients include:

- Dan Weinstein, World Championship medalist short-track speed skating
- Al MacInnis, St Louis Blues, Norris Trophy winner, strongest slap-shot in the NHL
- Joe Nieuwendyk, Dallas Stars, Conn Smythe Trophy winner, Stanley Cup winner
- Chris Pronger, Colorado, St. Louis Blues, winner of Norris and Hart Trophy
- Canadian short-track speed-skating team
- Nanceen Perry, World Record Holder 4 x 200 m
- Michelle Freeman, number 1 ranked hurdler in the World

Athletes on Professional Teams which Charles correctly trains include:

- Detroit Red Wings
- Colorado Avalanche
- St. Louis Blues
- Montreal Canadians
- Toronto Maple Leafs
- Ottawa Senators
- New York Rangers
- New York Islanders

- Calgary Flames
- Chicago Blackhawks
- New Jersey Devils
- Florida Panthers
- Tampa Bay Lightning

World Championship medalists in:

- kayak
- judo
- bobsleigh
- luge
- alpine skiing
- biathlon
- power-lifting
- freestyle skiing
- swimming
- figure skating
- speed-skating short track

- speed-skating long-track

Theoretical Background:

- Author
- B.Sc. Kinesiology
- M.Sc. Exercise Physiology

Books Published:

- Modern Trends in Strength Training
- Winning the Arms Race
- The Poliquin Principles
- The German Body Composition
- Manly Weight Loss

Multimedia Publications:

- Poliquin Power! Audio Series

Writer of the foreword on the upcoming UNICEF fundraising recipe book which include recipes of Canada's Olympic athletes like Myriam Bedard, Jean-Luc Brassard.

International lecturer in practical and theoretical aspects of physical preparation (more than 190 conferences since 1985).

For an exclusive seminars, personal phone consultation, and corporate sponsorship, please contact us at our website http://www.charlespoliquin.net

INDIVIDUALIZATION OF MASS GAINING TRAINING PROGRAMS

By Charles Poliquin
http://www.charlespoliquin.net/

Gaining mass is probably the most predominant goal amongst weight trainees. However, a very small percentage of current trainees are satisfied with their gaining schedule after their first 12 weeks into it. Why, because pretty much any training system will work for a novice lifter. To keep making gains, one must follow proper training principles. To further add to the problem, there is no single mass gaining training program that works for everybody. However there are training principles that will help you design one that works best for you. For any given training program, there are four main factors that affect its outcome:

1. The interpretation by its reader on how to apply the program. No two readers will interpret and implement a given set of loading parameters in the same fashion.
2. Not everybody reacts to out-of-the gym training stressors. One situation can be looked on placidly by one trainer, while another trainer's cortisol levels will shoot up.
3. Genetics. No two trainers are born with the same genetic make-up to respond to a given training program. Even in identical twins, I have seen differences in training responses, this may have to do with the fact that there is one who is always more dominant psychologically.
4. Training age. A program that may be great to get your bodyweight from 165 lbs to 180 lbs, will be useless to get your from 180 to 190 lbs. Trainers

who have made significant gains in hypertrophy have one thing in common: they have tried many approaches.

The objective of this chapter is to give you the necessary framework to design an hypertrophy program that works for you. In part I of this chapter I will outline 22 time and result tested training principles for hypertrophy. Part II will outline sample workout programs that apply those success based principles.

PART I

TRAINING FOR MASS PRINCIPLES

Principle 1: Exercise technique is of paramount importance

Knowing the best exercise technique for each lift is more important than any loading parameter, dietary regime, supplement, or psychological technique. Whether you have a perfect diet, get quality sleep and have a great routine, if you don't know how to lift properly you are opening yourself to plenty of wasted efforts and frustration. My clients have often reported to me, that tips on how to lift that I have taught them have had the greatest positive influence on their progress curve. If you don't know how to lift, don't waste time, get help from a qualified professional. Without a shadow of a doubt, non-gainers have horrendous lifting technique.

How many trainees do you know who are limited in their exercise selection because of training injuries?

By the way, rep tempo and exercise are not synonymous. Poor mechanics at a controlled tempo is still poor technique.

Regarding technique, squats, deadlifts and pulls are the one that require the most attention. In order to properly learn these, I suggest you contact anyone of my associates on my website at www.CharlesPoliquin.net

Principle 2: Never train more than two days in a row.

People who want to gain large amounts of muscle mass should never train more than two days in a row. Olympic level throwers have long been proponents of this concept. Training more frequently tends to lead to overtraining not so much at the level of the muscle cell but at the nervous system level. In other words, it is hard to recruit high threshold motor units training at high intensities for more than two days in arrow.

There are three possible options of split routines to the individuals wanted to gain weight:

Option 1

Three non-consecutive days a week, whole body workouts. Example: Monday, Wednesday, Friday. In this case, I prefer to use two different routines covering all major body parts. This routine is best suited for 20% of trainees. The ones with more limited recovery ability, or for individuals with limited time for training like medical school students for instance.

Option 2

Four days a week, split workouts. Example: Monday, Tuesday , Thursday, Friday. In this case, the lower body would be trained Monday and Thursday, while the upper body is trained Tuesday and Friday. This is the option which I would

prescribe 60% of the time. It is well suited for the individual with average recovery ability.

Leg training is most demanding and should be done first when coming back from the weekend recovery period.

Like option 1, it also offers the advantage of leaving the weekends off for rest and relaxation.

Option 3

This option is for the more gifted individual which represents about 20% of the population. The drawback is that it demands more time commitment and requires that you most often have to train on weekends. The more gifted individual can experiment with the splits routine provided below:

Split option 3 A

Day 1: Chest and Back
Day 2: Legs & abs
Day 3; off
Day 4: Shoulder and arms
Day 5; off

Split option 3 B

Day 1: Back & Triceps

Day 2: upper thighs & abs

Day 3; off

Day 4: Chest & Biceps

Day 5; Shoulder & Calves

Day 6 : Off

Split option 3 C

Day 1: Hamstrings & Calves

Day 2: Back & Shoulders

Day 3; off

Day 4: Quads & Calves

Day 5; Chest & Arms

Day 6 : off

Split option 3 D

Day 1: Back & Calves

Day 2: Chest & Forearms

Day 3; Off

Day 4: Posterior Chain & Abs

Day 5: Shoulders and Arms

Day 6: Off

Day 7; Quadriceps and calves

Day 8 : Off

Principle 3: Training frequency is determined by the progress in strength.

There is a lot confusion amongst readers of bodybuilding information on the optimal training frequency. There is only one best frequency: the one that works for you.

Now the question is how does one determines that. Very simple. I call it the 2% rule of progress. Unless you are a very advanced lifter i.e. 2.2 times bodyweight in the bench press, You should be able to put either 2% more weight on the bar, or do an extra rep, every time you repeat a workout. Of course, you should always compare set 1 of a given exercise, with set 1 of the same exercise the following workout, and of course set 2 is compared with set 2, and so on. If you are meeting that target strength increase, this is the right frequency for you.

If you are not meeting that target gain, you are either under recovering or waiting too long between workouts. Try at first increasing the number of days between workouts. If this fails, reduce the number of days between workouts AND the number of sets for that workout, which would make you and option 1 type of person.

As a rule of thumb, you have been training correctly for about 7 years, then the 2% rule has evolved to the 1% rule. In that case, Principle 4 becomes even more important.

In a nutshell, my philosophy on training frequency is rather simple: Train hard, come back once you can lift more. In other words, wait for supercompensation to take place. So training frequency per muscle group is once every 3 to 10 days per lifts.

Powerlifting champion Fred Hatfield is a strong proponent of this system. So was Mike MacDonald, one of the most successful bench pressers of all time. Terry Todd related to me that he would test how he felt in the bench press muscles with just using a broomstick for resistance. If it felt odd he would take an extra day off, or whatever how many days offs he felt it would take to be stronger than the last workout.

The programs outlined in Part II illustrate different types of frequencies, keep in mind that these frequencies are not set in stone. Pay attention to symptoms of impending overtraining like a sudden drop in morning bodyweight and adjust not only the frequency buy the overall volume in terms of numbers of sets and number of exercises.

Principle 4: Variety of loading parameters is critical to achieve mass gains.

Variety in the **range** of loading parameters is **more important** when trying to muscle mass than when trying to increase relative strength. While a relative strength athlete needs to sets of 1-5 reps in order to gain strength without increasing mass, the person who desires muscle mass increases requires reps falling between 6 to 20. By the same token, when you seek muscle mass increases

you want to do a greater number of exercises for that bodypart in order to tap in a wider range of motor units.

Keep in mind that variety of loading parameters is not synonymous with "the Joe Weider instinctive training principle" or the train-as-your-mood-goes method. There has to be consistency and planned structure to succeed in your bodybuilding program. Variety is useful only in a planned manner.

Principle 5: A program is only as good as the time it takes to adapt to it

To insure rapid gains in muscle mass, make sure to change all loading parameters (reps, sets, speed of contraction, rest intervals, choice and order of exercise) of your training program every three weeks or so.

From experience, I would say that most individuals left on their won will adapt to a training after about 6 exposures to it. When under the supervision of an experienced strength coach who can pick the right loads, this value drops to only 4 workouts.

The more gifted the trainee, or the greater the level of his/her strength, the more often the program needs to be changed. Athletes in sports that need to develop extreme levels of short-term power like throwers and bobsledders are in the extreme range for variety implementation. They often need to change at least one loading parameter every single workout.

Principle 6: Alternate between volume and intensity as training stressors.

For most individuals, I find that alternating every 3 weeks cycles of high volume (accumulation phase) with 3 week cycles of high intensity. (intensification phase) works best . This type of training has had great success with my athletes. On average 16 to 18 lbs of lean body weight are gained over a 12 week period. Samples routines are provided in Part II of this chapter.

During an accumulation phase, for most individuals the loading parameters should look like this:

Reps:	8-20
Sets/exercise:	3-4
Rest intervals	60-90 seconds
Number of exercises/bodypart	2-3
Time under tension per set	40-60 seconds
Total sets per bodypart	6-8

During an intensification phase, for most individuals the loading parameters should look like this:

Reps:	5-8
Sets/exercise:	4-5
Rest intervals	3-4 minutes
Number of exercises/bodypart	1-2

Time under tension per set	30-40 seconds
Total sets per bodypart	**8-10**

I suggest you start off with a 3 weeks accumulation alternated with 3 weeks of intensification to get a base level concept. That usually for about 70% of trainees. After this, I suggest you experiment with the right ratio of volume and intensity that works for you.

You may find that 2 weeks of accumulation alternated with 3 weeks of intensification works best for you because your tolerance for volume is limited. On the other hand, your cousin may find that 3 weeks of accumulation alternated with 2 weeks of intensification works best for him. There is no best ratio, only the one that works best for you. The 2% rule as explained in principle 3 will help you determine how long you should stay on a particular program.

Principle 7: If you are in the longer than one hour, you are making friends not training

Keep your workouts short and challenging. Once your warm up is completed, you should not be in the gym longer than an hour. If you are in there longer than an hour, you are making friends, your are not training.

Workouts exceeding the one hour mark have been shown to be associated with rapidly decreasing androgen levels. This shift in androgens negatively influences

the testosterone-cortisol ratio. Since this value is very strongly correlated to strength gains (r=0.86), one may infer that training under depressed androgen levels is counter-productive, since the catabolic effects of the glucocorticoids would negate the anabolic effects of the androgens. Apparently an hour pause is sufficient to allow the testosterone levels to normal. This is why modern strength training has evolved to multiple daily sessions from the traditional two-hour workouts.

Principle 8: In accumulation phases, load the muscles for at least 40 seconds per set.

To gain size the muscles need to be loaded long enough. Of course, there are genetic freaks who can gain with sets of only 5 to 10 seconds duration, but they are the exception not the rule, and they don't even need to read this chapter anyway. Powerlifting champion Roger Estep comes to mind in this matter, he had a better physique than most Mr. America contestants, yet his preferred rep/set scheme was multiple sets of one rep.

So for example, lets say you take 5 seconds to complete the eccentric portion of the lift, and 1 second to complete the concentric range, your repetition cycle is of 6 seconds on average, therefore you want to do minimum of 7 reps per set if you are following that tempo prescription.

When people fail to make gains, it is often because they rush through sets. If one were to ask me what is the ideal time under tension to gain size, I would say 40

seconds, this will work in about 60% of individuals. For individuals with high fast-twitch make-up, this value is around 20 to 30 seconds. On the other hand, about 20% of individuals get better hypertrophy response from doing sets in the range of 60 to 70 seconds per set.

Principle 9: In intensification phases, load the muscles for at least 20 seconds per set.

In this phase, your goal is tap in higher threshold motor units, therefore you will be using greater loads for less reps.

So for example, lets say in the bench press, you are taking 2 to complete the eccentric portion, taking a 2 second pause in the bottom position of the lift, and 1 second to complete the concentric range, your repetition cycle is of 5 seconds on average, therefore you want to do minimum of 4 reps per set if you are following that tempo prescription.

In intensification phases, pausing between reps permits greater motor unit activation, thus the handling of greater loads. A pause as short as 2 seconds in the favorable angle of the range of motion is sufficient to greatly enhance activation of the muscle's motor unit pool.

Principle 10: For greater workout efficiency make antagonistic pairs contract alternately.

Regardless whether you are in an accumulation phase or an intensification phase, you will be able to recruit more motor units if antagonist pair contract alternately(e.g. flexion followed by extension). as opposed to agonist contractions alone (precontraction of antagonists).

The ability of achieving full motor unit activation (MUA) in a muscle contraction may be enhanced when immediately preceded by a contraction of the antagonists. This has the added benefit of allowing to double the workload per training unit. Alternate exercises working agonists muscles with exercises working antagonistic muscles together, while respecting long rest intervals.

For example, after doing a 6 R.M. set of incline barbell press for the chest, rest 100 to 120 seconds perform an heavy set for the antagonist muscle i.e. 6 R.M. set of weighted pull-ups for the upper back, rest another 100 to 120 seconds and repeat the described-above procedure for the required amount of sets.

Are you delusional about your fiber make-up?

In the last few years, I have many readers write in claiming that they were fast-twitch individuals because they could only limited amount of reps at a percentage of max. For example, at 85% of maximum, for most lifts, a typical individual will do 5 R.M., a gifted fast-twitch athlete will do 2 reps. I have seen in twenty two years only one person who did even less: one rep at 85%. He was a running back from the NFL. At a bodyweight of 190 lbs, he bench pressed 300 lbs his first day

training under my guidance. His teammates corroborated the fact that he was not a weight room enthusiast.

However, I doubt very much that there is that many of them running around. Here is why:

1. For the last two decades, I have trained mainly Olympians. Therefore athletes who went through an extensive selection process before I ever got the chance to work with them. One of the factors that made them superior was their superior fiber make-up. Even amongst that select segment of the population, only a small percentage 0.3% had scores below 3 reps on the 85% of 1 R.M.. The athletes who achieved such scores were throwers, American Football wide receivers and running backs, lugers, bobsledders, weightlifters and judokas.

2. I have seen individuals improve the number of reps they can do at a given high percentage of max (e.g. 85%) once they correct a mineral deficiency and/or have gotten rid of high levels of toxic metals such as mercury and lead.

3. Over the last two years, we have measured levels of mercury after injected with the chelating agent D.M.P.S.. The athletes who had high levels of mercury, tended to have a poor ability to repeat at a high percentage of maximum. The number of reps they could do a t 85% would increase within 8 weeks of following a program to detoxify that toxic metal.

4. If an athlete's meat intake is very low, his ability to do reps at high percentage of maximum is compromised as his creatine intake is low.

5. Also I have seen individuals score poorly on high reps because they lived under the illusion that they were fast-twitch, by manipulating their warm-up and using a combination of kilo and pound plates to prevent assessing the weight on the bar properly by them, testing showed that they were in fact slow-twitch.

6. Outside of very intrusive biopsies, which not that valid anyway, the best tests for fiber make-up are done in biomechanics labs where time to peak force are measured.

7. Individuals who are truly fast-twitch not only well on strength tests but rather distinguish themselves on field power tests like throwing and jumping tests variations, such as the penta-jump and the seated medicine ball throw. The standardized track and field quadrathlon test could give a fair idea of what your fiber make-up test is.

Another way is to test your fiber make-up is to find your 3 R.M. and then wait 5 minutes and test for 1 R.M.. The most I have ever seen someone do on top of their 3 R.M. is 23% more. That is the range that top 7 World Class Olympic lifters will do. Yet, I have seen an Olympic Silver medalist in weightlifting only do 10% more which is the average score. If you can only do 2% more, take up rowing.

Principle 11: Choose exercises who give you the most bang for your buck.

Quadriceps

Back squats, front squats, cyclist squats, barbell hack squats, Trap Bar Deadlifts, backwards sled dragging, all forms of lunges/split squats.

Posterior chain

Snatch deadlifts on podium, standing bent-knee good mornings, Romanian deadlifts, All forms of Olympic pulls, All forms of deadlifts: barbell, dumbbell, Trap Bar…

Upper Back

All forms of pull-ups and chin-ups
All forms of rows: barbell, dumbbell and most machines

Chest

All forms of barbell and dumbbell presses, whether they are incline, decline or flat.
All forms of dips.

Traps

All forms shrugs, Olympic pulls, power cleans and power snatches.

Elbow flexors

All forms on incline and Scott curls. No the standing barbell curl is not one of them according to both MRI and EMG studies

Triceps

All forms of presses and free weight triceps extensions, particularly in the decline position.

This is not to say that isolation type exercises are never used in weight gaining regimens. For mass building purposes, they are best used in pre-exhaustion or post-exhaustion training schemes.

Now if one looks at the exercises given, no need for a fancy gym. It is quite possible to develop a large and muscular physique using basic home gym equipment. Or just look at some the physiques built at the Club Fed gyms…

Also keep in mind that many commercial gyms are now devoid of the most basic mass and strength building tool: the Power Rack.

Plus training at home will allow you to use some result producing tools such as the Trap Bar, the cambered, thick dumbbells and barbells.

The greatest advantage of home gym training is that you are in total control of your training.

Principle 12: Strive to be strong at all angles.

One mistake I often see when applying the most bang for your exercise principle is that people only do the ones where they can use the highest loads. For example, they will do back squats but won't do front squats, they will do close parallel chin-ups but not subscapularis pull-ups and so on…

They are the same of individuals that will only incline barbell press if the bench angle is set at 45 degree or less, for fear of not appearing strong to their fellow lifters. So what, if your bench is set 62 degrees, it is the recruitment of new motor units that counts. If you understand the concept of structural balance, you will not be afraid to train lifts which you are poor at. Take the example of Ed Coan who had made an impressive jump in his bench press performance. When asked what he attributed it to, he replied that he had brought up his press behind neck.

Besides gaining muscle mass faster while using this principle, you will also remain injury free as your strength levels will be balanced. Overuse of certain exercises leads to pathologies similar to repetitive pattern conditions like carpal tunnel syndrome.

Principle 13: Dumbbell work is the foundation of strength.

Staying away from dumbbell work is another training mistake. One man who knew how critical dumbbell work was the legendary Pat Casey, the man officially credited for being the first bench press of 600 lbs. Plenty of heavy dumbbell incline presses was done before he reached that landmark weight in the bench press.

Besides exercising the muscles for greater ranges, dumbbell work requires stabilization of the joint which makes succeeding barbell work much easier. Of course, for practical and physiological reasons, this principle applies more to the training of the upper extremities.

To further elicit more motor units, I strongly suggest that you get into thick handle dumbbells like the ones sold on GraceFitness.com

One of the best compliments I had for my Arizona training facility came from strength legend Bill Kazmaier who came in my facility to get a shoulder treatment. He came early for his appointment so he asked if he could get in a quick workout. Once he saw my thick handle dumbbells, his eyes lit up like a four year old kid on Christmas morning. After his workout, we had a quite a chat on the role of thick handles in developing strength and mass.

Principle 14: Strive to increase your poundage's for reps

Be aware that before bodybuilders became walking pharmacies, in the days of Reg Park and Bill Pearl, they were strong. Reg Park was known to press behind neck

over 300 lbs for reps. In those days, gyms were not so abundant and the Iron Game participants: weightlifters, bodybuilders and powerlifters all trained together, so there was pressure for bodybuilders that have muscles to could produce strength.

They knew that muscles that were going to lift big loads for reps were going to be larger muscles. For some odd reason, this very simple rule has been forgotten,

Since the product time under tension and load used is the critical factor to elicit hypertrophy gains, a very simple way to insure results is to project goals. For example if your best performance is 225 lbs for 6 reps in the back squat, you may want to assign yourself the goal of doing 265 lbs for 6 reps in 12 weeks from now. You can be sure that by that time your thighs will be significantly larger.

If you were to use single rep performance for your goal, you may achieve it, but you may not be necessarily larger.

Powerlifters and Olympic lifters often put 40 to 50 lbs to their lifts without gaining a significant amount of weight, but if they were to get the same poundage increase for their best 6 reps performance, you can be sure they would be competing in the next weight class up.

A basic rule of thumb that you should keep in mind: a weight increase for reps for a major lift by 10 pounds translates into a gain of 1 pound of lean tissue. In other words, increase your lifts for 6 reps by 50 lbs, you will gained 5 lbs of muscle mass.

Principle 15: Coax, not force, your muscles to adapt to greater loads.

Physically and psychologically, it's easier to increase the amount of weight you can lift if you go up in small increments. Unfortunately, the smallest plate available in most gyms is two and a half pounds, so the smallest weight increment on a barbell is five pounds. That's usually the smallest increment on dumbbells as well, so it's actually ten pounds when you're using them in pairs. You can easily see how a five-pound increase is too big a jump if you're using, say, a single 20-pound dumbbell to work the rotator cuff muscles of the shoulder. It's a 25-percent increase in the load. It would be like trying to jump straight to 500 pounds on a lift where you can do 400.

The best way to coax your muscles into adaptation is through application of the Kaizen Principle. In Japanese, "Kaizen" means "constant and never-ending improvement." It is a philosophy that small, incremental improvements made consistently will, over the long term, produce large gains. ***There are several ways to increase the weight in small increments:***

1. *PlateMates*
2. *Small discs*
3. *Combinations of pound and kilogram plates*
4. *Assorted weight collars*

The easiest way to apply the Kaizen principle for dumbbells is to use PlateMates, magnetic add-on weights sold by Benoit Built, Inc. The principal advantage of

PlateMates is that they attach easily to dumbbells as well as to barbells. An additional benefit is that they can be used to correct inaccuracies in low-quality dumbbells and plates. For example, if you have a dumbbell that is nominally 25 pounds but actually weighs around 24, you can add on a PlateMate to bring it closer to standard. Discrepancies between dumbbells or plates might not seem like such a big deal. In fact, though, awareness of such discrepancies can cause fear of injury—fear that may actually manifest itself in an injury if it disrupts concentration when you lift.

PlateMates are available in 2½-, 1⅞-, 1¼-, and ⅝-pound sizes in two shapes: donut and hexagon. I recommend the donut-shaped weights, since they fit both circular and hexagonal dumbbells. To order PlateMates, call 1-888-79-SPRAY.

Another approach to increasing the weight in small increments is to use Eleiko Olympic small discs of 0.5 and 0.25 kilograms. They fit on Olympic-size bars and dumbbells. You can order them from Dynamic Fitness by calling 1-734-425-2862. For Imperial system weights (pounds), your best bet is Ivanko 1.25-pound plates. You can purchase them by calling 1-800-759-6399 or 1-925-253-0323 or by going on-line at www.ivanko.com.

You can also use combinations of kilogram and pound plates along with the EZ bar solid collars. For example, 1.25- and 2.5-kilogram plates weigh 2.75 and 5.5 pounds respectively. An EZ bar collar weighs about 1.5 pounds. If the base weight on the bar is 225 and your personal best for one rep is 240, you could apply the Kaizen principle to increase the weight in the following manner:

225 + 2(5) + 2(2.5)	= 240.0
225 + 2(5) + 2(2.75)	= 240.5
225 + 2(5.5) + 2(2.5)	= 241.0
225 + 2(5.5) + 2(2.75)	= 241.5
225 + 2(5) + 2(2.5) + 2(1.5)	= 243.0
225 + 2(5) + 2(2.75) + 2(1.5)	= 243.5
225 + 2(5.5) + 2(2.5) + 2(1.5)	= 244.0

Finally, you can use collars of various weights. Former Olympic thrower Bruno Pauletto's company, Power Systems, sells assorted collars. The Olympic Okie Grip Collars weigh 2 pounds each, the Olympic Metal Quicklee Collars weigh 1 pound each, and the Olympic Muscle Clamps weigh 0.5 pounds each. Combinations of these collars allow you to increase the weight by 1, 2, 3, or 4 pounds at a time. I particularly like the Okie grips if I am going to work with my customized, thick-grip Olympic bar. The rubber inner lining of the Okie grips prevents slipping of the plates.. I bought my first pair in 1986, and they still hold tightly on the bar, even with very heavy loads. These collars can be purchased by phone at 1-800-321-6975 or by fax at 1-800-298-2057.

Principle 16: Be quiet in the gym.

No talking in the gym. Your proverbial non-gainer is often the guy that yaks away in the gym. Talking between sets about irrelevant topics takes away from the focus needed to use optimal loads for the prescribed number of reps.

In fact, I think they should make legal to roundhouse kick in the face with a pair steel-toe boots anyone you who uses a cell phone in the gym. The only talking permitted would be training related: pushing your partner, telling him or her how much weight you want on the bar. Training has to be conducted in a business-like manner if you are serious about making gains. Concentration on every rep and every set is the key to effort and results. This is why there are no mirrors and music in my Performance Center, the rule is simple; go heavy or go home. There are also no chairs to sit on to drink your post-workout. Lounging around will destroy a great atmosphere. Once their workout is done, we give them their post-workouts in a bottle to drink on their way home.

Principle 17: Keep accurate records of your training poundage's

Keep a detailed log book of your training program. According to Tommy Kono, the Michael Jordan of the sport of weightlifting, there is no single better training aid. In his words: "the palest ink is better than the best of memories". A well kept training journal will allow you to monitor and evaluate the efficacy of your training program and help to set short-term goals.

No matter if your arms are thirteen inches or nineteen inches in girth, a training log keeps you on track for long-term success. Honesty is critical to derive success from a training log. Only record the reps done in proper form.

I once was asked by an intern trainer to go over his training log to help him design better training programs for himself. I would see things like 100 lbs done for 5.3 reps. I asked him how can you do 5.3 reps. He replied well I did 5 reps complete reps, then I did only a third of the rep…I then asked with a serious look on my face "How can you be sure it was not 5.32 or 5.38 reps?".

I could instantly read the anxiety in his eyes indicating a nine-fold increase of cortisol from the perceived screw-up. In my usual diplomatic style, I continued "You are pregnant or you are not. There is no in-between. Next time, record just 5 reps please." The poor guy was probably producing more cortisol wondering if he had done 5.2 or 5.3 reps.

Needless to say, once I related the story to my hockey star client Al MacInnis, he promptly assigned the intern the nickname "5.2", which stuck on to this day.

When using the training diary as a tool, make sure that training conditions were the same. For example, rushing through a workout shortens the rest intervals, and thus makes a comparison with a normal workout difficult.

The training diary helps me tremendously as a strength coach on deciding how to orientate the training from phase to phase for every single client. At my training facility our training diaries are computerized so that we have ongoing statistical

analyses of the training progress and effectiveness. This methodological log keeping, with the help of a brilliant , mathematician has helped me developed structural balance norms and optimal and precise volume and intensity prescriptions for specific lifts.

Principle 18: The more demanding neural work should be done first in the workout.

In plain English, this implies that low rep work and/or high velocity work should be done first in the workout. So for example, if you are going to work both in the 6-8 rep range and in the 15-20 rep range, then the sets of 6-8 rep should be done first, then the 15-20 reps are done after. If you do the reverse both your total tonnage and average weight lifted will be lower, thus leading to suboptimal gains.

In regards to high velocity work, it would mean for example that power cleans would be done before squats, as acceleration is critical in the performance of a power clean. Relatively speaking, the nervous system has to be more fresh to do a great series of power cleans than to do a great series of squats.

Principle 19: The number of sets per exercise is inversely proportionate to the training frequency for that body part

From experience, I have found that people who grow best on only 2 sets of 8-12 reps a body part, react better when they train that muscle 3 times weekly.

Conversely, the gifted ones, who put size on by doing 5 sets of 4-7 reps/2 exercises per bodypart react best to a training frequency of 5-7 days for that bodypart.

You can find the same analogy of how people learn new educational material. To pass a kinesiology exam where you need to know all the muscles with their attachments, nerve supplies, and movement patterns, some people may need to read the same chapter 3 times before moving on to the next one. Some individuals will do better by learning from 5 books different from the class manual, and others will read half the class manual at one sitting, remember it all, wait a month to finish the book and pass with flying colors.

Principle 20: Tolerance to training volume can be increased by proper nutrition.

The dietary principles and recommendations outlined by co-author Will Brink will effectively allow you to recover more quickly. I have often seen individual hard gainers turn in easy gainers once their diets were fixed.

By improving their nutritional status, they could handle greater training loads leading to faster and greater gains in mass and strength. A simple mineral deficiency can ruin havoc on your work capacity, that is the ability to repeat sets without dramatic drop-offs in performance levels.

Principle 21: Cut back on the other training

Technical training and energy system training should be put on a maintenance mode **if done at all** when training for added hypertrophy. Most coaches are probably having an anxiety attack reading these lines. However, my experience and the feedback from top-level coaches in alpine skiing, diving, figure skating, gymnastics and volleyball, support the fact that athletes perform their skills at a higher level when they return to them after a concentrated twelve week strength training block. Of course, a very brief period of adaptation (two-three weeks) is needed to reeducate the central nervous system in how to use that newly built body.

If you are training to gain lean tissue, you should stay away from aerobic work, particularly the slow rhythmic type. This type of work is associated with catabolic hormones which will break down your muscle mass, and make your training effort in the gym wasted.

Be aware that if you are engaging in other physical activities like lets say tae-kwon-do classes, it will be hard to gain lean tissue. I would suggest you cut back on other activities until you gain the desired weight.

PART II

Sample training programs 3 days a week

Sample training programs.

Option 1: High Frequency-Low volume responding individuals

These consists of three days a week, whole body workouts, it very productive for about 20% of the population. Ideal for individuals who have very limited time for training, and yet desire to pack on the pounds.

Accumulation type workouts

Monday & Friday

A-1 Back Squats 2 x 15-20 reps on 2010 tempo, rest interval 90 seconds
A-2 Lying leg curls feet inward 2 x 6-8 reps on 4010 tempo, rest interval 75 seconds

B-1 Parallel Bar Dips 2 x 10-12 reps on 3010 tempo, rest interval 75 seconds
B-2 Close Parallel Grip Chin-ups 2 x 8-10 reps on 4010 tempo, rest interval 75 seconds

C-1 Incline Dumbbell Presses 2 x 10-12 reps on 3010 tempo, rest interval 75 seconds
C-2 Seated Cable Rowing 2 x 8-10 reps on 4010 tempo, rest interval 75 seconds

D-1 Decline Triceps EZ Bar Extensions 2 x 10-12 reps on 3110 tempo, rest interval 75 seconds

D-2 Incline Dumbbell Curls 2 x 8-10 reps on 4010 tempo, rest interval 75 seconds

E-1 Standing Calf Raises 2 x 10-12 reps on 2210 tempo, rest interval 60 seconds
E-2 low Cable Pull-ins 2 x 10-12 reps on 2020 tempo, rest interval 60 seconds

Wednesday

A-1 Back Barbell Lunges 2 x 15-20 reps on 2010 tempo, rest interval 90 seconds
A-2 Dumbbell Deadlifts 2 x 12-15 reps on 3010 tempo, rest interval 90 seconds

B-1 Back Step-ups 2 x 15-20 reps on 10X0 tempo, rest interval 90 seconds
B-2 Back Extensions 2 x 12-15 reps on 2012 tempo, rest interval 75 seconds

C-1 Incline Barbell Presses 2 x 10-12 reps on 3010 tempo, rest interval 75 seconds
C-2 Supinated Chin-ups 2 x 8-10 reps on 4010 tempo, rest interval 75 seconds

D-1 Decline Dumbbell Presses 2 x 10-12 reps on 3010 tempo, rest interval 75 seconds
D-2 One Arm Dumbbell Rows 2 x 8-10 reps on 4010 tempo, rest interval 75 seconds

E-1 Seated Raises 2 x 15-20 reps on 2010 tempo, rest interval 60 seconds

E-2 Twisting Crunches on Swiss Ball 2 x 10-12 reps on 2020 tempo, rest interval 60 seconds

Option 1

Intensification type workouts

Monday & Friday

A-1 Front Squats 3 x 4-6 reps on 5010 tempo, rest interval 120 seconds
A-2 Lying leg curls feet outward 3 x 4-6 reps on 5010 tempo, rest interval 90 seconds

B-1 Cambered Bar Bench Presses 3 x 6-8 reps on 4010 tempo, rest interval 90 seconds
B-2 Lean-away Chin-ups 3 x 6-8 reps on 4010 tempo, rest interval 90 seconds

C-1 Seated Dumbbell Presses 3 x 6-8 reps on 4010 tempo, rest interval 90 seconds
C-2 Incline Hammer Curls 3 x 6-8 reps on 4010 tempo, rest interval 90 seconds

D-1 One Leg Calf Raises 2 x 8-10 reps on 2110 tempo, rest interval 70 seconds

D-2 Twisting Garhammer Raises 2 x 10-12 reps on 2010 tempo, rest interval 60 seconds

Wednesday

A. Bent-Knee Barbell Deadlifts, 4 sets: 8,6,4,4 reps tempo, rest interval 180 seconds

B. Half-Deadlifts in Rack + Shrugs, 3 x 6-8 reps tempo 2110 rest interval 180 seconds

C-1 Decline Barbell Presses 3 x 6-8 reps on 3110 tempo, rest interval 90 seconds
C-2 Subscapularis Pull-ups 3 x 6-8 reps on 4010 tempo, rest interval 90 seconds

D-1 Standing Pause EZ-Bar Reverse Curls 3 x 6-8 reps on 2210 tempo, rest interval 90 seconds

D-2 Gripping Machine 2 x 10-12 reps on 2012 tempo, rest interval 60 seconds

PART II

Option II

Sample training programs 4 days a week

Option 2: Average recovery individuals.

These programs consists of four days a week, split type workouts, it very productive for about 60% of the population. It also offers the advantage of having the weekend off. Some individuals would prefer to do some of these workouts of the weekend. The basic rule is two days on/one day off, two days on/two days off. For illustration sake, we will use the Monday-Thursday and Tuesday-Friday approach.

Accumulation type workouts

Monday & Thursday

A-1 Cyclists Back Squats 4 sets: 10, 12, 15, 20 reps on 2010 tempo, rest interval 90 seconds

A-2 Lying leg curls feet inward 4 sets x 6-8 reps on 40X0 tempo, rest interval 75 seconds

B-1 Lunges 4 sets: 10, 12, 15, 20 reps on 20X0 tempo, rest interval 90 seconds
B-2 Romanian Deadlifts 4 sets x 10-12 reps on 4020 tempo, rest interval 75 seconds

C-1 Standing Calf Raises 3 sets: 12, 15, 20 reps on 1110 tempo, rest interval 60 seconds

C-2 low Cable Pull-ins 2 x 10-12 reps on 2020 tempo, rest interval 60 seconds

Tuesday & Friday

A-1 Incline Dumbbell Presses 4 sets: 8, 10, 12, 15, on 3010 tempo, rest interval 75 seconds
A-2 Close Parallel Grip Chin-ups 4 x 8-10 reps on 4010 tempo, rest interval 75 seconds
B-1 Decline Dumbbell Presses 3 x 10-12 reps on 3010 tempo, rest interval 75 seconds
B-2 One Arm Dumbbell Rows 3 x 8-10 reps on 4010 tempo, rest interval 75 seconds
C-1 Decline Pronating Dumbbell Triceps Extensions 3 x 10-12 reps on 3110 tempo, rest interval 75 seconds

C-2 Seated Off-set Dumbbell Curls 3 x 8-10 reps on 3010 tempo, rest interval 75 seconds

Option 2

Intensification type workouts

Monday & Thursday

A-1 Front Squats 5 sets x 4-6 reps on 50X0 tempo, rest interval 120 seconds (On Thursdays substitute Trap Bar Deadlifts for the Front Squats)

A-2 One and 1/4 Lying leg curls feet outward 5 sets x 4-6 reps on 50X0 tempo, rest interval 100 seconds

B-1 Bulgarian split squats 4 x 5-7 reps on 30X0 tempo, rest interval 100 seconds
B-2 Standing Good Mornings 4 sets x 6-8 reps on 3020 tempo, rest interval 100 seconds

C-1 Seated Calf presses 4 x 8-10 reps on 2210 tempo, rest interval 75 seconds

C-2 Twisting Low Cable Pull-ins 4 x 8-10 reps on 2010 tempo, rest interval 75 seconds

Tuesday & Friday

A-1 Top Half Range Incline Presses in Rack 5 x 4-6 on 2210 tempo, rest interval 100 seconds

A-2 Subscapularis Pull-ups 5 x 4-6 on a 5010 tempo, rest interval 100 seconds

B-1 Incline Barbell Presses 5 x 4-6 on a 5010 tempo, rest interval 100 seconds

B-2 Bent-over EZ Bar Rows 5 x 4-6 on a 5010 tempo, rest interval 100 seconds

C-1 Seated Parallel Grip French Presses 3 x 7-9 reps on 3110 tempo, rest interval 90 seconds

C-2 Scott close-grip EZ bar Curls 3 x 7-9 reps on 5010 tempo, rest interval 90 seconds

PART II

Option III

Sample training programs 3 days out of 5

Option 3: Gifted individuals.

There are many split routine options for these individuals, as their recovery ability superior. However, in most cases, I recommend a three days out five training split, where each bodypart is trained thoroughly once every five days. The only disadvantage with the 3 days out of 5 split is that most often you do have to train at least one day per weekend. But when you are serious about your training this is not too much of a constraint.

For illustration sake, I will detail the following training split:

Day 1: Chest, Back & Shoulders
Day 2: Thighs, Calves
Day 3: off
Day 4: Arms & Forearms
Day 5: off

As you can notice, there is no direct abdominal work in this phase. I often eliminate or reduce drastically one bodypart's volume per phase, this allows for greater concentration on chosen bodyparts and permits recovery for some. For example, if one wants big arms, a key to reaching that goal is to do NO DIRECT WORK on them, three months in a row out of every year. In this case, the split may look like this:

Day 1: Chest, Back
Day 2: Thighs, Calves
Day 3: off

Day 4: Shoulders & Abs

Day 5: off

Accumulation type workouts

Day 1

A-1 25 Degree Incline Dumbbell Presses 4 sets: 6, 8, 10, 12, on a 3110 tempo, rest interval 75 seconds

A-2 Lean-away parallel grip Chin-ups 4 x 7-9 reps on 4010 tempo, rest interval 75 seconds

B-1 Flat Dumbbell Presses 3 x 10-12 reps on 3010 tempo, rest interval 10 seconds (not a typo TEN seconds)

B-2 Incline Cable Flyes 3 x 10-12 reps on 3010 tempo, rest interval 90 seconds

B-3 Seated Cable Rowing to Neck 3 x 8-10 reps on 2012 tempo, rest interval 10 seconds (not a typo TEN seconds)

B-4 Decline Barbell Pullovers 3 x 15-20 reps on 2010 tempo, rest interval 90 seconds

C-1 Rope Cable Upright rows 3 x 12-15 reps on 3010 tempo, rest interval 75 seconds

C-2 Seated Dumbbell Presses 3 x 8-10 reps on 2012 tempo, rest interval 10 seconds (not a typo TEN seconds)

Day 2

A-1 Cyclists Back Squats 4 sets: 10, 12, 15, 20 reps on 2010 tempo, rest interval 10 seconds (YES, 10 seconds)
A-2 Leverage leg presses 4 sets: 15, 20, 25, 30 reps on 2010 tempo, rest interval 180 seconds

B-1 Lying leg curls feet inward 4 sets x 6-8 reps on 40X0 tempo, , rest interval 10 seconds (YES, 10 seconds)

B-2 Romanian Deadlifts 4 sets x 10-12 reps on 4020 tempo, rest interval 120 seconds

C-1 Standing Calf Raises 3 sets: 12, 15, 20 reps on 1110 tempo, rest interval 10 seconds (YES, 10 seconds)

C-2 Seated Calf Raises 3 sets: 20, 25, 30 reps on 1110 tempo, rest interval 120 seconds

Day 4

A-1 10 Degree Decline close grip bench presses 4 sets: 6, 8, 10, 12, on 3210 tempo, rest interval 75 seconds
A-2 Seated Zottmann Curls 4 sets: 6, 8, 10, 12, on 3210 tempo, rest interval 75 seconds

B-1 Rope French Presses 3 x 10-12 reps on 3110 tempo, rest interval 10 seconds (not a typo TEN seconds)
B-2 Pronated Triceps Pressdwons 3 x 15-20 reps on 3010 tempo, rest interval 90 seconds
B-3 Scott Gorilla Bar Reverse Curls 3 x 7-9 reps on 4010 tempo, rest interval 10 seconds (not a typo TEN seconds)
B-4 Low Rope Supinating Curls 3 x 12-15 reps on 3010 tempo, rest interval 90 seconds

C-1 Decline Pronated Wrist Curls 3 x 12-15 reps on 2010 tempo, rest interval 60 seconds
C-2 Gripping Machine 3 x 15-20 reps on 2010 tempo, rest interval 60 seconds

Option 2

Intensification type workouts

Day 1

A-1 Barbell Bench Press 6 sets: 8,6,4,4,6,8, on 3110 tempo, rest interval 100 seconds

A-2 Medium parallel grip Chin-ups 6 sets: 8,6,4,4,6,8, on 3110 tempo, rest interval 100 seconds

B-1 60 Degree Incline Dumbbell Presses 4 x 8-10 reps on 3010 tempo, rest interval 90 seconds

B-2 One Arm Arc Dumbbell Rowing 4 x 8-10 reps on 2012 tempo, rest interval 90 seconds

Day 2

A-1 Front Squats 6 sets: 6,4,4,4,4,6 reps on 5010 tempo, rest interval 100 seconds

A-2 One & one quarter Lying leg curls feet outward 6 sets: 6,4,4,4,4,6 reps on 5010 tempo, rest interval 100 seconds

B-1 Back Lunges 4 sets x 6-8 reps on 30X0 tempo, , rest interval 90 seconds

B-2 Seated Good Mornings 4 sets x 7-9 reps on 3020 tempo, rest interval 90 seconds

C-1 One leg Calf Raises 3 X 8-12 reps on 1210 tempo, rest interval 75 seconds

C-2 Tibialis 3 X 8-12 reps on 2010 tempo, rest interval 75 seconds

Day 4

A-1 Close grip bench presses with chains 5 sets: 8,6,4,4,4, on 40X0 tempo, rest interval 100 seconds

A-2 Seated Close Grip Scott Curls 5 sets: 8,6,4,4,4, on 40X0 tempo, rest interval 100 seconds

B-1 Incline Barbell Triceps Extensions 5 sets: 6,6,6, 8,10 on 2210 tempo, rest interval 100 seconds

B-2 Incline Hammer Curls 5 sets: 6,6,6, 8,10 on 4010 tempo, rest interval 100 seconds

C-1 Low Pulley Pronated Wrist Curls 3 x 10-12 reps on 2010 tempo, rest interval 75 seconds

C-2 Low Pulley Supinated Wrist Curls 3 x 10-12 reps on 2010 tempo, rest interval 75 seconds

PART 3 -- EXTRA RESOURCES

Charles Poliquin Website

See more articles from Charles Poliquin at his website here.

http://www.charlespoliquin.net

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