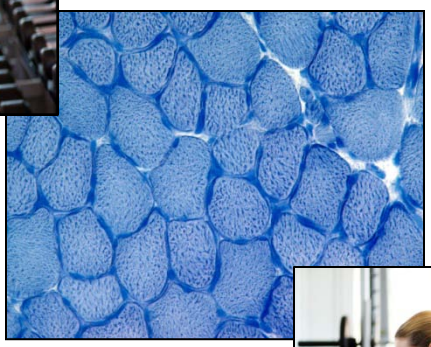
Building Muscle

Challenging Current Dogma

Sports Science Insights
Hot Topics Conference
Chicago, May 14 &15, 2010

CONFERENCE SUMMARY



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The May 2010 conference in Chicago on **Building Muscle: Challenging Current Dogma** was the first in what we hope to be a series of conferences sponsored by Sports Science Insights. The intent of the conferences is to transfer cutting-edge sports science knowledge from top-notch scientists into the hands of sports health professionals.

We chose **Building Muscle** as the first conference theme because of the widespread misconceptions about how muscle strength and mass are best developed and because of the exciting advances in strength science and nutrition being made in laboratories around the world.

Take a look below at the **Conference Faculty** and **Conference Summary** for a glimpse of what the Building Muscle conference was all about.

Conference Faculty

Left to right: Stu Phillips, Larry Kenney, Bob Murray, Marty Gibala, Jim Pawelczyk

Stu Phillips, PhD, FACSM, FACN
Stu is a professor at McMaster University and an expert in protein metabolism and the role of dietary protein in stimulating muscle protein synthesis. Stu is also interested in how exercise and nutrition impact body composition.

Larry Kenney, PhD, FACSM
A professor at Penn State University and a past-president of the American College of Sports Medicine, Larry moderated the **Building Muscle** conference. Larry's research expertise is in control of skin blood flow, temperature regulation, and hydration.

Bob Murray, PhD, FACSM
As managing principal of Sports Science Insights, LLC, Bob organized and hosted the conference. Bob spent almost 23 years as director of the Gatorade Sports Science Institute and now works as a consultant for companies in need of targeted expertise in sports science.

Marty Gibala, PhD, FACSM
Marty is a professor and chair of the Department of Kinesiology at McMaster University. His research interests include muscle metabolism, sports nutrition, and the effects of high-intensity training (HIT).

Jim Pawelczyk, PhD, FACSM
A former payload specialist aboard the 1998 flight of space shuttle Columbia, Jim is an associate professor at Penn State University whose research interests include the physiology of the microcirculation and is also interested in how dietary supplements affect performance.

Conference Summary

Explain how training and nutrition make muscles bigger and stronger. That was the not-so-simple challenge we posed to Drs. Gibala, Phillips, and Pawelczyk in planning for the May 2010 Sports Science Insights conference. All three speakers rose to that challenge and provided fast-paced, entertaining, and educational overviews that blended cutting-edge science with practical applications for personal trainers, strength coaches, sports, nutritionists, athletic trainers, and sports scientists.

Here are a few of the conference highlights:

DOGMA: AT LEAST 3 SETS OF EXERCISE ARE REQUIRED TO INCREASE MUSCLE STRENGTH. In general, 3 sets of exercise are more effective than 1 set of exercise at increasing muscle protein synthesis and stimulating intracellular signaling molecules. However, there is little correlation between the number of sets and the resultant increase in the cross-sectional area of muscle. **Maximal muscle fiber activation** is the key to increasing strength and mass, and is more important than the number of sets, the relative load, or the number of training sessions per week. The remodeling of muscle fibers in response to strength training involves complex molecular signaling pathways that link mechanical signals to the increased expression of protein required for the increased synthesis of contractile proteins, regulatory proteins, and structural proteins.

DOGMA: THE GREATEST GAINS IN STRENGTH OCCUR IN RESPONSE TO SOPHISTICATED RESISTANCE TRAINING PROGRAMS AND EQUIPMENT. The key to maximizing muscle's response to resistance training is to consistently **lift to fatigue**. Regardless of the simplicity or complexity of training-program design, fatigue that results from full motor-unit recruitment -- maximal activation of muscle cross-bridges -- is the ultimate goal of resistance training and the key to increasing muscle strength. The principles of progressive overload, specificity, and variation (periodization) remain indispensable elements in training program design to ensure that athletes consistently lift to fatigue.

DOGMA: INCREASING BLOOD HORMONES DURING WORKOUT SESSIONS IMPROVES THE RESPONSE TO STRENGTH TRAINING. Anabolic hormones (testosterone, HGH, IGF-1) are important for supporting and sustaining increases in strength and mass but there is **no causal link** between the hormone response to resistance training and changes in strength or mass. For example, doing leg exercise before arm exercise increases circulating hormone levels but that does not affect the fractional synthetic rate, cross-sectional area, maximal voluntary contraction, 1-repetition max, or 10-repetition max in arm muscles. In addition, anabolic hormones are not necessary to stimulate the rise in post-exercise muscle protein synthesis.

DOGMA: INGESTING PROHORMONES IMPROVES THE RESPONSE TO STRENGTH TRAINING. Prohormones (e.g., androstenedione, dehydroepiandosterone) do not appear to be effective at increasing strength and mass, likely because **only about 2%** of ingested prohormones are converted to testosterone.

DOGMA: ATHLETES REQUIRE DIETS HIGH IN PROTEIN. There is no good evidence that athletes need to eat more than **1.7 grams of protein per kilogram of body weight per day** to meet their daily protein needs. That's 170 grams of protein for a 220-lb athlete, the amount of protein in 24 ounces of beef or 6 small chicken breasts. In other words, athletes who consume a varied diet will have no difficulty ingesting enough protein to meet the demands of muscle for the amino acids required for growth and repair. Study after study has demonstrated that consuming additional protein does not further enhance muscle protein synthesis or lean body mass.

DOGMA: PROTEIN AND AMINO-ACID SUPPLEMENTS ARE MORE EFFECTIVE THAN FOOD AT STIMULATING GAINS IN STRENGTH AND MASS. Protein and amino-acid supplements provide no anabolic advantage compared to the proteins in whole foods and some supplements carry the risk of contamination with banned substances. **Food first.** Supplements should never replace good nutrition. Gains in muscle mass and strength are supported by the ingestion of high-quality proteins such as those found in milk, eggs, meat, and soy. Interestingly, the milk protein fractions, casein and whey, appear particularly effective at stimulating muscle protein synthesis, perhaps in part because the high leucine content in whey may inhibit muscle protein breakdown.

DOGMA: CARBOHYDRATE IS NOT AN IMPORTANT FUEL SOURCE FOR STRENGTH TRAINING. Muscle glycogen is the main fuel source for resistance training because training sets and sessions outlast the capacity of the phosphagen energy system to provide ATP. In fact, aerobic metabolism makes an increasingly larger contribution to energy production as muscles fatigue. Consequently, adequate carbohydrate in the diet and carbohydrate intake during training can improve the ability to perform resistance training. Athletes can benefit from this simple advice: **don't train hungry.** Carbohydrate intake before and during resistance training, protein intake before and/or after resistance training, and adequate hydration interact with the stimulus of training to maximize gains in strength and mass.

DOGMA: THE GREATER THE AMOUNT OF PROTEIN CONSUMED AFTER TRAINING, THE GREATER THE ANABOLIC RESPONSE. Research continues to support the effectiveness of ingesting roughly **20 grams of high-quality protein** (i.e., proteins containing all the essential amino acids) within 3 hours after resistance training. In addition, consuming small amounts of protein (e.g., 10-20 grams) throughout the day creates anabolic pulses (in response to increases in plasma essential amino-acid concentration) that may contribute to increases in strength and mass. Consuming larger quantities of protein does not further increase muscle protein synthesis.

DOGMA: CREATINE SUPPLEMENTATION ALONE CAN INCREASE STRENGTH. The typical American diet provides about 2 grams of creatine per day and supplemental creatine has been shown to increase muscle creatine content in some people. Creatine ingestion by itself does not increase strength or mass, but in concert with strength training, supplemental creatine (3-6 g/d) can increase muscle creatine content in some athletes, leading to increases in measures of **explosive strength** and an increase in muscle hypertrophy.