



# **POLIQUIN<sup>®</sup>**

## **PRINCIPLES**



**Successful Methods for  
Strength and Mass Development**

**3rd Edition**



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Strength and Mass Development**

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# Preface

Information has grown exponentially since the *Poliquin Principles* was first published in 1997. There was valuable information in the original *Poliquin Principles*, but as information grew updated editions were needed. Specifically, new discoveries in nutrition and functional medicine have led to the development of more effective supplement protocols. One is the concept of peri-nutrition, in which supplements are used immediately before, during and after a workout.

As with the 2nd edition, this book contains two major sections: Section I defines the basic principles of resistance training, and Section II shows how to apply these principles to training major body parts. The sets and reps chapter for this edition was divided into two separate chapters, and likewise the nutrition chapter was divided into two chapters, one on nutrition and one on supplements.

We know more today than ever. It's been estimated that the amount of information doubles every 18 months, and we've had to adjust our theories within that same time frame. That's why we decided it was time for this new edition of the *Poliquin Principles*.

Weightlifting Action Photos: Bruce Klemens

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Warning: Before beginning any exercise program, consult with your physician to ensure that you are in proper health. This book is not meant to provide medical advice; you should obtain medical advice from your private health care practitioner. No liability is assumed by the Poliquin Group for any of the information contained herein.

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# Introduction

In working with elite-level athletes from a variety of sports, including bodybuilding and powerlifting, we [the coaching staff of the Poliquin Group] have discovered the best ways to increase strength and muscle growth in the shortest amount of time. Sometimes this is accomplished by helping resolve chronic injuries; sometimes it's through scientific nutrition and supplementation. The most dramatic changes, however, usually come from the manipulation of training variables, also known as loading parameters.

These loading parameters, which are covered in the first six chapters of this book, include reps, sets, tempo, rest, frequency, duration, volume, exercise selection and exercise order. Before we begin those discussions, let's take a brief look at the evolution of resistance training methods.

## Of Bulk and Bunk

Bodybuilders have been inundated with inadequate and sometimes inaccurate information. We can't put all the blame on muscle magazines, as there are some very good ones, such as *Iron Man*, but there are many bodybuilding writers who have promoted training concepts that are simply not accurate. Case in point: Nautilus founder Arthur Jones.

In *Nautilus Training Principles: Bulletin No. 1*, Jones said bodybuilders must work to the point of momentary failure to "...reach their individual limits of muscular size and strength very quickly." We agree that overload is essential for increasing maximal motor unit activation, but we strongly disagree with Jones when he also proclaimed that overload "should be done in the performance of sets of at least 6 full repetitions and not more than 20 full repetitions." On the contrary, low reps are essential for achieving maximal growth.

Misinformation regarding exercise physiology is not confined to the bodybuilding community. Although some outstanding researchers in the US, such as William Kraemer, Ph.D., produce exceptional research studies, most sports scientists who study resistance training in the US are limited by factors such as time, scope and subjects. Untrained college students are often used as subjects, and practical limitations usually require these studies to be completed within a few months. In contrast, many of the studies in Norway, Finland and Germany use elite athletes and span a four-year Olympic cycle. American studies also often lack sufficiently motivated subjects to achieve optimal results and accountability for important training variables such as lifting tempo and rest between sets.

We have the utmost respect for bodybuilders and the intensity they devote to their training, but many of their methodologies are scientifically unfounded. Considering the tremendous amount of new information now available in the Iron Game, we're amazed by the prehistoric practices that permeate the practice of building muscle. Today, there is no excuse for mediocre and inefficient exercise routines.



# SECTION 1: Defining the Poliquin Principles



Donald C. Reinhardt is a four-time IPF World Champion and is the first powerlifter to exceed 2400 pounds in the total. He broke 40 world records. Without knee wraps, he squatted 934 pounds; he also bench pressed 607.4 pounds and deadlifted 885.5 pounds.

# Chapter 1: Reps



Pyrrhos Dimas is a three-time Olympic champion from Greece. His best lifts include a 398-pound snatch and a 473-pound clean and jerk in the 187-pound bodyweight class.

When it comes to lifting weights, the first question bodybuilders ask is “How much?” The second question, which influences the first, is “How many?” The accepted wisdom of a few years ago dictated 8-10 reps. However, just as a lot of people believe that old adage about needing eight glasses of water a day (which, by the way, has never been scientifically proven), everyone accepts this “magic” number range without questioning who arrived at it or how.

First of all, there is no magic number. As you’ll learn, repetition protocols should change

depending on the condition of the athlete, the nature of the exercise and the goal. Learning a little about the principles behind repetition prescriptions will give you a better idea of how to apply these principles to your own workouts.

The following general principles about rep selection are based upon scientific research as well as practical, empirical evidence from work with elite athletes.

## **Follow the Neural-Metabolic Continuum**

The amount of weight you lift in relation to your one-repetition maximum (1RM) determines how much tension a muscle produces. The preponderance of credible research and empirical evidence shows the level of tension imposed upon a muscle is a critical factor in obtaining a strength or hypertrophy response.

The number of reps you select will influence all other loading parameters: sets, speed of contraction, rest intervals and even exercise selection. The bottom line? Strength researchers have found that reps in the 1-to-5 range maximally increase strength with minimal gains in muscle mass, and reps in the 6-to-12 range maximally increase strength through muscle mass gains (Table 1).

## RELATIONSHIP OF NUMBER OF REPETITIONS TO PERCENTAGE OF MAXIMUM AND THE TRAINING EFFECT

| NUMBER OF REPS | PERCENT OF MAXIMUM | TRAINING EFFECT |
|----------------|--------------------|-----------------|
| 1              | 100.0              |                 |
| 2              | 94.3               |                 |
| 3              | 90.6               |                 |
| 4              | 88.1               |                 |
| 5              | 85.6               |                 |
| 6              | 83.1               |                 |
| 7              | 80.7               |                 |
| 8              | 78.6               |                 |
| 9              | 76.5               |                 |
| 10             | 74.4               |                 |
| 11             | 72.3               |                 |
| 12             | 70.3               |                 |
| 13             | 68.8               |                 |
| 14             | 68.8               |                 |
| 15             | 66.2               |                 |
| 16             | 65.0               |                 |
| 17             | 63.8               |                 |
| 18             | 62.7               |                 |
| 19             | 61.6               |                 |
| 20             | 60.6               |                 |

**Table 1**

Extreme muscle mass is one of the primary goals in bodybuilding, but that doesn't mean bodybuilders should never perform low reps. Low reps with heavy weights are the only way to stimulate the development of the Type IIb muscle fibers, which are the fast-twitch fibers that have the highest potential for growth. Another benefit of low-rep training is that when you come off a cycle of low reps, you will be able to use heavier weights. Heavier weights create a higher level of muscle tension, which in turn leads to a greater growth response. Mike Payette, a former Mr. Canada who became a professional wrestler, performed 40 percent of his exercises in the 4-rep range.

### **Let the Reps Dictate the Weight**

Maximal voluntary contractions occur when you attempt to recruit as many motor units as possible to develop force; in fact, you must periodically force yourself to use maximal voluntary contractions to get results. This condition is the physiological basis of what is

commonly referred to as the overload principle: If you do not apply overload to your muscles, there is no reason for your muscles to become bigger or stronger. (The exceptions are beginners and rehab patients, whose strength levels are so low that training to momentary failure is not necessary to achieve optimal results.)

When you plan your workouts, determine the desired training effect and select a repetition bracket to suit that goal. If you want to gain size, as a general guideline you would select a weight that enables you to complete a set of between 6 and 12 reps. If you complete only 5 reps, the weight is too heavy. If you can do more than 12 reps, the weight is too light.

The need to allow the reps to dictate the weight is a problem with some computerized workout programs. Most computer workout programs determine what you should lift for each workout by taking a percentage of your 1RM in each exercise. However, the 1RM continuum varies greatly from one muscle group to another, and as you can see from Table 2, different studies produce different results.

Because so many factors affect your strength at any given time, plugging yourself into a computer-generated program based upon a one-rep max may compromise the quality of the workout. If you're feeling subpar, the weights will be too heavy; and if you're feeling great, the weights will be too light, leading to plenty of frustration.

### 1RM CONTINUUM IN THE BENCH PRESS ACCORDING TO VARIOUS AUTHORS

| R.M. | Percentages (authors) |       |       |       |       |       |       |       |
|------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|      | (1)                   | (2)   | (3)   | (4)   | (5)   | (6)   | (7)   | (8)   |
| 1    | 100.0                 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 2    | 95.0                  | 95.0  | 94.0  | 97.4  | 96.6  | 95.0  | 96.4  | 94.4  |
| 3    | 92.5                  | 90.0  | 91.0  | 94.9  | 92.6  | 90.0  | 93.3  | 91.8  |
| 4    | 90.0                  | 86.0  | 88.0  | 92.4  | 89.7  | 87.5  | 89.9  | 89.2  |
| 5    | 82.5                  | 82.0  | 85.0  | 89.8  | 87.0  | 85.0  | 86.4  | 86.9  |
| 6    | 85.0                  | 78.0  | 83.0  | 87.6  | 84.7  | 82.0  | 83.9  | 84.7  |
| 7    | 82.5                  | 74.0  | 81.0  | 85.5  | 82.0  | 79.0  | 81.3  | 82.6  |
| 8    | 80.0                  | 70.0  | 79.0  | 83.3  | 79.1  | 76.0  | 78.8  | 80.6  |
| 9    | 77.5                  | 65.0  | 78.0  | 81.1  | 77.5  | 73.0  | 76.9  | 78.7  |
| 10   | 75.0                  | 61.0  | 77.0  | 78.9  | 75.5  | 70.0  | 75.0  | 76.8  |

(1) Landers 1986\*

(5) Witt, 1984

(2) McDonagh & Davies, 1984

(6) Feser, 1977\*

(3) Rhoades & Wescott, 1987

(7) Anderson & harring (1977) in Sale & MacDougal (1981)

(4) Berger in Viel et al., 1984

(8) Kennedy, 1980

\* Figures in italics have been extrapolated

Table 2 © Poliquin & Léger, 1991

## Determine Muscle Fiber Composition

A muscle with a high percentage of slow-twitch fibers responds best to higher reps. Let's look at how this concept applies to training the calves and hamstrings.

The calf consists primarily of two muscles, the two-head gastrocnemius and the one located under it called the soleus. The gastrocnemius contains predominantly fast-twitch fibers and responds best to lower reps. In contrast, the soleus contains predominantly slow-twitch fibers and responds best to reps in the 15-25 range (to give sufficient time under tension for these fibers to hypertrophy). Now let's look at the hamstrings.

Sprinters and Olympic-style weightlifters often have much better development of the hamstrings than bodybuilders. This is because the hamstrings are composed of primarily fast-twitch fibers, and to access these fibers you must train them at a high intensity level.

One practical way to determine muscle fiber type, and we must credit Arthur Jones for this idea, is by seeing how many times you can lift a submaximal weight. This is partially true. If two trainees have a 1RM of 100 pounds for the barbell curl, the one who curls 80 pounds only 5 times has more fast-twitch fibers than the person who can curl the same weight 10 times. Compared to the usual method of determining fiber type that involves taking painful muscle biopsies, Jones' test is extremely convenient for untrained individuals. However, you must understand that you can skew this relationship by making the body more neurologically efficient (with relative strength training methods) or less neurologically efficient (with aerobic work).

## **Consider Exercise Complexity**

If an exercise involves multiple joints in a complex skill, such as the Olympic lifts, excessive reps will produce undesirable technical and motor-learning changes. When you're performing more than 6 reps in the power clean, for example, the relatively small rhomboid muscles will tire out first, causing an inefficient change in lifting technique.

In the 80s, a Division I football strength coach recommended sets of up to 30 reps in the power clean. His team had won a national championship at the time, so this outcome is evidence that a scientifically sound weight training program is only one variable contributing to success in college football. Likewise, we are not keen on boot camp programs that recommend high reps for power snatches, power cleans and push presses – even with the relatively light weights they use, technique is often compromised.

With the increased contributions of science to training methodology, the subject of selecting the appropriate number of reps for your workouts has become very confusing. And because science has not yet provided all the answers, we will continue to see much variation in training methods. Of course, tackling the subject of repetitions is only part of the solution. You also need to select the appropriate number of sets.



## Chapter 2: Sets



John Kuc was the first powerlifter to squat 900 pounds and total 2300 pounds. He was also known for his deadlifting ability, lifting 870 pounds at a bodyweight of 242.5 pounds.

Let's start with a simple definition: a set is a group of consecutive reps. The completion of a *set* is signaled by the start of an extended rest period or a change of exercises. This means that one *superset* – two exercises for different muscle groups performed in sequence – equals two sets. One *giant set* – three exercises for the same muscle group performed in sequence – equals three sets. *Descending sets*, in which virtually no rest time is taken between weight changes, equals just one set. Although some individuals endorse one-set training, when you apply the previous definitions you often find their workouts contain extended sets. With extended sets, the total time the muscle is under tension contributes to the total volume that elicits a hypertrophy response.

### **Variables Influencing Set Selection: A Top 10 List**

The overload principle suggests that stronger athletes need more sets; real-life examples prove multiple-set systems produce faster and greater gains in muscle mass, strength and power. But there are many other variables to consider when determining how many sets you should perform in a workout. Here are 10 of them:

**1. Number of reps per exercise.** Most strength coaches believe there is a minimum amount of time the muscles must be stimulated for maximum size and strength gains. Consequently, when training with low reps, you must perform more sets to attain the optimal volume for strength development. This is illustrated in Figure 1.

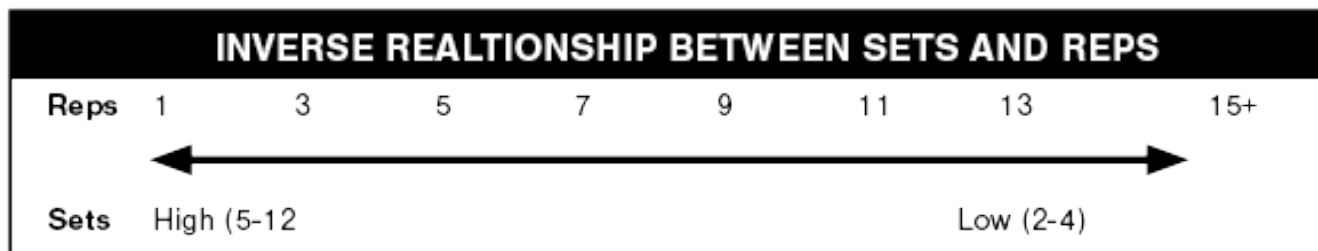


Figure 1

**2. Number of exercises per training session.** The more exercises you perform, the fewer sets you need to achieve an optimal training effect. If you add exercises to your workout without reducing the average number of sets per exercise, you may exceed the optimal time to complete a workout.

**3. Training level.** One or two sets per exercise are usually enough for beginners because their training age is low. When we talk about training age, we don't necessarily mean chronological age; a 17-year-old could be considered advanced, and a 50-year-old could be considered a beginner.

**4. Gender.** At any given percentage of their maximum for one rep (1RM, or one repetition maximum), a woman can perform more reps than a man. Take the arm curl, for example. At 70 percent of her 1RM, we've found that a woman should be able to perform about 17 reps, whereas a man should be able to complete only about 12. Also, because there is an inverse relationship between sets and reps, this difference in neurological efficiency means women should do fewer sets at a given intensity.

**5. Nutritional status.** Advances in nutritional supplements, plus better drug-testing methods, have enabled drug-free athletes to close much of the gap between them and athletes who use drugs. Paying careful attention to peri-nutrition, which refers to whatever supplements you take immediately before, during and after a workout, can make significant changes in how you progress.

**6. Muscle size.** The number of sets performed should be inversely proportionate to the size of the muscle mass trained. Small muscle groups recover more quickly than large muscle groups and, therefore, can handle more sets. Thus, you can perform more sets for the biceps than you can for the quadriceps.

**7. Principle of individualization.** Bodybuilders and strength athletes have reached high levels of performance using a variety of training philosophies. Because everyone has a unique response to a given program, the number of sets should be individualized. For example, compare Rick Weil, a former world record holder in the bench press, to Doug Hepburn, a famous strongman and weightlifting champion in the 1950s. Weil's training primarily consisted of a low number of sets, whereas Hepburn's training primarily consisted of a high number of sets.



## WHY ISN'T THERE A PERFECT PROGRAM?

# Different Individuals = Different Responses Adaptation = Stagnation

**8. Principle of quality over quantity.** Even when you rest for the appropriate time between sets, after a few sets the muscles will fatigue to the point where increasingly fewer reps can be performed before failure. This condition is called the critical drop-off point. *The critical drop-off point* occurs when you reach a 5-7 percent drop in performance, and at this time you should move to another exercise or body part. You'll know you've hit the critical drop-off point when you must reduce the amount of weight you're lifting to maintain the selected rep range or when you experience a drop of 2-3 reps from one set to the next.

The basic premise of the critical drop-off point, which should be credited to the late Canadian sprint coach Charlie Francis, is "never increase the quantity of stimulus at the expense of quality." It is pointless to perform sets in which the resistance is reduced so much that you don't train the appropriate motor units and don't create sufficient tension on the muscles to elicit gains. These additional "garbage sets" would also impede recovery by putting excessive strain on your nervous system and energy stores.

**9. Hormonal output and anabolic state.** To maintain the quality of the training stimulus, you should perform no more than 30-36 sets per workout. We've seen better results when the total number of sets is kept between 20 and 25. Bulgarian weightlifting coach Angel Spassov and former US national weightlifting coach Dragomir Cioroslan believe training sessions should not last over one hour, and 45 minutes would be even better. Bodybuilders also often respond best to brief workouts. Former Mr. Universe André Charette made his greatest progress on two 40-minute workouts per day, whereas bodybuilder Mike Payette made his best gains by training only once a day for about 52 minutes per workout.

**10. Muscle composition.** Muscles that are inherently fast-twitch respond best to more sets; muscles that are inherently slow-twitch respond best to fewer sets. Thus, you can perform more sets for the hamstrings (fast twitch) than for the soleus (slow twitch). Also, muscles not normally subjected to intense loading in daily activities, such as the neck flexors, respond better to fewer sets.

## Prescriptions for Increasing Muscle Mass and Relative Strength

One of the most controversial topics in resistance training is the optimal number of sets needed to perform to increase muscle mass. There are the low-set proponents such as Dorian Yates and the late Mentzer brothers, and the high-set proponents such as Arnold Schwarzenegger and Anthony Ditillo. Both camps are right. What matters is the proportion of high-set work to low-set work through a sound, periodized approach to training. However, we can make some useful generalizations, and Table 3 shows several

effective set-rep prescriptions for increasing muscle mass.

| <b>FOR INCREASING MUSCLE MASS</b>   |               |
|-------------------------------------|---------------|
| Intensity:                          | 60-82 Percent |
| Repetitions:                        | 6-20 RM       |
| Sets:                               | 3-6           |
| Rest Intervals:                     | 2-4 minutes   |
| Concentric Tempo:                   | 1-10 seconds  |
| Eccentric Tempo:                    | 4-10 seconds  |
| Total Set Duration:                 | 20-70 seconds |
| <b>TOTAL EXERCISES PER WORKOUT:</b> | <b>6 - 12</b> |

Table 3

Strength coaches often encounter the challenge of trying to design training programs to improve an athlete's strength without significantly increasing lean body mass. The type of strength they want is called *relative strength*.

Relative strength is especially important in sports that involve weight classes, such as boxing, wrestling, and weightlifting. Athletes in these sports must be as strong as possible at the lightest bodyweight. Relative strength is also important to athletes who require strength without excessive muscle mass, such as skiers, cyclists, figure skaters, gymnasts, and bobsledders. Despite being relatively light, skiers and bobsledders often have leg strength comparable to elite weightlifters and bodybuilders. Felix Belczyk and Cary Mullen are both World Cup medalists. Belczyk weighs 191 pounds and Mullen weighs 200 pounds, and both have front squatted 352 for 3 reps. Ian Danney of the Canadian bobsled team has front squatted 451 pounds, all the way down, and he weighed only 180 pounds.

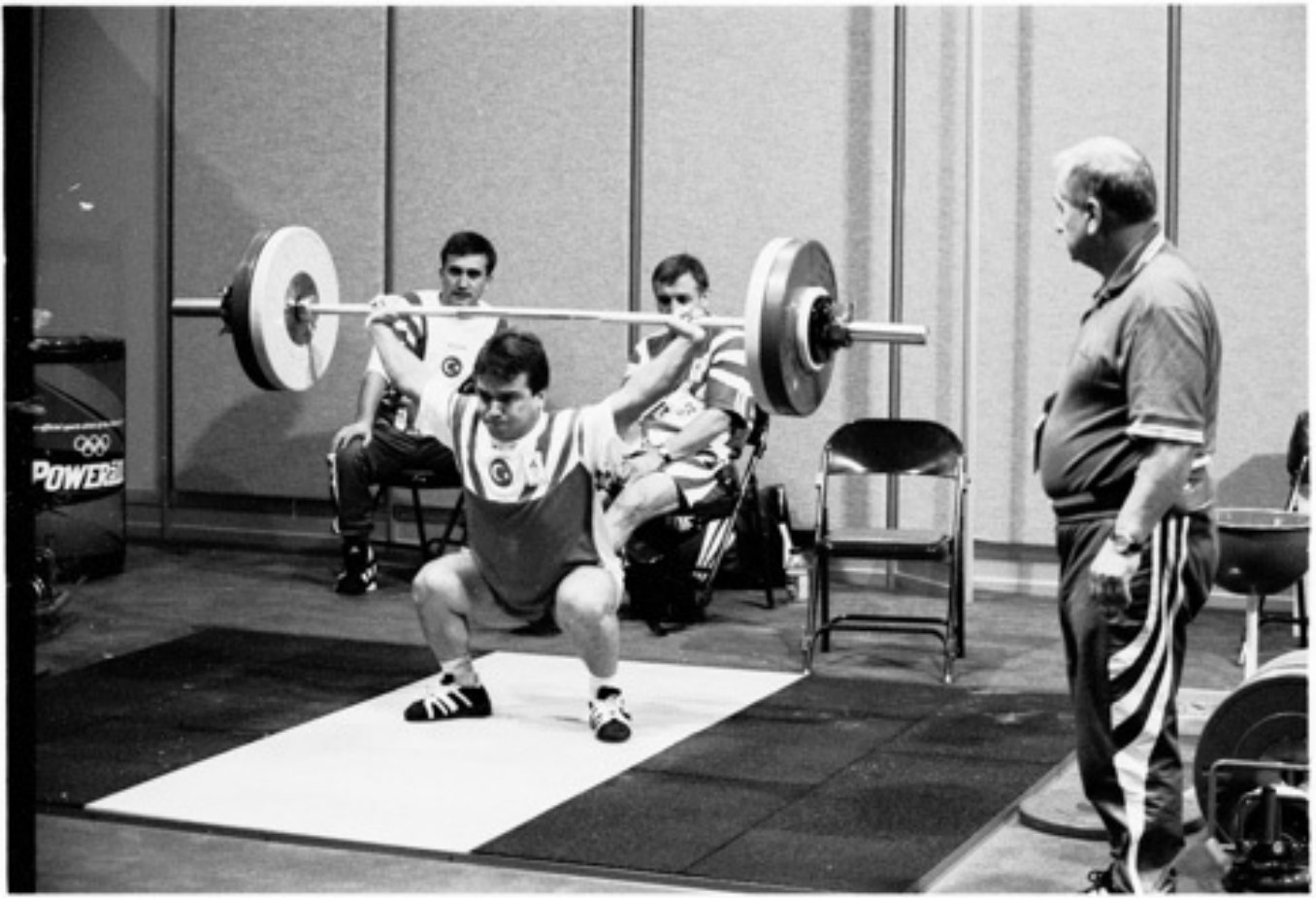
The neuromuscular basis of relative strength training involves performing brief but maximal voluntary contractions to improve the neural drive to the muscles. The great voluntary effort associated with such training recruits the highest-threshold motor units so as to make use of their greater strength and rate of force development. Near-maximal and maximal weights must be used. Table 4 contains set-rep prescriptions for relative strength.

| <b>FOR INCREASING RELATIVE STRENGTH</b> |                  |
|---|------------------|
| Intensity:                              | 85-100 Percent   |
| Repetitions:                            | 1-5 RM           |
| Sets:                                   | 5-12             |
| Rest Intervals:                         | 4-5 minutes      |
| Concentric Tempo:                       | 1-4 seconds      |
| Eccentric Tempo:                        | 3-5 seconds      |
| Total Set Duration:                     | Under 20 seconds |
| <b>TOTAL EXERCISES PER WORKOUT:</b>     | <b>6 - 12</b>    |

Table 4

Of course, this is a book primarily about bodybuilding. Relative-strength training produces minimal increases in size, so a bodybuilder should not use those methods except as an occasional means to introduce variety.

## Chapter 3: Tempo



Three-time Olympic champion Naim Süleymanoğlu is, pound-for-pound, the greatest lifter in the history of the sport. In the 132-pound bodyweight class, Naim snatched 336 pounds and clean and jerked 418 pounds.

As bodybuilders and other athletes reach higher levels of conditioning, they must address all the major components of training. From watching countless athletes train, we would say the single most overlooked component of program design is tempo.

Let's start with some definitions. *Speed of contraction* refers to the rate of movement of the implement or limb involved in any given strength exercise. In sport science circles, it is described or measured in terms of degrees per second. For simplicity, we measure speed of contraction as the time it takes to complete each phase of a repetition. We use the term tempo collectively to describe the total amount of time it takes to complete an entire repetition.

Simply prescribing a specific number of repetitions for a set does not ensure that the appropriate stimulus is being applied. For example, if two athletes are told to perform a dumbbell row for 10 reps, one might perform each repetition slowly and finish the set in 45 seconds, whereas the other athlete might perform the exercise as though they were trying to start a lawnmower and finish the set in 8.2 seconds before dropping the weight to the floor. Such variations make it difficult to determine the effectiveness of a workout because each athlete is receiving a different training stimulus despite performing the same number of reps.

German strength experts Rolf Feser and Lothar Spitz believe that athletes not only need to perform explosive ballistic contractions to create central nervous adaptations, but also need to use other types of training protocols. Pierre Roy, an accomplished weightlifting coach in Canada, used 5-second eccentric contractions for sets of 6 reps when he wanted one of his lifters to gain size in preparatory training periods.

There are also the writings of Soviet weightlifting coach Michael Rudolf Plukfelder, who trained weightlifting champions Vasily Alexeev and David Rigert. Alexeev was the first man to clean and jerk 500 pounds, won two Olympics, and broke 80 world records. Rigert broke 68 world records and won Olympic gold. Plukfelder was also a proponent of varying the tempo for strength enhancement, and his ideas were endorsed by Professor Alexei Medvedev, head coach of the Russian weightlifting team.

Many weightlifting coaches from the Eastern Bloc countries believe in variation of speed of contraction. One problem, however, was that researchers often were aiming to find one precise – “ideal” – tempo prescription. For example, Soviet researchers S.I. Lelikov and N.N. Saxanov published a paper in 1976 entitled “The Rate of Increase in Leg Strength Depending on the Tempo of Performing Squats.” The purpose of the four-month-long study, which involved 32 weightlifters of various strength levels, was to determine the best tempo prescription for increasing strength in the back squat.

In the study’s introduction the authors said, “There is no experimental research in either the weightlifting literature (or for other types of sports, for that matter) dealing with a comparative analysis of whether a fast, moderate, or slow tempo of performing exercises, under the natural conditions of training, is the most effective means for increasing strength.” One result of the study was that the group that trained using a moderate lifting tempo achieved the best improvement in strength gains.

While the authors are to be commended for recognizing the importance of manipulating the speed of contraction of repetitions, we have to be careful about inferring practical information from this study. Let’s expand on this idea.

Many sports scientists have tried to determine the optimal combination of sets and reps that will produce the best gains in strength. They would compare, for example, a protocol of 10 reps for 3 sets to a protocol of 5 sets of 5 reps. Instead, as Dr. Mike Stone and his colleagues did in the late ’70s, they should have been experimenting with workouts that varied set-rep protocols over the duration of the study. The bottom line is that there is no one single, perfect, “best” speed-of-contraction protocol. In the Soviet study, it would have been interesting to have one of the experimental groups perform a slow speed of contraction for the first half of the experiment, and then a fast speed of contraction for the second half.

When designing tempo prescriptions, there are some general guidelines you can follow that are backed by sport science. Slow-speed lifting brings about more metabolic adaptations than high-speed lifting. Training at faster speeds does not induce these changes. Also, performing slow reps builds the connection between the mind and the muscle, and they make a great finishing-off set.

An important step in reaching your ultimate goals in lifting is recognizing the importance of tempo. Remember the example of the two guys performing 10 reps in the dumbbell row? One completes the reps slowly, and the other fast. Doesn't it make sense that they would achieve different training effects? Of course. Although both are performing the same number of reps, the tempo is affecting other variables. For a bodybuilder, one of these variables is "time under tension," that is, the amount of time the muscles must contract to complete a set.

To develop maximum muscle mass, the optimal time a muscle should contract during a set should fall between 20 and 70 seconds. This range allows for a lot of variation, from sets consisting of 1 rep and lasting 70 seconds (brutal!) to sets involving 15 reps. This does not mean that bodybuilders should avoid performing shorter or longer sets, but that the majority of their sets should fall within this range.

## Reading Tempo Prescriptions

To achieve the appropriate training stimulus, you must adhere to the precise speed of movement for all aspects of a lift: eccentric, isometric and concentric. Instead of using such vague terms as "fast" or "slow," express tempo in workouts with a four-digit abbreviation – such as 4231. This is an extension of a 3-digit formula first popularized by Ian King, a strength coach from Australia, but strength coach Charles Poliquin added a fourth digit to encompass all major phases of a repetition to ensure the precise training stimulus. The formula that should be used is broken down as follows:

**The first number refers to the eccentric part of the exercise.** An eccentric contraction occurs when a muscle lengthens, such as when you lower the resistance during the descent of the squat. Eccentric training is often neglected by American strength coaches to the detriment of their strength training programs. In fact, research by renowned biomechanist Tom McLaughlin showed that the most successful powerlifters are those who have the best eccentric control of the weights they lift.

**The second number refers to the isometric pause in the stretched position.** This pause usually occurs between the eccentric (lowering) phase and the concentric (lifting) phase of a repetition, such as when the barbell makes contact with the chest during the bench press. Pauses in this "disadvantageous" position (i.e., poor leverage) of a lift increase intramuscular tension, which can further boost strength development.

**The third number refers to the concentric contraction.** The concentric contraction occurs when a muscle shortens, such as when you curl a barbell to your shoulders. If X is used in the formula, it implies explosive action with full acceleration. Obviously, it would be dangerous to use X for the eccentric contraction of exercises such as squats and bench presses, so you will only see the X used as the third number in these prescriptions. Likewise, using an "XXXX" prescription for a power clean, such as recommended by one misguided strength coaching certification, would suggest that the athlete would pull the weight off the floor as fast as possible, bounce it off their shoulders and then slam it to the floor – not exactly a safe training recommendation.

## **The fourth number refers to the isometric pause in the shortened position.**

This is the type of contraction that occurs at the end of the concentric phase, such as when a bench press is locked out. Pauses in this “advantageous” position (i.e., good leverage) also increase the recruitment of more fast-twitch fibers, which are the fibers that will provide the most increases in strength and power.

Putting it together, a 4213 tempo prescription for the bench press would mean you would lower the barbell to your chest in 4 seconds, pause for 2 seconds when the bar makes contact with your chest, press the weight to extended arms in 1 second, then rest 3 seconds when the barbell is locked out before performing another repetition.

This simple format enables you to take more precise control of the training stimulus. To achieve consistency between reps, it’s best to count at a speed that is similar to the action of a clock (e.g., one thousand and one, one thousand and two, etc.). This method will prevent counting erratically or too fast. The count should begin when the resistance implement (barbell, dumbbell or body part) starts moving, not before or after this period.

As an example of how to prescribe workout tempo, here is an excerpt from the training diary of Pierre Lueders, 1994 Overall World Cup winner in the bobsled. This is a three-week program designed to make large gains in leg strength, and Pierre certainly had strong legs. At a bodyweight of 220 pounds, Pierre power cleaned 352 pounds and did a rock-bottom front squat with 462 pounds!

### **A. Snatch Pull from Floor**

Week 1: 6 x (4,3,2,4,3,2), 30X1, rest 180 seconds

Week 2: 6 x (3,2,1,3,2,1), 30X1, rest 180 seconds

Week 3: 6 x (3,2,1,3,2,1), 30X1, rest 180 seconds

### **B. Front Squat**

Week 1: 4 x 5-6, 3211, rest 120 seconds

Week 2: 5 x 4-5, 3211, rest 120 seconds

Week 3: 6 x (2,2,2,3,3,3), 3211, rest 120 seconds

### **C. Russian Good Morning**

Week 1: 3 x 8-10, 3031, rest 120 seconds

Week 2: 3 x 6-8, 3031, rest 120 seconds

Week 3: 4 x 4-5, 3031, rest 120 seconds

### **D. Low Cable Pull-In**

Week 1: 3 x 10-12, 1011, rest 90 seconds

Week 2: 3 x 6-8, 1011, rest 90 seconds

Week 3: 4 x 4-5, 1011, rest 90 seconds

## The Cause for the Pause

The pause is an often neglected component of lifting speed. In the bench press it has been shown that pausing 4 seconds on the chest will dissipate virtually all the plyometric effect elicited in a heavy lift. In fact, it's estimated that during a bench press competition an extra 1-second delay for the judge's clap could make a 5 percent difference in the amount of weight lifted! In contrast to powerlifters, bodybuilders want to emphasize longer pauses in their training because the muscles must contract harder when the plyometric effect is reduced.

Because more muscle fibers are involved in lifting heavy weights, the most intense sets would consist of only 1 repetition performed with the heaviest weight you could manage. Consequently, training with slow sets of 10 reps technically should not be called *high-intensity* training but *low-intensity* training.

For the development of maximal strength, slow-speed training performed with heavy weights has a definite advantage over high-speed lifting. Slowing the movement increases both the duration of the stimulus and the levels of tension imposed on the muscle, factors that favor the development of strength and muscle mass. High-intensity, slow-speed training, which would be indicated by exercise prescriptions such as 4 x 4-6 on a 4161 tempo, will produce the following muscle-building effects: stimulation of the Type IIa fibers and increased muscle glycogen, CP, ATP, ADP, creatine, phosphorylase, PFK, and Krebs cycle enzyme activity – which collectively equate to more strength and muscle mass!

Studies have shown the superior value of varying lifting speed compared to keeping the speed of contraction constant throughout a program. To increase poundage at both high and low speeds, training must be performed at both speeds. Low-velocity training produces greater increments in force production at low speed than high-velocity training produces. However, high-velocity training alone does not produce changes as great as those produced by training that includes both high and low velocity.

For elite athletes, it may be necessary to vary lifting speeds to elicit a training response. Various world-class athletes have reported enhanced performance from systematically planned variations in the speed of contraction. For example, in hammer throwing, low-velocity work (e.g., slow-tempo deadlifts) has been beneficial for enhanced control of knee- and trunk flexion during turns; and high-velocity training (e.g., power snatch) is taught to enhance power in the release phase of the throwing movement.

The key in power training for athletes is to keep the repetitions low (generally 1-5) to recruit the high-threshold motor units. Training with higher reps, even while concentrating on acceleration, would still access lower-threshold fibers.

Regarding isokinetic equipment, although it allows you to train at a specific speed, it does so at a constant rate. One of the principal components of power is acceleration, and isokinetic equipment does not allow you to accelerate the resistance. In fact, long-term studies have shown that isokinetic training can reduce power.

While strength training at higher speeds is specific to the movements that occur in most



sports, this type of training must be performed only after obtaining a solid base of maximal strength. Eventually, many athletes could get great results from these types of explosive exercises, but they must first develop a base with slow-speed work. Then they must continue to use slow-speed movements throughout their athletic careers to ensure continued progress.

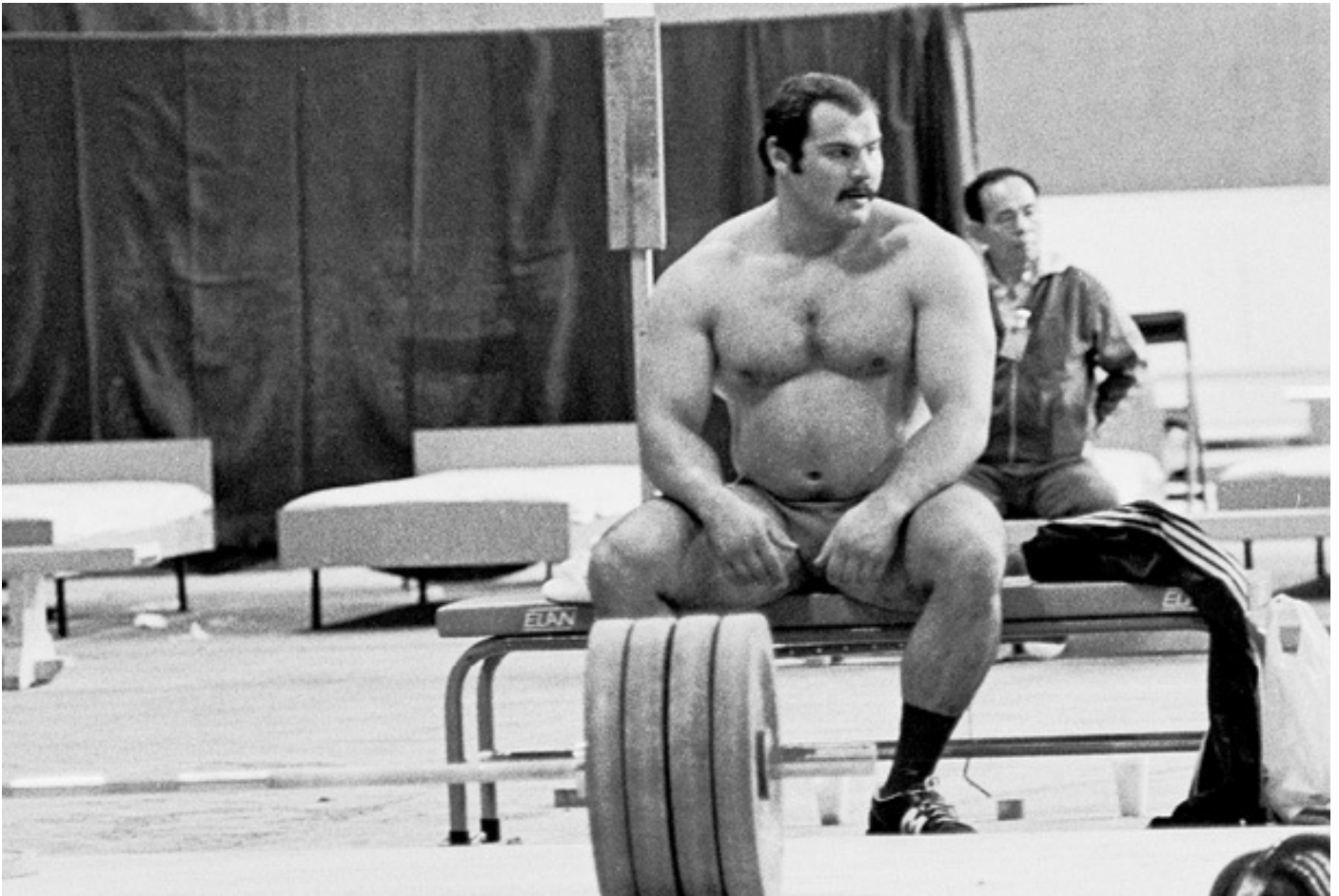
For a bodybuilder, one secret to success is to manipulate training speeds to create maximum adaptation. As such, slow-speed exercises should be emphasized over fast speeds because they make the muscles work harder by eliminating the use of momentum. However, slow-speed training should never be the only training speed employed. Muscles require a variety of stimuli for optimal results, and varying training speeds will provide much of the necessary variety.

As you proceed through this book, you will come across several routines for specific purposes. In each of these routines you will see a tempo prescription. Follow it. Counting through each phase of the lift keeps your concentration focused where it should be – on the components of the lift. You'll also begin to feel how slight variations in the tempo affect the exercise. In just a few weeks you'll be able to see positive differences from varying your lifting speeds.



Poliquin Group Gymnasium, East Greenwich, Rhode Island

# Chapter 4: Rest Intervals



Russian's Anatoly Pisarenko broke 13 world records on his way to winning four World Championships. He dispelled the myth that a large gut was needed to become the strongest weightlifter in the world.

The length of rest intervals is rarely addressed in workouts that appear in bodybuilding magazines and strength coaching publications. Although beginners can make progress on just about any type of program, trainees who overlook this important training variable will not make the progress they should.

The length of your rest between sets affects several factors that are important in the adaptations brought on by your training. The rest interval accomplishes the following:

1. Regulates the partial, or nearly complete, restoration of the short-term-energy substrates necessary for maximal performance.
2. Allows for the clearance of the metabolic waste accumulated in muscle tissue following intense muscular work.
3. Allows the central nervous system to recover.
4. Slows down the elevated metabolic rate and heart rate caused by exercise.
5. Affects the secretion of hormones that affect strength, fat loss, and muscle gains and to what magnitude.

Sports scientists recommend rest intervals of three to four minutes (and up to five minutes) for training with maximal loads: 1- to 5 reps maximums at 85 to 100 percent of

max. That approach prevents early fatigue and enables you to make repeated efforts at high intensity. In fact, weightlifting coaches will repeatedly change a lifter's attempts in competitions to allow for more rest time as the clock is stopped when the loaders change weights.

A guiding principle when developing strength is that the rest interval should be long enough to permit the nervous system to recover almost completely but not so long that you lose what's called the post-tetanic potentiation effect (PTP). PTP is the phenomenon by which your contraction strength potential is increased for five to 10 minutes after a heavy set because of greater neural activation. This concept became popular in the English-language literature after it was translated from Dietmar Schmidtbleicher's work from German in the early '80s.

The peak effect – that is, greatest potentiation – occurs about four minutes after a near-maximal contraction and then gradually wanes so that it's gone by around the fifth minute. Consequently, when training for strength, you should rest about four minutes between sets of an exercise – that is, assuming we're talking about a compound exercise. For isolation exercises, three minutes rest should suffice.

An individual's maximal strength has an impact on that phenomenon, however. If you can curl 155 pounds for reps, you may need four minutes rest; if you curl only 75 pounds for reps, three minutes rest should suffice.

With a properly designed strength session, you should become stronger on every set of an exercise – up to a point. That point occurs later for well-trained athletes. An intermediate trainee may reach it in 4 sets while an Olympian may reach it on the 8th set. When Bulgarian weightlifting coach Ivan Abadjiev spoke at the Eleiko Strength Summit in 2011, he reinforced the idea that weightlifters need to perform a much higher volume of maximal weights than lower-level lifters to fulfill their athletic potential.

The most important principle to consider about rest intervals and how they affect bodybuilding is that there is an inverse relationship between reps and rest: The more reps you perform, the lighter weights you must use and the less rest you need. This brings up the question "How much rest is enough?"

Most American exercise physiologists recommend a 1:5 work/rest ratio to train the ATP-CP system, which is the energy system involved in high-intensity muscular contractions. A 1:5 ratio means that whatever time it takes you to complete a set, it would take you five times as long to recover adequately from that set. However, not everyone is in agreement with the Americans in this field.

Canadian exercise physiologist Normand Gionet believes that a 1:5 ratio does not provide sufficient recovery for the ATP-CP system; he recommends a ratio of 1:12-18. The late Canadian sprint coach Charlie Francis was also a strong believer in long rest intervals. He suggests a ratio between 1:20 and 1:30!

Coach Francis says a nervous-system cell takes five to six times longer to recover than a muscle cell. This means that even though energy stores may be nearly replenished by a ratio of 1:5 or 1:6, your nervous system has not recovered enough to effectively activate

the fast-twitch fibers responsible for muscle growth. And if the nervous system cannot activate the fast-twitch fibers, what is the point of performing another set?

Although counting repetitions is a convenient way to determine work performed, it is more precise to consider how long it takes to complete a set. The amount of time it takes to complete a set is referred to as the “time under tension,” or “TOT.” As with reps, the longer a muscle is stressed, the less rest time is needed.

It's also important to vary (i.e., periodize) your rest intervals. Despite the established cause-and-effect relationship of varying rest intervals, failure to vary rest intervals limits adaptation to the training stimulus. This concept has yet to be validated in the scientific literature, but we believe that it positively favors the rate and magnitude of strength and size gains, especially with elite athletes.

In addition to reps and sets, there are several other factors to consider when determining rest intervals. Here are three of them: training experience, muscle mass and strength levels, and aerobic fitness.

**Training experience.** The ability to tolerate short rest intervals with loads in the 60-80 percent range (6-20 reps) is a function of years of accumulated training. The lactate buildup resulting from this type of training is tolerated by only the well-conditioned bodybuilder. Therefore, rest intervals must be shortened for advanced trainees only, as for beginners lactate buildup will interfere with proper exercise performance. In fact, to prevent excessively high lactate buildup, it's best to alternate upper- and lower-body exercises in your workouts.

**Muscle mass and strength levels.** The bigger and stronger the trainee, the longer the rest interval should be. There appears to be a direct linear relationship between the length of the rest interval and the bodyweight of the trainee. Thus, a heavyweight bodybuilder such as Mamdouh “Big Ramy” Elssbiay, who has competed as heavy as 316 pounds, would need a longer rest period than Francis Benfatto, who weighed 145 pounds less than Big Ramy.

**Aerobic fitness.** The more aerobically fit an athlete is, the shorter the rest interval should be – that's the theory. The problem is that an aerobically-fit individual is normally weaker and usually possesses minimal muscle mass. It's also common that these individuals tend to rush between heavy sets to maintain a high heart rate which decreases neural adaptation. Unfortunately, a high heart rate by itself does not lead to maximal gains in strength and mass.

## Putting Theory into Practice

A weightlifter or strength athlete must emphasize complete recovery, but a bodybuilder has two choices when selecting the rest interval: nearly complete recovery or incomplete recovery. To see the benefits of each, let's examine three types of training methods for an individual who can barbell curl 100 pounds 10 times on a 4011 tempo (every rep would take 6 seconds: 4 to lower the weight, no pause, 1 second to lift, and then pause 1 second before starting another repetition).

**Method 1: adequate rest and constant weight.** In this method a constant weight is used and you are given at least three minutes to recover, which allows almost all the energy stores to resynthesize by the end of every set. Assuming that your first set is a maximal effort, you will tend to fatigue two percent, or one rep per set, after three minutes. Here is how it looks:

Set 1: 100 pounds x 10, rest 180 seconds

Set 2: 100 pounds x 9, rest 180 seconds

Set 3: 100 pounds x 8, rest 180 seconds

Set 4: 100 pounds x 7, rest 180 seconds

**Results:**

Average weight lifted: 100 pounds

Total reps performed: 34

Time under tension: 204 seconds

Because the rest is more complete, this method enables you to use heavy weights on every set and, therefore, make more tensile demands of the contractile fibers. This higher tension leads to myofibrillar growth. These longer rest intervals have also been associated with greater testosterone levels in experienced athletes performing exercises that work large muscle groups.

**Method 2: adequate rest and decreasing weight.** In this method the rest interval is the same as in Method 1, but the weight is adjusted precisely from set to set to account for fatigue. Here is how it looks:

Set 1: 100 pounds x 10, rest 180 seconds

Set 2: 98 pounds x 10, rest 180 seconds

Set 3: 96 pounds x 10, rest 180 seconds

Set 4: 94 pounds x 10, rest 180 seconds

**Results:**

Average weight lifted: 97 pounds

Total reps performed: 40

Time under tension: 240 seconds

As with Method 1, the longer rest intervals increase the average amount of weight that can be used, but the decreasing weight has the advantage of increasing the time under tension. Because hypertrophy is related to time under tension with optimal loading, this would be the optimal system to force myofibrillar growth.

On paper this method looks great, but how many gyms do you know of that have training implements that can be decreased two percent at a time? (MedX machines can do this quickly with their double weight-stack design, but using only these machines would

seriously limit your exercise choices.) In most gyms you usually decrease weight in increments of five percent.

As a compromise, try decreasing the weight by five percent every two sets, which would result in the following performance: 100 x 10, 100 x 9, 95 x 10, and 95 x 9. This would change the average load to 97.5 pounds and the time under tension to 228 seconds.

**Method 3: inadequate rest and decreasing weight.** In this method only 60 seconds' rest is allowed, so that energy stores are not completely resynthesized by the end of each set. In this system you tend to fatigue at about 10 percent per set (4-5 reps). Here is how it looks:

Set 1: 100 pounds x 10, rest 60 seconds

Set 2: 90 pounds x 10, rest 60 seconds

Set 3: 80 pounds x 10, rest 60 seconds

Set 4: 70 pounds x 10, rest 60 seconds

### **Results:**

Average weight lifted: 85 pounds

Total reps performed: 40

Time under tension: 240 seconds

This option is often used by bodybuilders to achieve the “pump” sensation that comes with it and is associated with high levels of growth hormone and lactic acid. It also increases the storage of glycogen and phosphagens and the associated enzymes for the metabolism of these nutrients.

As with the first two methods, the third method creates hypertrophy, but not for the same reasons. While methods 1 and 2 are great for creating hypertrophy by favoring the growth of the contractile proteins, method 3 promotes hypertrophy through energy substrate storage. It follows that for maximum muscle mass, all three methods should be used. In other words, for optimal progress to occur in bodybuilding, you need to vary the rest intervals.

## **Super Results with Supersets**

Although four minutes rest between sets of the same exercise is generally best for strength, there are ways to manipulate that recommendation. If you alternate two exercises for opposing muscle groups you can get by with less rest time between sets, provided that you still keep four minutes between sets of the same movement. Applying that idea to seated dumbbell presses and loaded chin-ups, your workout could be designed as follows:

A1. Seated dumbbell presses: 6 x 4, 40X0 tempo, rest 120 seconds

A2. Weighted chin-ups: 6 x 4, 40X0 tempo, rest 120 seconds

Breaking down this superset even further, the workout would proceed as follows: set 1 of seated dumbbell presses, rest 120 seconds; set 1 of chin-ups, rest 120 seconds; set 2 of

seated dumbbell presses, rest 120 seconds; set 2 of chin-ups, rest 120 seconds; and so on. Keep the pattern until you complete all 6 sets of 4 reps. Although the rest time between sets is 120 seconds, you have more than four minutes of rest before recruiting the same muscle groups again.

If you have the antagonistic pairs contracting alternately (flexion followed by extension), as opposed to agonist contractions alone (precontraction of antagonists), you can often enhance full motor-unit activation in a muscle contraction.

Alternating between two antagonistic muscle groups or movements is the best way to train for strength. It makes for shorter rest intervals, a greater total volume of work per training session and a greater recruitment of motor units. But don't just take our word for it.

The September 2011 issue of the *Journal of Strength and Conditioning Research* published a study that investigated the effects of eight weeks of two types of heavy weight training protocols, one involving circuit training protocols and another using traditional strength training protocols. This study involved 33 participants, approximately 22 years of age, who had been performing resistance training for at least 12 months before the experiment.

The authors noted that both training groups were equally effective in improving maximal strength, peak power, and muscle mass. However, significant decreases in body fat occurred only in the circuit training group. Further, the circuit training group completed their workouts faster: 105 minutes of total training time compared to 55 minutes for 3 sets, and 125 to 78 minutes for 6 sets. In other words, circuit training enabled these subjects to achieve nearly identical results in approximately half the training time.

One of the most dramatic examples of how rest intervals influence a training effect is the German Body Composition program. The shorter rest intervals increase the production of growth hormone, and as such this type of protocol will help reduce body fat. The following is a three-week program designed for weight loss. Because aerobic exercise can compromise muscular strength, this workout utilizes weight training to elicit weight loss. The workouts divide the body into two parts, each trained twice a week.

### **Day 1 and 3**

#### **A1. Dumbbell Lunge**

Week 1: 4 x 15-20, 20X1, rest 45 seconds

Week 2: 4 x 15-20, 20X1, rest 45 seconds

Week 3: 4 x 15-20, 20X1, rest 45 seconds

#### **A2. Lat Pulldown to Sternum**

Week 1: 4 x 10-12, 3211, rest 45 seconds

Week 2: 4 x 10-12, 3211, rest 45 seconds

Week 3: 4 x 10-12, 3211, rest 45 seconds

#### **A3. Lying Leg Curl, Feet Neutral**



Week 1: 4 x 10-12, 5011, rest 45 seconds

Week 2: 4 x 10-12, 5011, rest 45 seconds

Week 3: 4 x 10-12, 5011, rest 45 seconds

#### A4. Decline Dumbbell Triceps Extension

Week 1: 4 x 10-12, 4011, rest 45 seconds

Week 2: 4 x 10-12, 4011, rest 45 seconds

Week 3: 4 x 10-12, 4011, rest 45 seconds

#### B1. Hamstring Leg Press

Week 1: 3 x 15-20, 2011, rest 45 seconds

Week 2: 3 x 15-20, 2011, rest 45 seconds

Week 3: 3 x 15-20, 2011, rest 45 seconds

#### B2. One-Arm Cable Row

Week 1: 3 x 10-12, 4011, rest 45 seconds

Week 2: 3 x 10-12, 4011, rest 45 seconds

Week 3: 3 x 10-12, 4011, rest 45 seconds

#### Day 2 and 4

#### A1. Dumbbell Squat

Week 1: 4 x 15-20, 2011, rest 30 seconds

Week 2: 4 x 15-20, 2011, rest 30 seconds

Week 3: 4 x 15-20, 2011, rest 30 seconds

#### A2. Pronated-Grip Front Lat Pulldown

Week 1: 4 x 10-12, 3011, rest 30 seconds

Week 2: 4 x 10-12, 3011, rest 30 seconds

Week 3: 4 x 10-12, 3011, rest 30 seconds

#### A3. Dumbbell Semi-Stiff-Leg Deadlift

Week 1: 4 x 10-12, 4021, rest 30 seconds

Week 2: 4 x 10-12, 4021, rest 30 seconds

Week 3: 4 x 10-12, 4021, rest 30 seconds

#### A4. Seated EZ Bar French Press

Week 1: 4 x 10-12, 3021, rest 30 seconds

Week 2: 4 x 10-12, 3021, rest 30 seconds

Week 3: 4 x 10-12, 3021, rest 30 seconds

B1. Low-Pulley Abduction, Standing

Week 1: 3 x 10-12, 3011, rest 30 seconds

Week 2: 3 x 10-12, 3011, rest 30 seconds

Week 3: 3 x 10-12, 3011, rest 30 seconds

B2. Seated Rope Rowing to Neck

Week 1: 4 x 10-12, 2111, rest 30 seconds

Week 2: 4 x 10-12, 2111, rest 30 seconds

Week 3: 4 x 10-12, 2111, rest 30 seconds

## **German Body Comp Training**

The German Body Comp program, or GBC, is a popular workout and is characterized by short rest intervals and multijoint movements to generate maximum growth-hormone production.

The program is based upon the pioneering research by Hala Rambie, a Romanian exercise scientist who defected to West Germany. Rambie made the important discovery that the lactic acid pathway is better for fat loss than the aerobic pathway. Rambie found that high blood lactic levels decreased blood pH levels, which in turn sends a message to the brain to accelerate its production of growth hormone. Higher growth hormone levels increase fat loss.

Not only does GBC result in greater fat loss than aerobic programs can produce, but it will not sacrifice strength and muscle mass. In fact, it can make you bigger and stronger. With aerobics, all you get is fat loss and weakness – why train your body to be weak?

How effective is the GBC program? We've seen men gain 12 to 18 pounds of muscle within 12 weeks while losing fat, and it's not uncommon for women to lose seven percent body fat in the same time period. Doug Weight, formerly of the St. Louis Blues, used a German Body Comp workout to transform his physique quickly. In just six weeks, the NHL star decreased his bodyfat by 4.32 percent while adding 11.5 pounds of muscle!

In addition to being great for anyone who wants to lose body fat, the GBC program is especially geared toward athletes because it improves muscular endurance. Law enforcement officers are prime candidates for the benefits of GBC, and high muscular endurance athletes such as speedskaters and hockey players have enjoyed success with this type of workout. In contrast, aerobic training does little to improve this type of endurance for most sports and will compromise strength and power – it's even been shown that upper body aerobic training can compromise jumping ability.

The GBC workout outlined in the book *German Body Comp Program* are designed for all levels of individuals. It's a mix of machines and free weights, with the exercises increasing in difficulty with the higher levels – along with the overall volume of training. To give you an example of how a GBC should be written, here's a three-week program for

an individual who has a considerable amount of training experience but can only train twice a week.

The workouts should be scheduled so that there is, at least, two days' rest between training sessions. So you could train on Monday and Thursday, or Monday and Friday. After completing six workouts, move on to a different training program. Note that each week the number of sets is increased, and the rest intervals are shortened, thereby increasing the difficulty of the workout.

#### A1. Split Squat, Front Foot Elevated, with Dumbbells

Week 1: 3 x 10-12, 40X1, rest 60 seconds

Week 2: 4 x 8-10, 40X1, rest 45 seconds

Week 3: 5 x 6-8, 40X1, rest 30 seconds

#### A2. Incline Bench Press

Week 1: 3 x 10-12, 40X1, rest 60 seconds

Week 2: 4 x 8-10, 40X1, rest 45 seconds

Week 3: 5 x 6-8, 40X1, rest 30 seconds

#### A3. Deadlift

Week 1: 3 x 10-12, 30X1, rest 60 seconds

Week 2: 4 x 8-10, 30X1, rest 45 seconds

Week 3: 5 x 30X1, rest 30 seconds

#### A4. Chin-Up, Supinated Grip

Week 1: 3 x 10-12, 30X1, rest 60 seconds

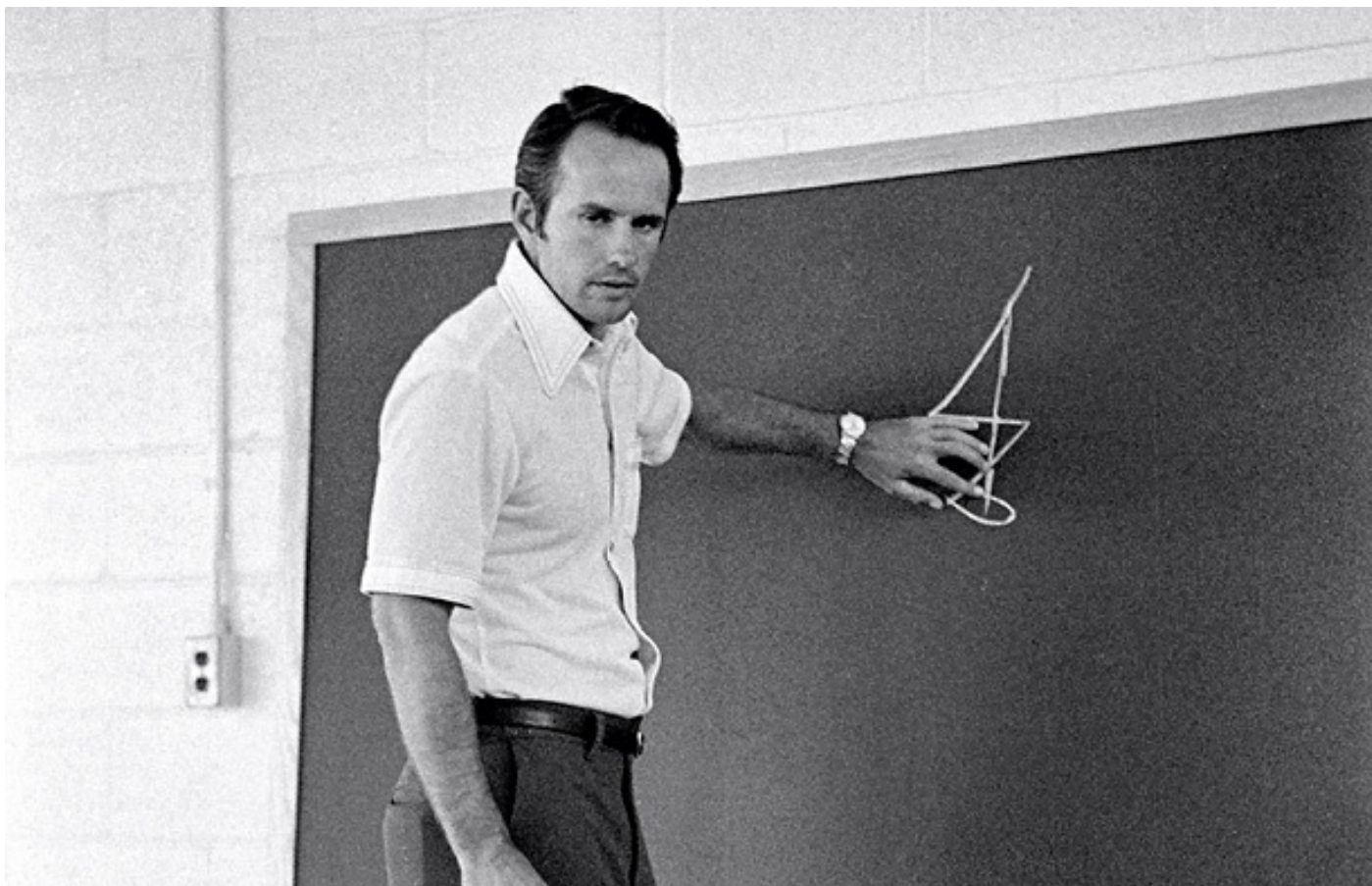
Week 2: 4 x 8-10, 30X0, rest 45 seconds

Week 3: 5 x 6-8, 30X0, rest 30 seconds

Don't be fooled by this workout – it is much more difficult than it looks, especially when you get down to the third week and are resting only 30 seconds between sets.

### **Intensify Your Training with Clusters**

Carl Miller is a weightlifting coach, but he is also a weightlifter with impressive accomplishments. For starters, at age 19 he broke the national teenage record in the snatch, and one of his coaches at that time was Frank Spellman, 1948 Olympic gold medalist in the 165-pound bodyweight class. At age 41, despite having had two spinal fusions, Miller snatched 281 pounds and clean and jerked 352 pounds at a bodyweight of 181 pounds. At age 61 he power cleaned 319 pounds and ran the 40 in 4.81 seconds.



**Carl Miller**

Pursuing coaching, Miller earned a master's degree in exercise science from the University of Arizona. After graduating, he coached weightlifting in South America for two years and in Japan for three years. In 1978, Miller was named head coach of the US Weightlifting Team for the World Championships. Miller should also be recognized as being one of the first persons to understand the Bulgarian weightlifting methodology and share it with the rest of the world.

In the '70s, Carl Miller wrote about the value of cluster training, a method that many strength coaches are only now discovering. Cluster training involves using prolonged repetitions between sets to increase the total weight used in the set and thus the overall intensity of the set.

Typically, cluster training works like this: If you can normally power clean 200 pounds for 1 rep and 180 pounds for 3 reps, try resting 15 seconds between single reps by pausing with the barbell on the floor between reps (not in the top position). You may be able to clean 185 pounds for 3 single reps, maybe even 190 pounds. The result is you are performing the same number of reps, but the intensity is greater – and likely the power output too. Plus, you will be training more of the higher-threshold motor units.

A 2012 study published in the *Journal of Strength and Conditioning Research* is the first we've found to test the effects of inter-repetition rest during multiple sets of the power clean. This study compared peak power output, force, and velocity in the power clean with no inter-repetition rest, or with either 20 seconds or 40 seconds of rest. Participants were trained college-aged men, and they performed 3 sets of 6 reps of the power clean at 80 percent of the 1RM. After each rep in the "no rest" group, participants returned the barbell

to the floor in a controlled manner and immediately performed the next rep. The subjects in the “rest” groups rested for 20 or 40 seconds in the start position of the power clean after they had returned the barbell to the floor.

Results showed that peak power significantly decreased by 16 percent during the “no rest” sets (i.e., there was a 16 percent drop in peak power from the 1st to the 6th rep of the set), compared to a decrease of 5.5 percent in the 20-second rest sets and to a decrease of only 3 percent in the 40-second rest sets. Peak force also decreased significantly in the “no rest” sets, whereas the other two rest groups maintained peak force throughout the set. Peak velocity of the bar also decreased significantly by 10 percent in the “no rest” group and dropped by only 3.8 percent and 1.7 percent in the 20-second and 40-second rest groups, respectively.

Researchers suggest that the short recovery between reps in the two inter-repetition rest models allowed for recovery of short-term energy substrates such as phosphocreatine. The 20-40 seconds of rest allowed participants in this study to almost completely resynthesize creatine and recover from the fatigue of the repetitions. This research confirms previous evidence that creatine is resynthesized in about 22 seconds.

Previous studies support mixing up training protocols with inter-repetition rest. A study of elite Australian rugby players found that using inter-repetition rest improves lower body power and velocity when training the power clean and squat. This study indicated that cluster training can lead to greater neural adaptations and the recruitment of more Type II muscle fibers.

Finally, a 2010 study on cluster training for the upper body found that this method allowed participants to perform a higher number of repetitions while maintaining the velocity of the lifting motion, even when fatigue would have become a factor in a traditional training scheme. The researchers concluded that cluster training is effective for developing power and speed for sports and should be programmed accordingly. Upper body cluster training can be used in sports such as wrestling, boxing, or judo, while lower body power may be enhanced for rugby, soccer or football, or for track and field throwing events.

The following is a sample arm workout using cluster training:

A1. 10-Degree Decline Close-Grip Bench press

3-5 clusters (5 x 1) @ 50X0 tempo, rest 10 seconds between reps and 120 seconds between sets

A2. Scott EZ Bar Semi-Supinated-Grip curl

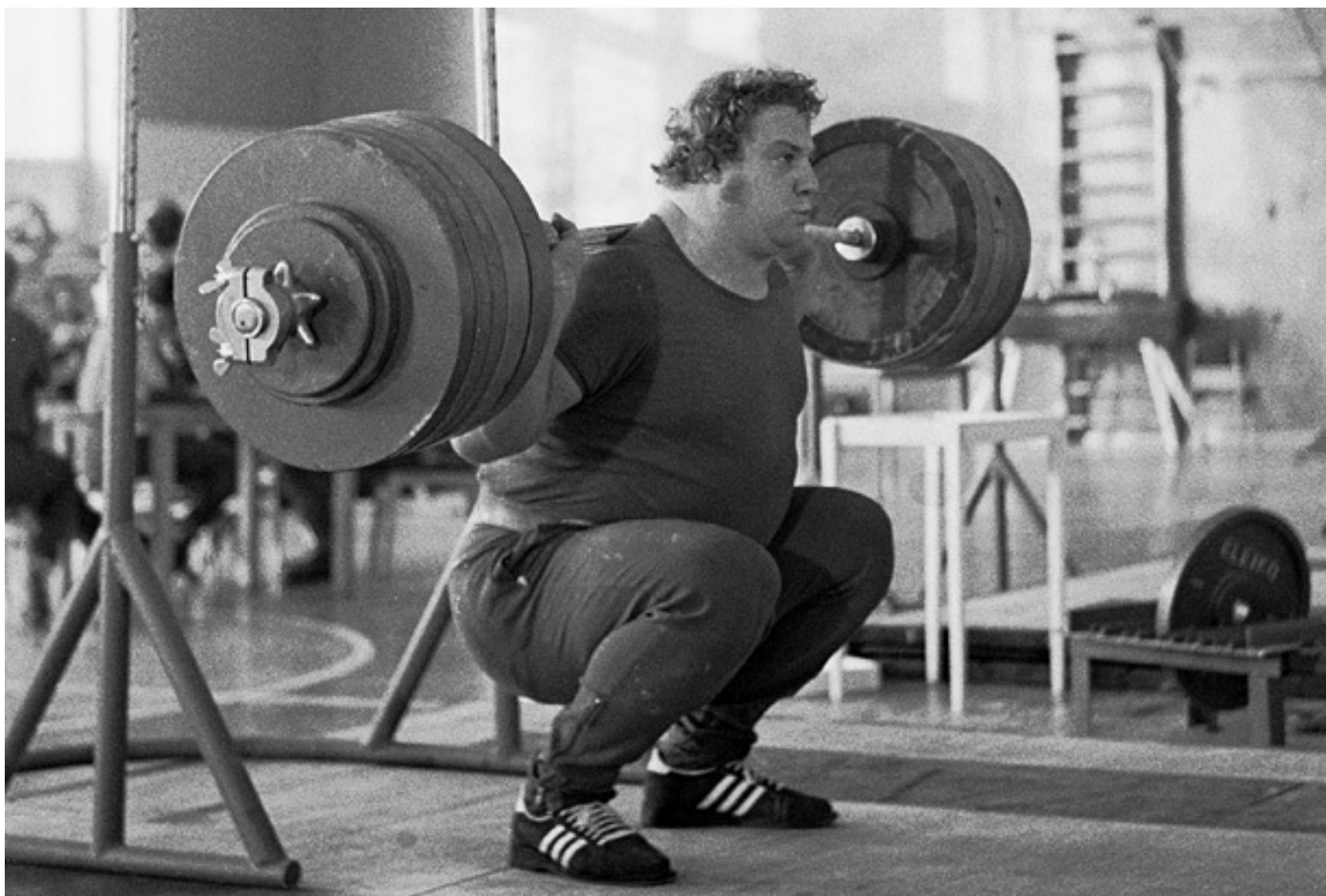
3-5 clusters (5 x 1) @ 50X0 tempo, rest 10 seconds between reps and 120 seconds between sets

When you are ready to give cluster training a try, you should increase the weight only if all reps and sets are successful. When you are ready to move up, a general guideline would be to increase the weight by 1 to 3 percent.

Hopefully, the abundance of empirical and scientific evidence available about the importance of rest intervals will encourage you to pay attention to it when designing your

weight training programs. Optimal rest intervals will make a big difference in helping you achieve your goals.

# Chapter 5: Frequency, Duration and Volume



Gerd Bonk from East Germany was the first weightlifter to clean and jerk 551 pounds (250 kilos). He won a silver medal at the 1976 Olympics and a bronze in the 1972 Olympics. He also broke the East German youth record for the shot put in 1967 with a result of 17.82 meters.

We live in a world where there are not enough hours to do everything that needs to be done. It's a world of compromise and sacrifice. If you want to become a champion bodybuilder, forget about every productive aspect of your life and just eat, sleep and live bodybuilding – and don't forget that this started out as a healthy endeavor.

In the latter scenario, consider the possibility that although it's a rarity, it is possible to become a champion bodybuilder and still have a life. *Hmmmm*, you say – *interesting concept...* . So, while we won't tell you what to do with all the time you'll have away from the gym, we will tell you how to best manage your time in the gym to produce maximum gains. To do this, you need to properly manipulate three critical elements of training: frequency, duration and volume.

## Training Frequency

To achieve maximum physical potential, most bodybuilders focus on providing the optimal amount of stimulus to the muscles. Train hard with forced reps. Train harder with negatives. Growl, grunt and scream – slap your training partners in the face and have them slap you back. Intensity has been the focus of today's bodybuilder, and there's no doubt that you have to train hard to get results. But intensity is only part of the growth equation. Recovery is the other.

Optimal recovery requires good nutrition, preferably with high-quality supplements such as fish oils and post-workout shakes, and determining how much training your body can handle. If you spend too much time in the gym, you risk injury and overtraining. If your workouts are too brief or too infrequent, your muscles will grow slowly or not at all.

One practical way to manipulate your recovery ability is to increase or decrease your training frequency, which is defined as the number of training sessions performed per week.

Old-timers will remember articles about Dave “The Blond Bomber” Draper’s workouts in *Muscle Builder/Power* magazine. Draper worked out practically every day and often performed 20 sets or more per body part. Draper’s training methods were extreme and indisputably constituted a protocol that enabled him to become one of the best bodybuilders of his era. It’s hard to argue with success, but that still leaves unanswered the question of whether or not Draper’s training methods will also work for you.

In the realm of track and field, Charlie Francis’s intelligent approach to training enabled his athletes to excel at the international level. His success established him as one of the greatest innovators in athletics. Even the East German coaches acknowledged his abilities. Part of Francis’s success can be directly attributed to his finding the optimal training frequency for each of his athletes. Francis’s philosophy is that there is no point in going back to the gym if you are not going to make progress. In other words, if you are not going to do an extra rep or add more weight, you might as well stay home.

In the realm of competitive weightlifting, there are conflicting schools of thought on training frequency. For example, Rick Weil, a world record holder in the bench press, recommends one session per week per muscle group. At the other end of the spectrum we find Russian weightlifters who train up to 12 times a week. The Bulgarians, who for three decades have competed on a level equal with the Russians, have pushed training parameters even further – often training 4-5 times a day!

The success of these various athletes indicates a debatable relationship between the actual number of training sessions needed to stimulate maximum levels of strength and the number needed for maximum hypertrophy.

It is common for competitive bodybuilders to perform multiple training sessions using a split routine (different muscles trained each day) or a split program (different exercises for the same muscle on the same day or successive days). Regardless of the system used, the training frequency for each muscle group is usually limited to three times per week.

The classic approach to training frequency has been to perform only three training sessions per week, on alternate days, for each muscle group. This equates to training each muscle group approximately once every 48 hours. Proponents of this training theory also believe that if muscle soreness interferes with performance during a subsequent workout, the intensity of the training was too high and should be reduced accordingly. This is a simplistic approach, and one that can still be found in the theory segments of many personal training certification courses.

For most individuals, 3-4 days’ rest between workouts for the same body part appears to



be, generally speaking, good advice. For optimal progress, however, you must consider the principles governing training frequency. Here are eight of them:

## 8 Principles of Training Frequency

**1. Frequency is recovery dependent.** A misconception perpetuated in strength training circles is the concept that one needs to train the same muscle every 48 hours or progress will be less than optimal. The opposite is true, as evidenced by the numerous world-class bodybuilders and powerlifters who are known to train a body part only once weekly.

Frequency is dependent upon your recovery ability at any given time. Failure to respect this rule may cause overtraining that could cause you to lose strength and muscle mass and come down with a variety of ailments that include lethargy and recurrent colds (Figure 2). Most bodybuilders train too frequently because they do not know how to assess their recovery ability or because they take too literally the slogan, “No pain, no gain.” However, provided you do an honest job and use the proper ratios of reps and sets, a frequency prescription of “twice per week, per muscle group” should work well. If you’re a more advanced bodybuilder, one workout every five days is probably the optimal training frequency.

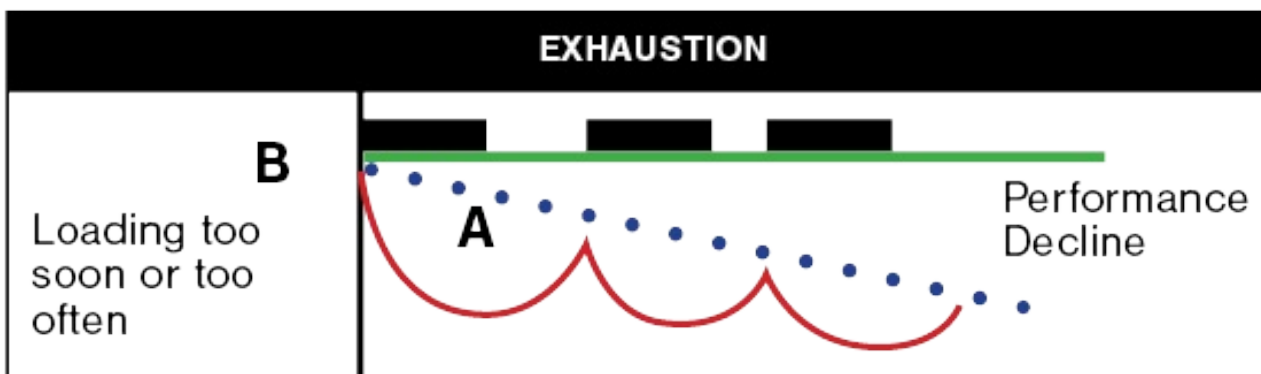


Figure 2

**2. Frequency is strength dependent.** The weaker the trainee, the more frequently they can train. In cases of rehabilitation, such as post surgery, training frequencies of 4-6 times a week are well tolerated. Female trainees, because of their lower levels of maximal strength initially, need greater frequencies of training to maximize their training progress. As female trainees reach higher levels of strength, the differences in training-frequency requirements diminish appreciably. This effect usually occurs after two full years of training (and when comparing gender differences, consider that at the 2012 Olympics a woman snatched 330 pounds and clean and jerked 407 pounds and lost!

**3. Frequency is muscle-group dependent.** Large muscle groups recover slower than smaller muscle groups, and muscles with a high percentage of fast-twitch muscle fibers recover slower than muscles with a high percentage of slow-twitch fibers. These facts have many practical applications. For example, while the soleus (predominately a slow-twitch, large-muscle group) may be trained two to three times a week, the hamstrings (predominantly a fast-twitch, large-muscle group) respond better to one or two training sessions per week.

**4. Frequency is exercise dependent.** Exercises that involve a small number of motor units, such as calf raises and wrist curls, can be performed more frequently than exercises that involve many motor units, such as squats. Exercises that involve a high percentage of motor units make greater demands on the central nervous system and, therefore, require longer recovery periods – it is not uncommon for powerlifters to rest ten days between intense deadlift sessions. Also, because multijoint exercises involve more muscles, they can create enough stimulus to ensure that strength and muscle mass are maintained in the secondary muscle groups. This is why someone who bench presses three times a week can see significant progress in their triceps development by performing isolation exercises for the triceps only once a week – the triceps are being worked during the bench press.

**5. Frequency is individualized.** Frequency is dependent on work capacity. Some individuals can handle prodigious training volumes, while others can handle only minimal volumes. With our clients, we look at their training response in their workout diaries, and increase or decrease their training frequency based on how fast they progress. For example, powerlifter Cathy Millen bench pressed every five days, squatted every seven days and deadlifted every ten days in a peaking phase. She was a world champion and held the world record in all these lifts. In contrast, former IFBB pros such as Joe Spinello and André Bilodeau made progress training twice a day with a four-days-on, one-day-off split. We have also seen pro bodybuilders who cannot train more than two days in a row without overtraining.

The solution to the dilemma is fairly simple; just ask yourself, “Am I improving?” If the answer is no, frequency has to go either down or up. And we should add that on average, it takes a good strength coach or personal trainer roughly 6-8 weeks to determine what methodology works best for an individual.

One of the major limiting factors in tolerating frequent workouts is the ability to load nutrients into the muscle cells, and this is likely mediated throughout a myriad of hormonal interactions such as with insulin, growth hormone and IGF-1. We’ve also found that bodybuilders with a high percentage of fast-twitch muscle fibers can rarely train two days in a row without overtraining.

**6. Frequency is repetition-bracket dependent.** The greater the intensity, the more rest is needed between workouts. Because intensity is partially determined by the number of reps performed per set, more rest days are needed between training sessions emphasizing low reps. Thus, if you are performing 2-3 reps per set, you may need 4-5 days’ rest between workouts for the same body parts – or even as much as 10 days! If you perform 15-20 reps per set, you can probably repeat the workout for that body part after 2-3 days.

If you are not improving, change your training frequency. Because most bodybuilders train too much, first try experimenting with reduced frequency. One reason that a few bodybuilders make progress for several weeks on heavy-duty programs is that they were so overtrained that the overtraining masked their true fitness level. Only when they reduced their training volume could hypertrophy occur. The fact is, there are not many

bodybuilders who can continue to improve on a frequency of 2-3 times per week per muscle group while holding down a regular job and dealing with other stresses of normal living.

Rather than thinking that only one frequency mode will suit you, realize that a variety of modes will stimulate greater growth. To paraphrase German philosopher Friedrich Nietzsche: “What does not kill me makes me stronger.”

**7. Frequency is influenced by adrenal stress.** All stressors have both general and specific effects on the body. If an athlete performs a set of squats, that activity has a specific stress on the muscle fibers, but it also produces general stress that triggers neural and hormonal responses. If the stress levels are too high, the body will not be able to adapt, and progress will cease or even regress.

Aerobic work is one of the worst offenders in creating adrenal stress. If an athlete is a marathon runner, then obviously a high level of aerobic work is necessary for that athlete to excel. However, aerobic work places considerable stress on the adrenal system, and the effects can significantly hamper progress in strength training. Although some studies suggest that a small amount of aerobic work will not affect strength gains, often these studies involve beginners or are performed for only a short period, making it difficult to yield information that would apply to advanced trainees.

**8. Frequency is dependent on nutritional intervention.** Numerous studies have established that one of the keys to optimal recovery is post-workout nutrition, which requires carbohydrates to lower cortisol levels and increase muscle glycogen. If the nutrition is good, a higher frequency of training can be tolerated.

## Training Duration

The next aspect of proper time management in the gym concerns the concept of duration. Duration can be defined as the time between the start of the workout and the finish of the workout, not including warm-up, stretching or cool-down. Duration is a result of the number of exercises, the number of sets, the duration of the sets (i.e., the speed of movement times the number of reps) and the duration of the rest periods.

Duration of training is essential to physical health. A study published in 2011 in the *International Journal of Epidemiology* found that intense physical activity such as strength training can help us live longer because it has protective effects on the body. The study was a meta-analysis of all previous studies on the connection between physical activity and mortality rates as classified by cause of death and age at death. The analysis included more than 1.3 million individuals and identified a very strong relationship between longevity and performing regular intense vigorous exercise for a total of more than 150 minutes a week. Let's move on to discussing how duration of training can influence a trainee's efforts to become bigger and stronger.

A modern trend in strength development is towards decreased duration of training time, an approach that has been referred to as the “Bulgarianization” of weightlifting. Endorsed by Russian, Romanian and Hungarian national weightlifting teams, this methodology is often

perceived as the “modern” way of training developed by Bulgarian National Weightlifting Coach Ivan Abadjiev, but it was already advocated as a superior form of training in the early 1950s by the American lifter Charles Ross.

Workouts exceeding the one-hour mark have been shown to be associated with rapidly decreasing androgen levels. This shift in androgens probably upsets the testosterone-cortisol ratio. Since this value is strongly correlated to strength gains, one may infer that training under depressed androgen levels is counterproductive, since the catabolic effects of the glucocorticoids would negate the anabolic effects of the androgens. Apparently, an hour break is sufficient to allow the testosterone levels to return to normal. This is why modern strength training has evolved to multiple daily sessions rather than the grueling two-hour workouts popularized in the Arnold days.

From an empirical point of view, multiple training sessions are associated with better recovery rates and enhanced concentration during the training sessions. Since maximal neural activation is essential for relative strength training, enhanced concentration would maximize the effectiveness of the training stimulus. However, you must consider that this type of multiple daily training workload may be realistic only for full-time sponsored athletes.

Once your warm-up is finished, if your workout takes longer than one hour you are making friends, not training! We’ve seen a few bodybuilders who were able to sustain full intensity for two-hour periods, but they reported better quality after shifting to shorter workouts. More important is the fact that most lifters who don’t grow are training for too long.

## **Training Volume**

The third element in time management, and the one that brings the other two principles together, is volume. Volume in strength training can be defined as the total number of repetitions completed in a given time frame. For example, if you performed 3 sets of 10 on 6 different exercises in a workout, the volume of that workout could be described as 180 reps ( $3 \times 10 \times 6 = 180$ ). This method of calculation is also commonly applied to a training week, month and year. To extend the above example, if four of the above workouts are performed in a week, the volume would be 720 reps ( $4 \times 180$ ). Over four weeks, the volume would be 2,880 reps ( $4 \times 720$ ), and over the year would be 34,560 reps ( $12 \times 2,880$ ).

Volume could alternately be described in terms of time spent on an exercise, time under tension, or number of sets. Russian weightlifting textbooks describe volume as the total amount of work performed in a specific period, such as a training session or a training week. Usually only lifts at or above 60 percent are recorded, as the lighter weights are considered part of the warm-up. If a lifter performed back squats for 5 sets of 5 reps and used 100 pounds, the volume of that exercise would be 2500 pounds. The Russians have determined precise volume levels for all levels of lifters, for all major lifts used in training, for levels of ability, and also for precise points within the training period. For example, if four workouts are performed in a week, the training volume for a typical week might be

divided as follows:

Day 1: 15 percent

Day 2: 23 percent

Day 3: 37 percent

Day 4: 25 percent

In the week before a competition, with the fourth day being the competition, a weightlifter would want to have the majority of the training volume at the beginning of the week. This would enable the athlete to be at their peak for the meet. Here is such a distribution:

Day 1: 54 percent

Day 2: 30 percent

Day 3: 16 percent

This method of assessing volume has been used with great success in the sport of weightlifting. However, when attempting to apply this method to strength training for hypertrophy, you may encounter certain problems. For example, this method assumes that all reps are performed at an identical speed and at a similar metabolic cost.

Contrary to what some bodybuilding authors have proclaimed, slow tempo does not increase the intensity of training. Instead, it prolongs the duration of the training stimulus, thereby increasing time under tension, which leads to hypertrophy. If a 5-rep set is performed that involves a 6-second eccentric contraction and a 6-second concentric contraction for each rep, the total time under tension is 60 seconds. That is similar in volume to a 15-rep set that includes a 3-second eccentric contraction and a 1-second concentric contraction:  $[15 \times 3] + [15 \times 1] = 60$  seconds. But if the reps method is used to assess the volume, there would be a significant difference between the two sets: 5 reps compared to 15 reps.

Furthermore, the metabolic cost of strength training exercise is normally associated with the size of the muscle mass involved. Therefore, 300 repetitions in the squat do not equal 300 curls; rather, 300 squats are more equivalent to 1,200 curls. The reps method assumes that a repetition of any exercise has a metabolic cost equivalent to that of a rep of any other exercise. This is more applicable to weightlifting, where the exercises are variations of the clean, snatch, jerk and squat. The assumption does not apply in bodybuilding, where smaller muscle groups such as the biceps and triceps are trained with dozens of adjunctive exercises.

One of the most important principles about training volume is this: Volume of training is always inversely related to intensity. In other words, you cannot work intensely and perform great amounts of work at the same time — when the volume is high, the intensity is low and vice versa. For example when working with loads exceeding 90 percent, one rarely exceeds a workout volume of 20 repetitions per exercise. While working in the 60 percent range, some trainees can easily do 10 times that volume (200 reps).

Another important principle is that for maximum hypertrophy, a greater volume of work is

necessary. When analyzing the training volumes of elite bodybuilders versus elite powerlifters and weightlifters, a greater volume of training is evident in the training of bodybuilders and is associated with more hypertrophy. This increased volume comes mainly from performing more exercises to allow the recruitment of a greater selection of motor units, hence inducing hypertrophy in a greater number of fibers.

When designing a specific program for a hypertrophy phase, you should measure your volume. If you use the reps method of volume assessment, the average number of reps per workout may be about 200 repetitions. If you use time as the indicator of volume, measure the length of the workout or number of training hours per week; for example, a one-hour workout. If you use the time under tension, 24 minutes might be reasonable (24 sets x 60 seconds = 24 minutes).

Research points to elevated levels of growth hormone in multiple-sets training versus single-set training, which may prompt a more anabolic environment. Maximal strength training methods (85 percent of 1RM) with their high-intensity resistance but low volume of work do not elicit substantial hypertrophy. Higher volumes of work (6 reps or more for multiple sets) are needed to ensure a critical concentration of intracellular amino acids to stimulate protein synthesis. However, this model has limitations since it assumes that all reps are performed at an identical speed and at a similar metabolic cost.

## **The 2 Percent Rule of Progress**

We've thrown a lot of information at you, but the bottom line regarding training frequency, duration and volume is that the best protocols are the ones that work for you! To help you determine what works, here's a practical guideline: the 2 Percent Rule of Progress.

Unless you are an advanced trainee, the 2 Percent Rule will apply to you. It states that every time you repeat a workout, you should be able to add 2 percent weight on the bar for the same number of reps or do an extra rep with the same weight. Thus, if you bench pressed 200 pounds for 8 reps in one workout, during the second workout you should be able to lift 204 pounds for 8 reps or lift 200 pounds for 9 reps. If you can accomplish this progression, or improve upon it, then your training frequency is appropriate.

When applying this rule, you should always compare the same sets of a given exercise. If you are performing 5 sets of 8 reps in the bench press, you would compare set 5 of the first workout with set 5 of the second workout, and so on. However, as you progress in strength, it becomes more difficult to make this level of progress. Thus, if you have seven years of training under your weightlifting belt, then the 2 Percent Rule would evolve into the 1 Percent Rule.

The philosophy behind the 2 Percent Rule is that you want to train hard, but only come back for another workout when you can lift more. That is, you have to wait for supercompensation to occur – and that may happen after three days to as many as 10 days per exercise.

Along with this principle, which many of the best bodybuilders of the past such as Bill Pearl and Reg Park understood, is that time under tension is critical to increasing muscle

mass. If you can squat 375 pounds for 1 rep and 300 pounds for 10 reps, increasing your 1-rep maximum to 475 pounds may not produce exceptional gains in muscle mass – compared to being able to perform 350 pounds for 10 reps.

To take this training principle to the next level, we'll share with you three basic options for frequency of training that reflect a variety of recovery abilities. The examples provided would be considered accumulation (high volume) phases in a training cycle.

## **Frequency Option 1**

This option, which works for about 20 percent of the population, consists of training the entire body on three nonconsecutive days a week. It's great for those who have very limited training time, such as Monday, Wednesday and Friday; or Tuesday, Thursday and Saturday.

### **Monday and Friday**

- A1. Back Squat, 3 x 15-20, 2010, rest 90 sec.
- A2. Lying Leg Curl, Feet Inward, 3 x 6-8, 4010, rest 75 sec.
- B1. Parallel Bar Dips, 3 x 10-12, 3010, rest 75 sec.
- B2. Close, Parallel-Grip Chin-Up, 3 x 8-10, 4010, rest 75 sec.
- C1. Incline Dumbbell Press, 2 x 10-12, 3010, rest 75 sec.
- C2. Seated Cable Rowing, 2 x 8-10, 4010, rest 75 sec.
- D1. Decline Triceps EZ Bar Extension, 2 x 10-12, 3110, rest 75 sec.
- D2. Incline Dumbbell Curl, 2 x 8-10, 4010, rest 75 sec.
- E1. Standing Calf Raise, 2 x 10-12, 2210, rest 60 sec.
- E2. Low Cable Pull-In, 2 x 10-12, 2020, rest 60 sec.

### **Wednesday**

- A1. Back Barbell Lunge, 3 x 15-20, 2010, rest 90 sec.
- A2. Dumbbell Deadlift, 3 x 12-15, 3010, rest 75 sec.
- B1. Back Step-Up, 3 x 15-20, 1010, rest 75 sec.
- B2. Back Extension, 3 x 12-15, 2012, rest 75 sec.
- C1. Incline Dumbbell Press, 2 x 10-12, 3010, rest 75 sec.
- C2. Seated Cable Row, 2 x 8-10, 4010, rest 75 sec.
- D1. Decline Dumbbell Press, 2 x 10-12, 3010, rest 75 sec.
- D2. One-Arm Dumbbell Press, 2 x 10-12, 3010, rest 75 sec.
- E1. Seated Calf Raise, 2 x 15-20, 2010, rest 60 sec.
- E2. Twisted Crunches on Swiss Ball, 2 x 10-12, 2020, rest 60 sec.

## Frequency Option 2

This option, which works for about 60 percent of the population, consists of a split workout with four training sessions per week. The basic rule is two days on, one day off, followed by two days on, two days off: Monday, Tuesday, Thursday and Friday; or Tuesday, Wednesday, Friday and Saturday.

### Monday and Thursday

A1. Cyclists Back Squat, 10,12,14,20 on a 2010 tempo, rest 90 sec.

A2. Lying Leg Curl, Feet Inward, 4 x 6-8, 40X0, rest 75 sec.

B1. Lunge, 4 x 10,12,15,20, 20X0, rest 90 sec.

B2. Romanian Deadlift, 4 x 10-12, 4020, rest 75 sec.

C1. Standing Calf Raise, 3 x 12,15,20, 1110, rest 60 sec.

C2. Low Cable Pull-In, 2 x 10-12, 2020, rest 60 sec.

### Tuesday and Friday

A1. Incline Dumbbell Press, 8,10,12,15 on a 3010 tempo, rest 75 sec.

A2. Close-Parallel-Grip Chin-Up, 4 x 8-10, 4010, rest 75 sec.

B1. Decline Dumbbell Press, 3 x 10-12, 3010, rest 75 sec.

B2. One-Arm Dumbbell Press, 3 x 10-12, 3010, rest 75 sec.

C1. Decline Dumbbell Triceps Extension, 3 x 10-12, 3110, rest 75 sec.

C2. Seated Offset Dumbbell Curl, 3 x 8-10, 3010, rest 75 sec.

## Frequency Option 3

This option, which works for about 20 percent of the population, is for those with superior recovery ability. This is a three-days-out-of-five training split, designed so that each body part is trained thoroughly once every five days – as a result, you have to train at least one day per weekend. For example, Monday, Tuesday, rest Wednesday, Thursday, rest Friday; followed by Saturday, Sunday, rest Monday, Tuesday, rest Wednesday; and so on. With these cycles, we often eliminate or drastically reduce the volume of one body part per phase to permit greater recovery or to concentrate on select body parts.

### Day 1

A1. 25-Degree Incline Dumbbell Press, 6,8,10,12 on a 2210 tempo, rest 100 sec.

A2. Lean-Away Parallel-Grip Chin-Up, 4 x 7-9, 5010, rest 100 sec.

B1. Flat Dumbbell Press, 3 x 10-12, 3010, rest 10 sec. (yes, 10 seconds!)

B2. Incline Cable Fly, 3 x 10-12, 5010, rest 100 sec.

B3. Seated Cable Rowing to Neck, 3 x 8-10, 3110, rest 90 sec.

B4. Decline Barbell Pullover, 3 x 15-20, 2010, rest 90 sec.



C1. Rope Cable Upright Row, 3 x 12-15, 3010, rest 75 sec.

C2. Seated Dumbbell Press, 3 x 8-10, 2012, rest 10 sec. (yes, 10 seconds!)

## **Day 2**

A1. Cyclist Back Squat, 10,12,15,20 on a 2210 tempo, rest 100 sec.

A2. Leverage Leg Press, 4 x 4-6, 5010, rest 100 sec.

B1. Lying Leg Curl, Feet Inward, 3 x 4-6, 5010, rest 100 sec.

B2. Romanian Deadlift, 3 x 4-6, 5010, rest 100 sec.

C1. Standing Calf Raise, 3 x 7-9, 3110, rest 90 sec.

C2. Seated Calf Raise, 3 x 7-9, 5010, rest 90 sec.

## **Day 3**

A1. 10-Degree Decline Close-Grip Bench Press, 6,8,10,12 on a 3210 tempo, rest 75 sec.

A2. Seated Zottmann Curl, 6,8,10,12 on a 3210 tempo, rest 75 sec.

B1. Rope French Press, 3 x 10-12, 3110, rest 10 sec. (yes, 10 seconds!)

B2. Pronated Triceps Pressdown, 3 x 15-20, 3010, rest 90 sec.

B3. Scott Gorilla Bar Reverse Curl, 3 x 7-9, 4010, rest 10 sec. (yes, 10 seconds!)

B4. Low Rope Supinated Curl, 3 x 12-15, 3010, rest 90 sec.

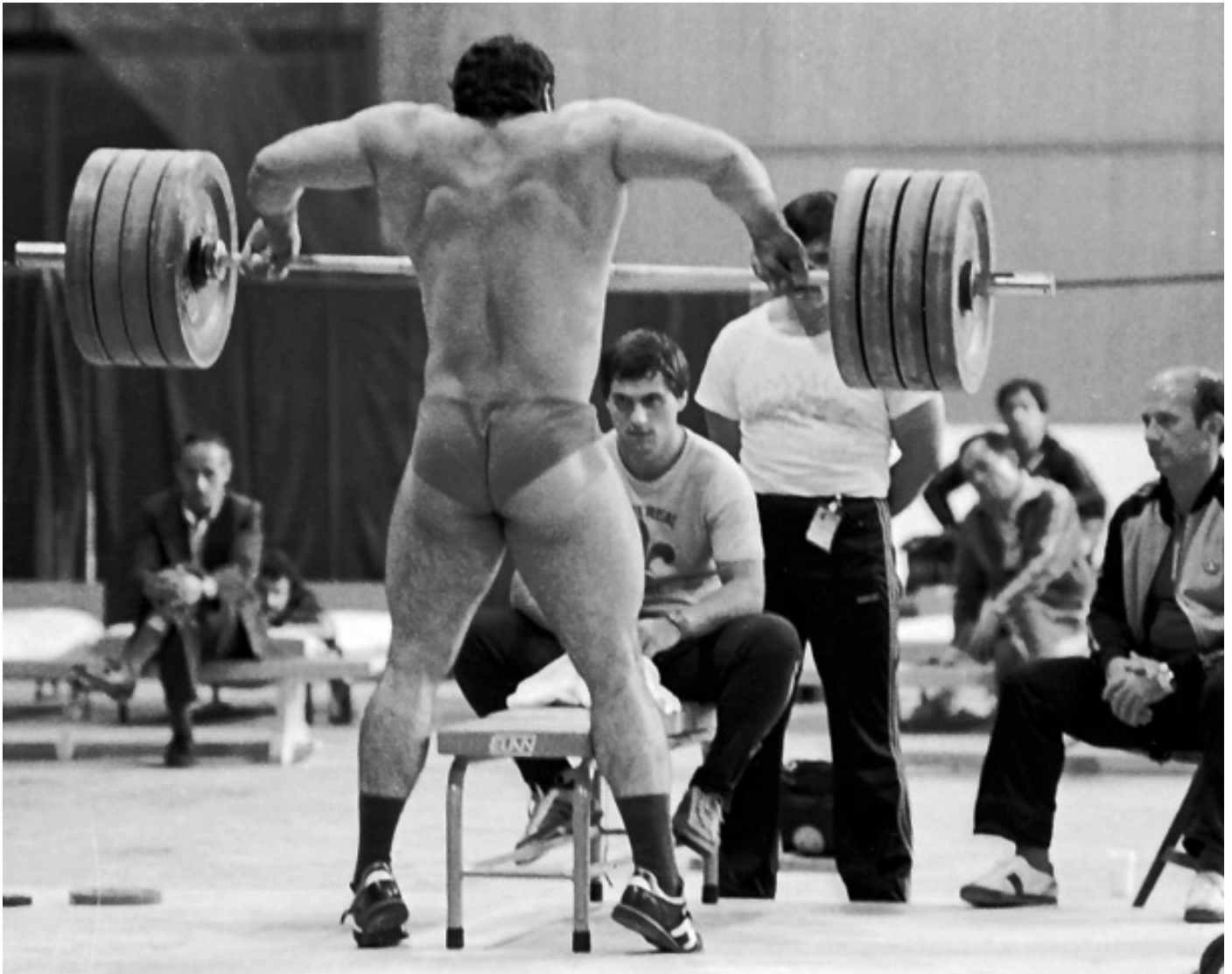
C1. Decline Pronated Wrist Curl, 3 x 12-15, 2010, rest 60 sec.

C2. Gripping Machine, 3 x 15-20, 2010, rest 60 sec.

So there you have it: three options for manipulating training frequency. One of them will work best for you.

Always take into consideration the 2 Percent Rule of Progress as a practical tool to guide your training decisions for optimal results.

# Chapter 6: Exercise Selection and Exercise Order



The tremendous upper back and erector spinae muscles of Russian weightlifting champ Anatoly Pisarenko are evident in this great photo by Bruce Klemens. His best lifts included a 454-pound snatch and a 584-pound clean and jerk, both world records at the time.

Much of the training talk in gyms is about which exercise will best target a specific muscle. Many such exercises will be covered in Part II, but before getting into those chapters, you need to understand the following principles of exercise selection.

**End goal.** You must keep the end goal in mind. If your quads are weak, it may be because your upper quads are more developed than your lower quads. If that is the case, you should focus on exercises that work the VMO – and even the calves. Arnold did not have exceptional leg development in his early years as a bodybuilder. In his later years, however, he had great VMO and calf development, and this development led to an overall more symmetrical physique. Likewise, if you have a thick waist, working the shoulders can give your torso a greater V-taper.

Back to Arnold: When he came to America, it was obvious that his weakness was his calves – that was made clear when he lost the 1966 NABBA Amateur Mr. Universe to a

much smaller but symmetrical Chet Yorton. Upon the advice of his idol Reg Park, Arnold made calf training a priority in his training. He worked his calves as hard and as long as any other body part, rather than pumping out a few sets of light calf raises at the end of a workout. And to further motivate himself, he cut his pants off at knee level to call attention to his weakness. The result of his commitment was a pair of diamond-hard calves that stretched the tape to 20 inches.

**No “best” exercise.** There is no such thing as a “best” exercise for a body part. Virtually all exercises are good, providing that you include sufficient volume and intensity of loading. However, if time is a limiting factor, some exercises are known to recruit more motor units.

For example, parallel bar dips recruit a greater proportion of the motor-unit pool of the triceps cross-section than, let’s say, triceps kickbacks. Another example comes from the work of Canadian sports physiologists showing that the incline curl and Scott curl produce greater motor-unit recruitment than the standing barbell curl, which in bodybuilding circles is sometimes called “the king of biceps mass exercises.” This is probably because incline curls and Scott curls permit greater neural drive to the elbow flexors since the postural muscles don’t fire as much during these exercises due to the support provided by the benches.

Various modern assessment tools such as the MRI and the integrated EMG are now making exercise selection decisions much easier. (An excellent book on the use of MRIs in exercise is *Target Bodybuilding* by Per Tesch.) These tools can assess the percentage of the muscle cross-section activated by various exercises. From the data from various studies using these devices we now know that decline triceps extensions with chains are far superior to triceps kickbacks in activating the triceps.

Instead of providing a “best exercises” list, we list some of the better exercises for a specific body part. For example, three superior exercises for the triceps are lying barbell triceps extensions with chains, parallel or V-bar dips, and overhead French presses. For the biceps, here are three great exercises: incline dumbbell curls, Scott narrow-grip barbell curls and 80-degree seated Zottman curls.

**Hormonal response.** Another factor to consider in exercise selection is the hormonal response. Although back squats and leg presses are used to train many of the same muscle groups, the human growth hormone (HGH) response is not the same. For instance, a 10RM workload yields the highest response in the leg press, whereas a 25RM workload has the greatest effect in the back squat. The variation in the HGH response to these exercises is probably due to the differing mechanics of the two lifts. The larger hormonal responses associated with exercises involving large amounts of muscle mass – squats, for example – are partially responsible for indirect strength in untrained muscle groups, even the forearm extensors. So, how does this apply to training?

When designing workouts for maximal weight loss, you want to get the greatest hormonal response. For that purpose choose exercises that are multijoint and that especially affect the lower-body muscles. To maintain a high level of intensity throughout such a workout,

and because it takes longer to recover from lower-body exercises, alternate between upper- and lower-body exercises.

**Agonists and antagonists.** It is critical to train the antagonist of the targeted muscle group. The muscle that causes the primary movement is called the agonist, or prime mover (i.e., the contraction of this muscle is responsible for the movement). As this contraction occurs, the opposing muscle, the antagonist, is relaxed. Thus, when you curl a weight, the biceps is the agonist and the triceps is the antagonist; but when you perform a triceps pressdown, the triceps is the agonist and the biceps is the antagonist. By having the agonist and antagonist contract alternately (such as in a set of an elbow flexion exercise followed by a set of an elbow extension exercise), you enhance the ability to achieve full motor-unit activation in a muscle.

Programs emphasizing only specific muscle groups will produce muscle imbalances between the agonist and antagonist muscles, thus disrupting body alignment and predisposing the trainee to injury. Neglecting to train the antagonists is counterproductive to the development of an athlete's maximal strength, starting strength and explosive strength. What happens is weak antagonists send inhibitory signals to the brain that shut down force output in the agonists. Compound exercises such as squats and deadlifts simultaneously train various muscle groups, thus minimizing the probability of muscular imbalance. However, be wary of overlapping compound exercises, which are different exercises that work the same muscle. Examples include overlapping the squat and deadlift, the jerk and overhead press, and the bench press and close-grip bench press. Overlapping often is the cause of overuse injuries and extremely slow rates of progress.

**Stabilizers and fixators.** It's important to determine which muscles act as stabilizers or fixators in your training goal. Stabilizers and fixators describe the function of muscles when they are used to anchor a body part so that the prime movers have a stable base to pull or push from. One pitfall of machine training is that the movement patterns are predetermined for trainees, thereby reducing the work of stabilizers and fixators and limiting their opportunity to grow in strength.

Quite often, improperly trained small stabilizing muscle groups will prevent the trainee from increasing the load on a compound exercise. This is because if the stabilizers perceive excessive tension on the prime movers, they will shut down neural output in the prime movers. The problem can be corrected by identifying the deficient area and training it with specific exercises at the end of the workout.

Adam Nelson, Olympic champion in the shot put, neglected his external rotator muscles and suffered because of it. The muscle imbalances he developed from incomplete training caused shoulder pain that prevented him from performing several important exercises, such as the power snatch. However, after several weeks of performing specific exercises for the external rotators, he power snatched 286 pounds for 3 reps; after six months of training, he increased his incline bench press, using a 3-inch-thick bar, from 385 to 525!

**Strength curve.** Consider that for long-term development, you need to maintain strength gains over the entire shape of the natural strength curve, which is the amount of

force a muscle can exert at specific angles. Strength is not gained evenly throughout the strength curve, as certain angles are more trainable than others. For example, at X angle of lumbar extension, if you gain X percent in strength, you will gain Y percent at XXX degrees of lumbar extension.

Trainees who are diagnosed with tendonitis often have abnormal soft-tissue tension that manifests itself at the tendon level, even though there is nothing wrong with the tendon. Often this condition can be alleviated by an assortment of soft-tissue techniques, but the problem will resurface eventually unless the trainee takes steps to correct the imbalance in the strength curve. For example, bodybuilders who overemphasize the mid-range of the strength curve, such as by doing only barbell curls and seated dumbbell curls, will find that the soft-tissue tension that is masquerading as tendonitis. This condition will often go away by switching the curl's point of torque. For example, close-grip Scott curls will emphasize the beginning point of the elbow flexion, while spider curls will influence the end of the range of motion.

**Thick-bar training.** We can't emphasize enough the value of using thick implements to increase the effectiveness of the strength training process. We strongly believe in using extra-thick dumbbells (2 to 2 1/2 inches) and barbells (3 inches). This is not an entirely new concept. Alan Calvert, one of the fathers of weight training, recommended it in 1924 in his book *SuperStrength*. We highly recommend thick bars and dumbbells for all upper-body exercises, and even for deadlifts. Thick-bar pressing movements (e.g., seated press, incline press, bench press) should be done in a power rack with safety pins, as the trainee may drop the bar at first. Many advanced trainees will experience new growth in mass and strength when switching to thick bars.

We are proponents of thick-bar training for bodybuilders for two main reasons: First, it increases motor-unit activation. The more motor units you recruit and the higher their firing rate, the faster you gain in strength. One of the mechanisms responsible for the enhanced recruitment could well be the fear factor: In the 3-inch bench press, for example, one must concentrate on not dropping the bar. Chiropractors and neurologists were consulted on what they judged was the exact mechanism responsible for the strength increase. The best answer that anyone has come up with is that the thick handles may inhibit an inhibitory reflex. If you inhibit an inhibition, you are stronger. When doing thick-bar work, you can't shift effortlessly into the mental "autopilot" with which most reps are completed. Everybody we know who trains using thick bars finds they can handle 10-12 percent more weight when they return to the smaller-diameter handles.

Second, thick-bar work increases grip strength and forearm development because the fingers, wrists, thumbs and forearms are more challenged by the bigger diameter. You will find that the muscles that adduct the thumbs will be quite sore when you start using these bars. For chins and rows, you will find that using straps will become unnecessary. Hence, your strength will be more functional. Try doing chins or curls with oversize bars for a new kind of training effect for the elbow flexors. Tape, foam or plastic pipe (or a combination) can be used to thicken your bars. One elite female judo athlete trained by one of our coaches could do 5 chin-ups. After six weeks of incrementally increasing the

diameter of her chin-up bars (by adding tape to the bar every workout), she did 5 chin-ups with 45 pounds attached to her waist.

**Changing exercises.** As a general guideline, exercises should be changed every six workouts for optimal progress (Table 5).

| GENERAL GUIDELINES                 |                         |
|------------------------------------|-------------------------|
| TRAINING AGE (No. of years)        | RATE OF EXERCISE CHANGE |
| 1                                  | 6-8 Weeks               |
| 2                                  | 4-6 Weeks               |
| 3                                  | 2-4 Weeks               |
| 7                                  | 5-7 Days                |
| Note: These are general guidelines |                         |

Table 5

Consider this is only a mathematical average because there is a wide array of differences among individuals. Elite athletes such as Adam Nelson need to change their exercises more frequently because their bodies adapt so quickly. Beginning and intermediate athletes may be able to use the same exercises for a month without experiencing a drop-off in progress. Another key factor that influences the rate of change is the nature of the exercise. The upper body needs more frequent changes in exercises than the lower body. Thus, a bench press improvement cycle would call for more variations than a deadlift- or squat - improvement cycle (Table 6).

| EXERCISES THAT OVERLOAD SPECIFIC AREAS OF THE ELBOW FLEXORS FORCE CUVE |                      |            |     |             |            |
|--|----------------------|------------|-----|-------------|------------|
| Day  | Exercise             | Reps/ Sets | Day | Exercise    | Reps/ Sets |
| 1  | Dumbbell Bench Press | 10 x 3     | 1   | Back Squat  | 8 x 4      |
| 2  | Dumbbell Bench Press | 10 x 3     | 2   | Back Squat  | 8 x 4      |
| 3  | Dumbbell Bench Press | 10 x 3     | 3   | Back Squat  | 8 x 4      |
| 4  | Dumbbell Bench Press | 10 x 3     | 4   | Back Squat  | 8 x 4      |
| 5  | Incline Bench Press  | 4 x 5      | 5   | Back Squat  | 8 x 4      |
| 6  | Incline Bench Press  | 4 x 5      | 6   | Back Squat  | 3 x 6      |
| 7  | Incline Bench Press  | 4 x 5      | 7   | Front Squat | 3 x 6      |
| 8  | Incline Bench Press  | 4 x 5      | 8   | Front Squat | 3 x 6      |
| 9  | Bench Press          | 8 x 4      | 9   | Front Squat | 3 x 6      |
| 10   | Bench Press          | 8 x 4      | 10  | Front Squat | 3 x 6      |
| 11   | Bench Press          | 8 x 4      | 11  | Front Squat | 3 x 6      |
| 12   | Bench Press          | 8 x 4      | 12  | Front Squat | 3 x 6      |

Table 6

As machines are especially popular with bodybuilders, we'll take a quick look at some of the most popular units for the upper body and lower body.

## A Bodybuilder's Guide to Resistance Training Machines

Anyone who visits our training facility will see Olympic lifting platforms, Olympic bars with bumpers, thick bars, thick-handled dumbbells (lots of thick-handled dumbbells!) and strongman equipment. But they will also see an abundance of exercise machines, often a half dozen or more machines for one body part. There are many good reasons to equip your facility this way.

It's important to have exercise machines because these are often the primary tools that our trainers have to work with. Also, many of those attending our seminars either are gym owners or are trainers who have the ear of those involved in purchasing equipment for the gyms where they work. Because it's not unusual for some machines to cost several thousand dollars (in fact, top-of-the-line pec decs can cost nearly \$3,000!), it's great for our trainers to be able to try out these machines and compare their features and functions. Plate loaded or selectorized? Fixed handles or adjustable handles? Chrome plating or chrome-look paint? There are a lot of features and functions to consider, and nothing beats pumping out a few reps on a machine to help you make the best decision.

One problem with many exercise machines is that the designers of the machines often do not have a background in biomechanics or they fail to consult those who do have such credentials. For example, one way to cut the manufacturing costs of an exercise machine is to have fewer parts. A fixed backrest costs less than an adjustable backrest, and fixed handles cost less than handles that rotate. While cutting corners may be a smart financial decision, these compromises inevitably affect the function of the machine. Look for companies that they have carefully thought out the design of their machines as it relates to biomechanics and do not compromise function to save a few dollars.

Although it takes only a few seconds to master the basic lifting techniques of machine exercises, it's necessary to follow some guidelines to get the most from your workout and to ensure maximum safety. Here are a few guidelines that apply to several popular resistance training machines.

**Abdominal crunch and torso twist.** Crunch machines allow you to perform abdominal crunch exercises with resistance, either from a seated or a reclined position. Compared to free-weight crunches, these machines enable you to more easily perform this exercise with additional resistance. The major problem with crunch machines is that when the legs are anchored, as in most of these crunch machines, you increase the activation of the muscles that flex the hip and, therefore, you can hyperextend the spine. To minimize the involvement of the hip flexors, always perform these exercises slowly and avoid gripping with the heels. As for the torso twist machines, this type of exercise places extreme shearing forces on the disks and does little to work the obliques, as these muscle fibers are primarily aligned diagonally to the torso.

**Biceps curl and triceps extension.** One problem with these machines is that often in an attempt to cut corners, the manufacturer skimps on the machine's ability to adjust to different body types. The seats should be adjustable on all these units, and it's best if there are some adjustments on the handles to fit different arm lengths. If a specific machine

causes pain in the wrists or elbows and you have no indications of soft-tissue damage, you should stick with handles that are attached to a cable as they often provide the most comfortable feel for the most people.

**Hack squat.** The hack squat, a favorite of Mr. Olympia competitor Tom Platz, has much greater hip involvement than the leg press. One EMG study showed that compared with the squat, the hack squat movement produces similar effects on the vastus lateralis and more strongly works the glutes and biceps femoris (the hamstring muscle involved in knee flexion). When it comes to involving the lower back (erector spinae), the hack squat produces less involvement than the squat produces but more than the leg press.

To be truly effective, machine hack squats require strong development of the vastus medialis muscles and extremely good stability of the knee joints. Unfortunately, less than 5 percent of trainees fit in that category, and therefore relatively few people can make significant gains from machine hack squats. Hack squats are effective only when they are performed over a maximal range of motion. However, trainees often compromise on range due to any number of reasons, such as laziness, a low pain threshold or the need to show off how much weight they can pack on the bars. For any or all of these reasons, they practically guarantee themselves poor results.

Machine hack squats seem to be more effective when you rise progressively on the balls of your feet during the descent. Once you reach the bottom position, concentrate on pushing off the balls of your feet to further activate the vastus medialis muscles. As you ascend, progressively lower your heels to the platform. Also, you should avoid hack squat machines with a short backrest as they will not adequately support the lower back. (With some of the popular ones in the '70s, the backrest was so short that the pelvis would roll under and cause hyperextension of the spine.

**Hip thrust.** The hip thrust is similar to the angled back squat, but the athlete faces the machine. It has been a popular exercise among football strength coaches, as they believe it is more similar to the positions that occur in tackling. The same safety precautions apply with the hip thrust as with other exercises performed on the hip sled machines. However, because the back is not supported in the hip thrust, it is much easier for the back to flex.

**Leg curl.** The first leg curl units included an apparatus called the iron boot. This was a metal boot that was attached to the feet, and a bar that passed through a hole in the boot allowed additional weights to be attached. Gravity would come into play and ensure that the leg curls were performed from a standing position.

The leg curl units with iron boots were superseded by machines with a flat surface so that you would perform the leg curls from a prone position. The design of this type of leg curl machine caused the lower back to hyperextend. You could reduce the problem by placing a rolled-up towel under your hips and concentrating on tightening your abs to stabilize your pelvis, but this wasn't a foolproof solution. Eventually, these machines were replaced with a V-shaped bench that minimizes the pressure on the back. Other back-friendly options are to use the standing, seated or kneeling variation of leg curl machines.

**Leg press.** In the early days of the iron game, athletes would perform vertical leg presses



by balancing the weight across their bare feet (and things got even worse when this practice was replaced with performing squats while standing on a Swiss ball!). It wasn't long before vertical leg press machines were developed with guided rods to provide stability. Horizontal machines followed, but the most popular are the incline versions. Design variations make it difficult to compare one's performance on one machine to that on another, but there is no question that considerably more weight can be used with these machines compared to the weight you can lift in squats. Mr. Olympia winner Ronnie Coleman could squat with 800 pounds and incline leg press with 2,300 pounds for 8 reps.

The leg press emphasizes the quadriceps, especially the vastus lateralis. The advantage of leg presses is less stress on the lower back because the back is stabilized. As such, those with lower back injuries or medical conditions that make squatting painful, such as scoliosis, often can perform the leg press without discomfort. Because of the stress of heavy back squats on the lower back, to get enough work on the legs many powerlifters include leg presses. Among the powerlifters who have reportedly performed leg presses are Steve Goggins, who squatted 1,102 pounds at 242 pounds bodyweight, and Andy Bolton, a superheavyweight who squatted 1,213 pounds.

The biggest concern with these machines is being careful not to allow the weight to be lowered to a point at which the lower back is rounded at the bottom – compare this movement to the harmful stress that occurs by performing a rounded-back deadlift. This is one reason you should only use machines that require you to start with your legs straight, because you can determine exactly how far you can bend your knees safely. Conversely, if you start the exercise with knees bent, you have a tendency to jerk the weight and create adverse pressure on your lower back.

If only for the variety they offer to keep your motivation high, machines have a legitimate place in the gym. And while they may not transform you into The Hulk, machines do provide a way to work your muscles while recovering from whatever damage you've done by pushing yourself too hard in sports or in everyday life. This brings us to the concept of exercise order.

## **The Science of Exercise Order**

The expression “circuit training” was formally introduced in 1953 by physiologists at the University of Leeds in England to describe a system of integrating several components of fitness into a single workout. This was a dramatic shift from the traditional approach of athletic and physical fitness training of that time.

Traditionally, strength training and energy system training were performed in separate training blocks. For example, an athlete might run in the morning and perform gymnastics or some resistance training in the afternoon; or they might alternate between days, such as by performing strength training on Monday, Wednesday, and Friday, and running on Tuesday, Thursday and Saturday, with Sunday being a day of rest.

One characteristic of traditional strength training is that all the reps for an exercise are completed before moving on to the next exercise. This is referred to as station training, and is ideal for complex movements, such as the Olympic lifts. This concentration of

exercises enables athletes to focus better on technique. A weightlifter might perform 10 sets of snatches, followed by 10 sets of clean and jerks, followed by 10 sets of squats. Athletes will often rest 2-4 minutes between sets, which means such a workout could last for two hours. Circuit training uses a different approach.

Rather than establishing rest intervals between sets, a circuit combines several exercises, usually about 10, so that no two muscles are worked at the same time. The idea is that the workouts are faster and also produce greater aerobic benefits. It's also a time saver. Whereas the 30 sets performed by an Olympic lifter with station training would take about two hours, 30 sets of a circuit training workout could be completed in 45 minutes.

There are two major drawbacks with circuit training: (1) any breaks between exercises take the body out of the aerobic zone and (2) the lack of significant rest periods reduces the amount of weight that can be lifted. As such, circuit training is appropriate for general fitness training but is inferior to doing strength and energy system training separately.

A better method of training, which is a variation of circuit training, is called supersets. A superset is a pairing of two different exercises. Pairing agonist and antagonist muscle groups is the most common form of supersets, but you can also superset exercises for the same muscle groups to upgrade the training stimulus. The two major types of these supersets use the principles of pre-exhaustion and post-exhaustion.

**Pre-exhaustion supersets.** With pre-exhaustion, a muscle is first fatigued by a single-joint exercise and then further exhausted by performing a multijoint exercise involving the same muscle group. You could perform biceps curls followed by chin-ups, or lateral raises followed by behind-the-neck presses. It's an amazingly effective training system for stimulating muscle growth.

Pre-exhaustion is a training principle that was introduced to the bodybuilding world in 1968 by Robert Kennedy in *Iron Man* magazine. Nautilus founder Arthur Jones popularized this form of training, and he was obsessed with finding the most painful ways to use this training system.

Jones liked the pre-exhaustion method so much that he even designed several of his early Nautilus machines to combine two exercises into one to minimize the amount of rest time between sets. For example, he designed a leg extension/leg press machine and a lateral raise/overhead press machine. Possibly because these machines were much more expensive than single-station units and because fewer gym members could use them at one time, these units are no longer being produced.

When selecting exercises for this type of training, consider that for optimal development of muscle mass, isolation exercises that recruit few motor units are not as effective as compound exercises. As such, close-grip bench presses are more effective than dumbbell triceps kickbacks to use for pre-exhaustion. This is not to say you should never perform these inferior isolation exercises, but they should not be emphasized as much.

**Post-exhaustion supersets.** A post-exhaustion routine is a great plateau buster. As the name suggests, this is a type of superset in which you first perform a compound exercise and then follow it with an isolation exercise that taps into the same motor pool of the

muscle you want to focus on.

To get the most benefit from this variation of supersets, select an exercise that recruits a lot of motor units and follow it with a superior isolation exercise, such as a Scott curl or a split squat lunge. Just remember that wimpy exercises such as triceps kickbacks or side adductor raises are not allowed. Two examples of effective combinations of exercises for post-exhaustion supersets are close-grip chins followed by low incline dumbbell curls, and parallel bar dips followed by overhead rope extensions.

One key to effective program design is knowing how to design supersets. Mastering this aspect of training will enable you to achieve your goals as fast as possible.

# Chapter 7: Recovery



Mike MacDonald held the world record in the bench press in four bodyweight classes at the same time! He popularized the use of the cambered bar for bench pressing, which is U-shaped in the center to enable the elbows to drop lower when the bar touches the chest.

It's easy to focus all our attention on the “work” of working out – the vein-popping effort, the sweat-drenched final rep and the pain of making gains. We sometimes forget that it's only after the weight is racked that the muscle begins to grow. When this crucial recovery time is overlooked or underrated, the unfortunate result is stagnant workouts and mediocre gains.

When it comes to obtaining the best results from the recovery process, today's most advanced thinking advocates short workouts. Nearly every expert agrees that the time in the gym must be less than an hour. The only point they disagree on is how many of these workouts you should have in a week or even in a day.

Research on hormonal response to exercise indicates that once your warm-up is finished and you have begun your first working set, you should leave the gym within one hour. The physiological rationale concerns the androgen fluctuation during the workout.

Workouts exceeding the one-hour mark are known to be associated with rapidly decreasing androgen levels. This shift in androgens probably upsets the testosterone-cortisol ratio. Because this value is very strongly correlated with strength gains, it's easy to see that training under depressed androgen levels is counterproductive – specifically, the catabolic effects of the glucocorticoids negate the anabolic effects of the androgens.

Research shows that a one-hour rest is sufficient to allow testosterone levels to return to normal. This is why the approach to strength training has evolved from the two-hour workouts advocated so heavily in the '70s to multiple sessions daily.

Excessively long workouts are immuno-suppressive; that is, they lower the power of the immune system. This is why overtrained athletes tend to come down with colds and other viral diseases so frequently. It was shown in an Australian study that the athletes most often affected with mononucleosis were triathletes, swimmers, and rowers – athletes who are submitted to prodigious volumes of work by their coaches.

Depending on the training intensity and the athlete, 2-10 days of recovery are necessary for tissue repair and protein synthesis. If the training stimuli are too far apart, the overcompensation will fade away (involution). If the training stimuli are too close, then overcompensation does not happen and strength diminishes. Similarly, if maximal-intensity stimuli are overemphasized, a state of general exhaustion may occur. For this reason you should be careful not to increase stress by having workouts that are too long; instead, maximize overcompensation by alternating high- and lower-intensity stimuli.

All stressors have both general and specific effects on the body. For example, a bodybuilding session will trigger specific adaptations in your body (such as larger and stronger muscle fibers and an increase in white blood cells). But these effects will also function as stressors and will trigger a general response from your body through various neural, hormonal and other biochemical means. If several stressors are imposed on your body concurrently – a condition called cross-sensitization – the total effect may be more than your systems can handle. The result is exhaustion and impaired recovery.

Now that we've established the importance of recovery, let's look for ways to enhance it. One way is to train twice a day; another is through appropriate supplementation.

## **Twice-a-Day Training: Better Gains, Better Recovery**

A few decades ago when a 500-pound bench press or running 10 seconds flat in the 100 meters was a big deal, training once a day and perhaps only three days a week was enough to get the job done. That was then, but to compete at the highest levels today requires much more time in the gym. You may be wondering if it's possible to maintain a high quality of training with longer workouts? The answer is no – but you can train harder and longer without doing marathon workouts. You simply increase the frequency of training.

In football, one of the preseason traditions is training twice a day in what are known as “two-a-days.” Part of the rationale for doing so much work in a single day is to learn as many new skills and plays as possible, but it also serves as a message to players that it's time to get serious about the game.

Other sports also make use of the concept of multiple workouts, but for other reasons. Distance runners, for example, often require a large volume of training that is difficult to perform all at once and at a high level. Rather than running 10 miles straight, they might do a morning run of three miles, and then a primary workout of seven miles later in the day. Splitting up their training this way prevents them from getting lazy – if they go for a long period without a run, they start thinking twice about whether this type of commitment

is worth the investment in time and energy.

Another lesson in the recovery mechanism comes from Bulgarian weightlifting tradition. In the '70s and for the next three decades, the Russians and Bulgarians dominated world weightlifting.

Bulgarian training takes into account evidence that the level of testosterone peaks about 15 minutes into a workout and remains at that level for about 30 minutes – adding up to 45 minutes, which Bulgarian trainers believe is the optimal duration for training. After 45 minutes, they take a break. Ivan Abadjiev, who popularized this concept, would keep his athletes using the heaviest weights possible in workouts lasting about 45 minutes. However, to obtain sufficient volume of training to make continual progress at the highest levels of the sport, Abadjiev found that his athletes needed to train at least twice a day – sometimes up to five times a day.

Most elite Olympic medalists train in multiple sessions a day (and are submitted to rigorous doping control as well). But let's get real: There's optimal training, and there's the fact that training five times a day is not practical for most athletes, regardless of their sport. However, it is often possible to train twice a day.

There are numerous factors that explain why training twice a day is a shortcut to gains. From a physical perspective, it maximizes anabolism. Because testosterone and cortisol both come from the same raw material – pregnenolone – you want to avoid long workouts that deplete the pregnenolone and interfere with testosterone production. From a psychological perspective, training twice a day allows for greater concentration during workouts. No matter how driven you are, excessively long workouts affect your mind. Eventually, you will not look forward to your workouts, and your desire to train hard will diminish.

A study in the 2012 *European Journal of Applied Physiology* shows that training twice a day increases the ability to produce force at high speeds. By training in a shorter double session, you will be able to sustain maximal force output better than by training longer only once a day. Researchers suggest double-session training is so effective because it increases neuromuscular function and leads to greater motor unit synchronization so that the nervous system can co-activate numerous muscle groups to produce force quickly over and over.

Because training volume increases anabolic hormone output, multiple training sessions are great for natural trainers. Conversely, the one-set-to-failure approach of the so-called high-intensity proponents produces an inferior hormone response. This is why (despite the fact that such workouts can result in progress for short periods, especially in overtrained athletes) We cannot recommend that type of training for long periods for any bodybuilder or strength athlete.

We are firmly convinced that athletes can get more out of their training if they commit to training twice a day; however, career and family commitments may make it impractical to participate in such an extensive training schedule. If you do have the time to train twice a day, we have several options and guidelines that will help you maximize your results,

depending on your goals.

**Be patient.** It can take up to six months to fully adapt to training twice-a-day, although highly-motivated athletes can adapt fully within three months. We suggest you increase your training volume gradually, such as by starting with two 20-minute workouts a day. You can also start by just focusing on the weak body parts; for example, any areas that were deficient in a structural balance test. The results will encourage you to progress to the entire body.

**Keep it short.** Excluding warm-up time, your workouts should initially be no longer than 40 minutes – training longer would be counterproductive. As your body’s recovery ability increases, you can increase your workout time to 60 minutes, but no more.

**Take long rests between workouts.** You need to take plenty of time between workouts to achieve an optimal training effect – we suggest about 4-6 hours between training sessions. This time spread is critical. If you use a shorter one, you will be too fatigued; and if you use a longer one you will negate the effects from the nervous system activation received in the morning workout.

Exercise scientists refer to this phenomenon as a supercompensation effect, which is a theoretical model that describes the body’s response to stress: a decrease in an individual’s fitness preparedness followed by a resistance phase in which the body adapts to a higher fitness state (Figure 3). Even though supercompensation usually refers to a longer training period, such as a few weeks, it can also occur after a single workout (because after a few hours the nervous system will rebound to a higher level).

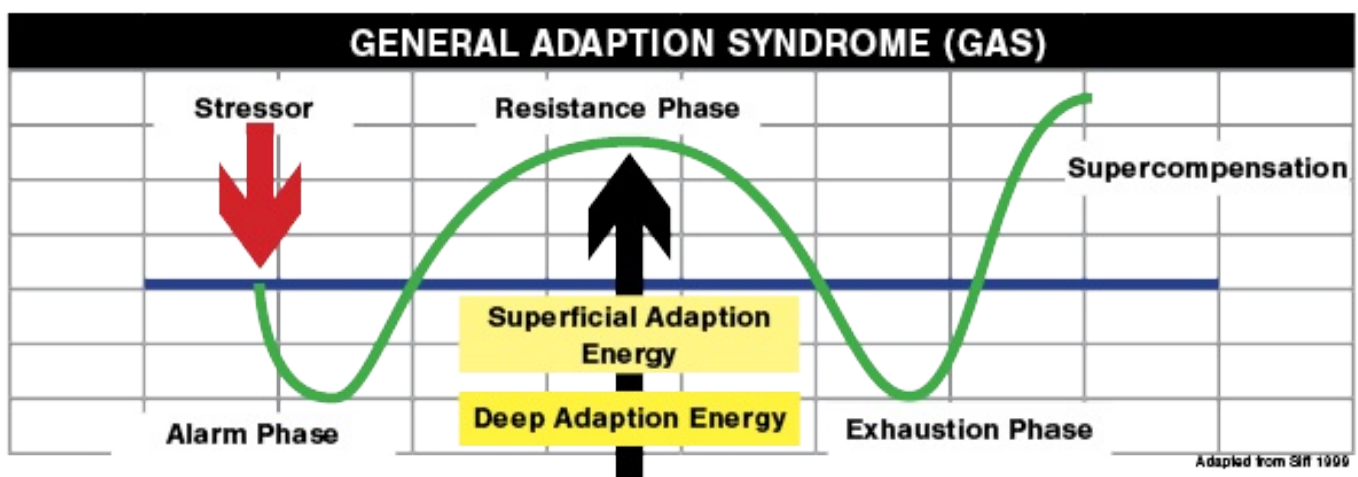


Figure 3

**Understand training fluctuations.** Training twice a day requires a period of adjustment. It is normal to lose some lean muscle mass as you begin this type of training – sometimes as much as 4-9 pounds during the first five days. And in fact, studies conducted on American and Finnish weightlifters who trained twice a day for short periods found that testosterone production can be temporarily depressed when they start this type of training. However, the testosterone will shoot right back up during an unloading cycle.

**Start twice-a-day training on weekends.** It’s best to start twice-a-day training on a Saturday so you can nap during the first two days of the cycle, which will help you adapt

to the training.

**Plan unloading periods.** One workout plan that works well with twice-a-day training is to organize the training into three 5-day cycles. In the first two cycles you train twice a day, and on the third cycle you unload with a cycle of cutting back to once-a-day training.

Twice-a-day training must be sequenced properly. We've found that you achieve the best results when you train the same body part twice on the same day. There are several options to accomplish this, such as the following:

### **Option A: Hypertrophy**

AM: Compound exercises

PM: Isolation exercises

If you are working the pectorals, for example, the morning session could consist of incline presses and dips, and the evening session would be devoted to isolation exercises such as the dumbbell fly and various cable exercises.

Powerlifters can also use a similar approach when they desire to move up a weight class post-competition. Here is an example:

### **Option B: Hypertrophy**

AM: 4-6 reps

PM: 12-20 reps

Working heavy in the morning and doing higher reps in the evening works quite well; for example, performing sets of 4-6 reps in the morning and sets of 12-15 in the evening.

### **Option C: Hypertrophy/Strength**

AM: Low reps, fast tempo

PM: Low reps, slow tempo

You could also do the same reps bracket during both workouts but use a different tempo; for example, performing 4-6 reps on a 20X0 tempo in the morning and 4-6 reps on a 4210 tempo in the evening. The explosive work in the morning tends to facilitate the evening workout; thus, you can use greater loads than normal in the evening. The nature of the exercise can take care of that.

One practical way to apply this system would be to perform power cleans in the morning and deadlifts with chains in the evening. Or, if your primary goal is to improve your jumping ability, the sequence would be plyometrics in the morning and squats in the evening.

### **Option D: Rapid strength gains**

AM: Relative strength methods

PM: Functional hypertrophy methods

If you are more interested in strength development, your morning workouts should be in



the 1-3 rep range; whereas your evening workouts would max out at 8 reps.

### **Option E: Rapid strength gains**

AM: Relative strength training

PM: Eccentric-only training

In this method, you train heavy in the morning and then perform eccentric-only training in the evening. For example, heavy front squats for 6 sets of 2-3 reps on a 5011 tempo in the morning, and eccentric back squats of 7 sets of 1 rep on a 10:0:1:1 tempo in the evening. For these squats, use eccentric hooks.

### **Option F: Olympic weightlifting or powerlifting**

AM: Competitive lift or derivative

PM: Assistance work

For an Olympic-style weightlifter, it could be snatches in the morning and front squats in the evening. For a powerlifter, it could be deadlifts in the morning and reverse hypers in the evening.

Regarding exercise selection for both workouts, you may want to do the same ones if strength is your primary goal, or change them completely if hypertrophy is your main concern. Thus, weightlifters would do back squats twice a day, while a bodybuilder may perform bench presses in the morning and incline dumbbell presses in the afternoon. Or you could just do a slight variation; for example, back squats, heels flat, in the morning; and back squats, heels elevated, in the evening.

## **Increasing the Volume**

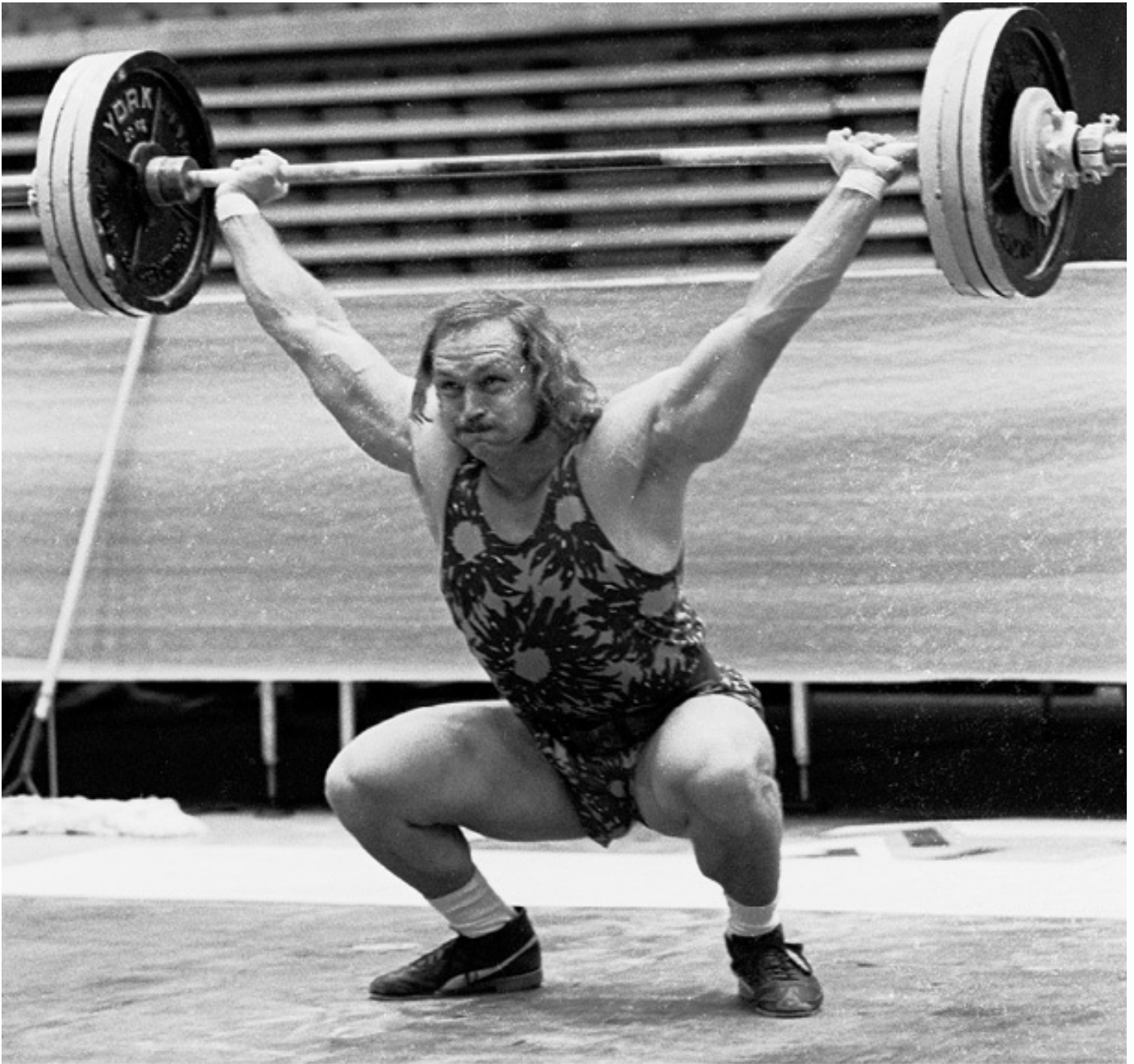
You have to be wise when introducing twice-a-day training by gradually increasing the volume. Here is a useful formula to accomplish this. (Note that when it says workout, it is a workout for a given body part, such as legs.)

| <b>Workout</b> | <b>Morning session</b> | <b>Evening session</b> |
|----------------|------------------------|------------------------|
| 1              | 40-50 minutes          | 20 minutes             |
| 2              | 50-60 minutes          | 20-30 minutes          |
| 3              | 40 minutes             | none                   |
| 4              | 50-60 minutes          | 25-35 minutes          |
| 5              | 50-60 minutes          | 30-40 minutes          |
| 6              | 40 minutes             | none                   |
| 7              | 50-60 minutes          | 40-50 minutes          |
| 8              | 50-60 minutes          | 40 minutes             |
| 9              | 50-60 minutes          | none                   |

**Eating patterns.** Because you have to be properly fueled for a workout, it's important to pay special attention to your eating patterns. Not eating enough in both quantity and frequency will hamper your gains immediately and may lead you to incorrectly assume

that you are overtrained. You are not overtrained; you are under-recovered. If you have a hard time putting muscle mass back on during your unloading phase, take post-workout shakes on your non-training days – lack of caloric intake during the supercompensation phase is usually the main reason that people do not achieve new levels of strength.

## Chapter 8: Advanced Training Methods



Al Feuerbach broke the world record in the shot put and won the US National Weightlifting Championships.

Tension is usually associated with negative conditions such as high blood pressure, insomnia, digestive disorders, fingernail chewing, profuse sweating and offensive body odor. In the world of physique training – that microcosm of existence doesn't follow the rules of normal society – tension is a good thing.

In the bodybuilder's dictionary, the word *tension* can be found between *supersets* and *Vanadyl*, and is defined as "the degree to which individual muscle fibers are voluntarily activated." Increasing muscle tension requires hard work and the discipline to tolerate discomfort, thereby giving support to the axiom "No pain, no gain." And judging by the physiques of aerobics instructors, it's primarily the quality, not the quantity, of muscle tension that determines how big and strong you can become.

There are three basic ways to increase the quality of muscle tension when you lift and thereby improve the overall quality of your training: increasing the load, slowing down the tempo, and combinations of both methods. Let's take a closer look at each, then explore in detail two more advanced methods of increasing muscle tension: drop sets and eccentric training.

## Increasing Muscle Tension

### Option 1: Increase the Load

The types of muscle fibers that significantly increase in size are called fast-twitch Type IIa and Type IIb; for maximum development you need to train both types.

Lifting weights between 90 and 100 percent of your 1RM produces maximum hypertrophy in the Type IIb fibers. Visual proof of this theory can be found in the physiques of legendary iron athletes such as Roger Estep from powerlifting and David Rigert and Victor Sots from Olympic lifting.

These great world champions seldom performed more than three consecutive reps in their training but nevertheless possessed physiques that many competitive bodybuilders would envy. Another strength athlete with an impressive physique is British strongman Gary Taylor. Taylor has push pressed, behind-the-neck, 496 pounds for 6 reps and has full-squatted 683 for 3 reps without knee wraps or a super suit. At 5 feet 10 inches tall and a solid 297 pounds, Taylor has capitalized on the benefits of heavy weight training to become one of the strongest men in the world.

Even though it will make you get bigger, training with heavy weights is considered more conducive to increasing maximal strength. This is because using heavy weights is more effective for improving intramuscular coordination, which is the ability of the central nervous system to recruit motor units. Not surprisingly, those who achieve impressive levels of hypertrophy with this type of training are blessed with extremely high levels of Type IIb fibers. In fact, muscle biopsies performed on Finnish weightlifters showed that the hypertrophy displayed by these athletes occurred mainly in the Type IIb fibers.

If you prefer to use primarily low reps in your training but still want to add muscle mass, you must be aware of the following factors:

**More sets are needed to achieve sufficient growth stimulus.** Because less mechanical work is performed with low-rep sets, the amount of contractile protein that is broken down is somewhat limited. The opinion of strength experts Jürgen Hartmann, Ph.D., and Harold Tünnemann, Ph.D., of former East Germany is that optimal overload with low reps requires 8-15 sets in that intensity zone. Although most of us have neither the time nor the desire to commit to so many sets per exercise, it's possible to perform this method with fewer sets by using modified drop sets, described later in this chapter.

**It's a longer process.** Although weightlifters often display extremely well-muscled glutes, quads, traps and erector spinae, it takes them a considerable amount of time to achieve such development. Often the weightlifters seen competing at international competitions have been lifting for 10 years or more and are at the peak of their athletic

careers. In the beginning stages of their careers, their musculature was considerably less developed. In fact, the first several years of a weightlifter's training emphasizes technique rather than strength development.

**Development occurs primarily in the Type IIb fibers.** The reason is that the nervous system of an advanced weightlifter is so well developed from the emphasis on low reps and heavy weights that it can bypass the recruitment of the Type IIa fibers. Although years of emphasis on training just the Type IIb fibers can produce remarkable muscular development, for maximum muscular development a bodybuilder must also use protocols that will work the Type IIa fibers.

**It's easy to burn out with this training method.** Millions of dollars and countless hours of research have been devoted to studying overtraining. The overtraining that can occur with low-rep training, according to former Soviet Union strength expert Vladimir Zatsiorsky, manifests itself in insomnia, anxiety, depression, early morning fatigue, high blood pressure at rest and an increase in the perceived rate of effort for a given weight. It's also possible that this type of training drains the adrenal glands. We are not saying it's inevitable that you will overtrain using these methods but that at the elite levels such training can be extremely complex.

## **Option 2: Slow Down the Tempo**

This concept is a favorite of Arthur Jones, Ken Hutchins and Ellington Darden. This training protocol is not an exclusively American discovery. Weightlifting coaching textbooks from Europe, published as far back as 1968, recommend slow-tempo protocols. In fact, renowned German weightlifting coaches Spitz and Feser told said they often prescribed slow work for sets of 6 reps for their athletes who needed to increase their lean body mass.

One problem with slow-tempo training is that it recruits primarily lower-threshold motor units. Any stimulus to the Type IIb fibers will occur only on the last few reps of a set, if at all, and the recruitment is even less for experienced athletes. Further, if you're trying to run faster and jump higher, or if you are in a sport where bodyweight classes are used, such as weightlifting, you want to emphasize training of the Type IIb fibers. The Type IIa fibers will contribute little to the performance of these activities and will most likely reduce performance by increasing your bodyweight.

## **Option 3: Combine Training**

We believe the optimal solution to achieving maximal motor-unit activation and muscle tension is to modify the training load during a set. To better understand this, let's look at a conventional set for a bodybuilder who can bench press 300 pounds (lowering the bar for a 4-second count) and can perform 7 reps with 240 pounds.

Now let's have the same individual perform a 7-rep set, but lift 300 pounds for the first rep, 285 for the second, and then drop the weight 10 pounds (5 percent) for every subsequent rep. In most individuals the difference between 1-2RM and 2-3RM is roughly 5 percent while the difference narrows to about 2 percent between reps of 4RM and

12RM. The drop in resistance is most effectively accomplished by using two training partners who will strip the bar at the end of each concentric contraction.

As you can see, the average load for the 7-repetition set is 7.4 percent higher in this protocol versus the first protocol, thereby creating a higher overall level of muscle tension. Also, the average concentric speed was slower in the second protocol because each rep represents 100 percent of momentary maximum strength.

One of the keys to ultimate overall gains in muscle mass is to select the appropriate combinations of muscle tension protocols. We should also mention that there are other ways to accomplish this – from impractical methods such as electrostimulation techniques (a popular method of the late Belgium super heavyweight weightlifter Serge Reding, the first man to snatch 400 pounds) to simply the intelligent use of supersets. Muscle tension is a key training variable, and finding ways to achieve the most effective levels of tension requires considerably more thought than just using a specific number of reps for a set and following the advice from the gurus to “train hard, but brief.”

## Refining Drop Sets

Drop sets are a popular training method in bodybuilding to prolong a set and thereby prolong muscle tension. With a drop set you perform several sets of the same exercise, but with no rest between sets and with each subsequent set using lighter weights than the previous one. For best results from this training method, you need to take into account how efficiently your nervous system recruits fast-twitch fibers.

Two of the primary factors that determine neurological efficiency are training experience and an individual’s ratio of fast- to slow-twitch fibers. Beginning trainees, particularly women, tend to be less neurologically efficient than advanced bodybuilders. This means they can perform more repetitions with weights closer to their 1RM. For example, at 80 percent of their 1RM, the average bodybuilder will be able to perform about 10 repetitions, while an advanced bodybuilder would probably be able to perform only 3-5 reps. However, just because a person’s nervous system is not efficient, that does not necessarily mean they are not strong.

To this day, when you think of big legs, the first name that usually comes to mind is Tom Platz – his legs have become the standard that all others are measured against and which few, if any, have equaled. At his best, Platz placed third in the 1979 Mr. Olympia, and in an exhibition in Germany in 1993 Platz beat the world record holder in the squat, Fred Hatfield, squatting just over 500 pounds for 23 reps to Hatfield’s 12. However, Hatfield did lift more than Platz for a single, 775 pounds to 865.

**Drop sets for the neurologically inefficient bodybuilder.** Here is an example of how a bodybuilder who is neurologically inefficient should perform drop sets. The exercise is the incline press, and this bodybuilder’s 1RM is 350 pounds.

All reps are performed at a 2020 tempo; this will produce constant tension in the muscles to recruit primarily the Type IIa fibers. There is no pause between drops of weight because this type of bodybuilder is more suited for muscular endurance.

**Drop sets for the neurologically efficient bodybuilder.** Here is an example of how a bodybuilder who is neurologically efficient should perform drop sets. Again, the exercise is the incline press and the bodybuilder's 1RM is 350 pounds. Notice that there is a 10-second pause between drops of weight; this will allow this type of bodybuilder enough time to activate the higher-threshold fibers.

All reps are performed at a 3:1 tempo; that is, a smooth descent of 3 seconds for the eccentric contraction, a pause of 1 second to eliminate the myotatic component, an explosive contraction to tap into the high-threshold fast-twitch fibers, and a 1-second pause before performing the next repetition. A pause should be taken where leverage is favorable (e.g., the lockout position in the bench press) so that the muscles can relax and the blood supply can be augmented. According to Australian strength and biomechanics expert Dr. Greg Wilson, this type of training tempo will enable you to access more of the high-threshold fast-twitch fibers.

Even though the desired speed of the bar displacement is explosive, the bar may not move very fast because of the high load. Nevertheless, you must still concentrate on accelerating the bar through the concentric range. When applying this technique to exercises with a greater range of motion, such as the squat and the deadlift, you may want to use 4-5 seconds for the eccentric lowering.

## **The Science of Eccentric Training**

In popular bodybuilding videos often you'll see the stars lifting barbells and dumbbells explosively. You'll see them jerking up curls and presses, huffing and puffing their way to a monster pump – and finishing off by slamming the weights back into the racks in exhaustion. Perhaps this is a bit of Hollywood embellishment, but somewhere along the way to learning how to “lift things up and put them down,” bodybuilders, personal trainers, and strength coaches have forgotten about eccentric training.

Just to make certain we're on the same page, let's review what happens during an eccentric contraction: the muscle lengthens while producing tension, thus braking or controlling the speed of movement. As such, during a bench press, lowering the weight to the chest would be considered an eccentric contraction. Research shows that of the three types of contractions, eccentric will produce the most muscle soreness and muscle mass. Here are examples of how to emphasize eccentric contractions in four popular exercises:

**Leg curl.** Exercise machines offer greater stability than free weights, and with this machine you can take advantage of this difference by lifting the weight with two limbs and lowering it with one. Obviously, this technique can also be used with leg extensions. However, this method should not be used with a conventional leg press because of the high shearing forces it places on the pelvis.

**Back extension.** To increase the eccentric overload of this exercise to match the strength curve, hold a dumbbell close to your chest, proceed to the top position of the exercise, and then extend the dumbbell in front of you. Lower it slowly. By changing the leverages during this exercise, you increase the resistance at the top of the movement. This technique is more difficult than you might think, and most trainees will find it sufficient to

use a light weight (such as 2 1/2 to 5 pounds).

**Chin-ups.** A lot of trainees, especially women and those who are overweight, cannot perform a single chin-up (palms facing the body) or pull-up (palms facing away from the body) in good form. Eccentric training is ideal for quickly achieving this goal. Have a training partner help you lift one leg (keeping it back, behind you) and have them assist so that you can lift your chin over the bar. At this point, the partner lets go (or holds on lightly without providing assistance), and then you lower yourself to extended arms. Another version is to set a barbell at hip height (or slightly lower) in a power rack, and then place your rear ankle on the bar – this will reduce the amount of bodyweight you have to lift. As a general rule, when an individual can lower their body to a count of 30, they can perform a single concentric rep in good form.

**Shoulder external rotation.** The rotator cuff muscles are important for sports that involve throwing because these muscles help decelerate the arm. They are also important for sports in which there is little eccentric movement, such as swimming; in such sports structural imbalances often develop that can increase the risk of injury. With this variation of a standing external rotator cuff movement, you use your free hand to help you pull the weight to the mid-range position, and then release it and slowly allow the cable handle to return to the start position. You will find that you can use considerably more weight with this exercise than you could in the conventional manner.

Consider that there are two types of eccentric contractions: fast and slow. Performing a heavy squat requires a slow eccentric contraction of the hamstrings, and sprinting requires fast eccentric contractions of the hamstrings. Because slow eccentric training is associated with a decrease in the rate of force development, it should be used mainly in the preparatory period. Fast eccentric training, such as plyometrics, should be reserved for the competitive period.

Eccentric strength is specific to many sports movements. During the follow-through of a baseball pitch, the involved muscle groups must provide important decelerative contractions to preserve healthy joint functioning (arthrokinematics). It's interesting that many textbooks on overuse injuries prescribe eccentric training to rehabilitate overuse injuries yet do not prescribe eccentric training to prevent them.

Eccentric strength is also important in many sports that require exceptional jumping ability, such as figure skating and gymnastics, as athletes in these sports need high levels of eccentric strength to control their landings and minimize the stress on the joints. In a research paper written by New Zealand sport scientist Warren Frost, major sports were classified according to the level of eccentric activity they require. The highest levels of eccentric strength were reported to be in sports such as American football, figure skating, gymnastics and downhill skiing. Sports such as golf, field hockey, and baseball were considered sports that rely more on concentric contractions. (For whatever reason, poker and chess were also examined. Guess what: neither of these activities requires high levels of either eccentric or concentric strength – good to know!)

Because fewer motor units of a muscle contract during an eccentric contraction, eccentric



training can generate up to 1.3 times more muscle tension than concentric training. Greater tension provides increased stimulus to the muscle fibers, which in turn encourages greater biological adaptations. Per Egil “Pella” Refsnes, a respected strength researcher from Norway, claims that eccentric training is the single-best method to boost strength levels in elite strength athletes. In fact, eccentric strength can improve performance in many exercises; research has shown that powerlifters who could lift the heaviest weights in the bench press could also lower their weights more slowly.

Of course, there are a few disadvantages of eccentric training. Embarking on eccentric training too early in an athlete’s career could damage connective tissues and place the athlete at a high risk of muscle injury. Further, it takes considerably longer to recover from workouts that emphasize eccentric contractions versus conventional workouts. Specifically, it can take seven to ten days to completely recover from an eccentric workout, so this type of training should be avoided with in-season workouts.

With many exercises that use heavy weights, such as squats, several well-trained spotters are required. Also, there are several unique pieces of training apparatus that are especially suited for eccentric training, such as eccentric hooks that release additional weights when the attached weights touch the floor (so there is more resistance in the eccentric range than in the concentric). There are now grip training machines that are specifically suited for eccentric training. As the value of this type of training becomes more widely recognized, we’re sure we’ll see many more pieces of equipment that facilitate the use of eccentric movements.

## **Practical Applications of Eccentric Training**

Strength coaches recommend using anywhere from 100 percent to 175 percent of maximum for optimal loading in eccentric work. However, it’s tempo that dictates the optimal weight to use in eccentric work; you should have a preset time of lowering (e.g., 6 seconds) in your mind before doing your set. Muscle failure in a properly performed eccentric exercise is associated with a response in which the muscles are shaking involuntarily as they do their decelerating work.

Athletes should try to visualize their muscles as giant brake systems that decelerate the resistance. If you start lowering the weight faster than the preset time, it’s time to terminate the set. And the greater the range of motion in the exercise, the longer the preset lowering time.

Besides the slow lowering of supramaximal loads, there are many other ways to perform or combine various forms of eccentric training. Using a method called complex training, athletes achieve hypertrophy through a combination of lifting maximal loads (1-5 RM) and fast eccentric training (plyometrics). One example is to superset 6 sets of 5 reps in the squat with 5 reps of hurdle jumps. The rationale is that the heavy sets tap into the high-threshold motor units and the plyometrics create muscle fiber damage that leads to the positive adaptation or hypertrophy of the high-threshold fast-twitch Type IIb fibers.

Before anyone considers jumping into advanced, complex training methods, we believe there should be a continuous, progressive buildup of eccentric training. This progression

can be broken down into the following six levels:

**Level 1.** This level is for the athlete with less than two years of training experience. No training with eccentric loads is needed; the simple lowering of loads under control should suffice.

**Level 2.** Use 70 percent of maximal load (1RM). Go to concentric muscle failure and then do 2-3 forced repetitions with the same load. Repeat for 2-3 sets. As a variation, you could perform only 1 forced rep, but try to stop the descending weights three times for a count of 4 seconds.

**Level 3.** Use 70 percent of maximal load. Go to concentric muscle failure and then do 2-3 forced repetitions with 15 percent more weight. Repeat for 2-3 sets.

**Level 4.** Use 80 percent of maximal load. Go to concentric muscle failure, and then do 2-3 forced repetitions with 20 percent more weight. Repeat for 3-4 sets. As an alternative to Levels 3 and 4, a training partner can manually apply resistance (i.e., push down on the bar) for the eccentric portion instead of adding weight. These additional negative repetitions will exhaust eccentric strength levels after you achieve concentric muscular failure.

**Level 5.** Using 110-120 percent of maximal load, do 4-6 eccentric-only reps for 4-6 sets, resting 4-5 minutes between sets. Take 8-10 seconds to lower the weight in each set.

**Level 6.** Using 125-140 percent of maximal load, do 2-3 eccentric-only reps for 5-6 sets, resting 4-5 minutes between sets. Take 4-6 seconds to lower the weight in each set.

Embarking on an eccentric strength training cycle exposes you to increased connective tissue damage and myofibrillar damage and higher cortisol levels. Three supplements to help deal with this stress are BCAAs, beta alanine, and vitamin C. As you can see, addressing the concept of tension in your workouts requires a considerable amount of planning, but the rewards are well worth the effort.

## Chapter 9: The Kaizen Principle



Russia's Vasily Alexeev was a two-time Olympic champion who broke 80 world records and was the first man to clean and jerk 500 pounds.

Regardless of where you are in the bodybuilding hierarchy, we'd like to introduce you to an effective training method that will improve the effectiveness of virtually any training program you use.

Anyone who has been training for a long time eventually reaches a point of diminishing returns, making it difficult to produce even a five-pound increase in a particular exercise. For some reason, you just can't seem to reach that next personal record, at least not as quickly as you expect and, hopefully, have become accustomed to. If your personal best in the bench press is 5 reps with 245, when you try 250 you get stuck on 4 reps for several

weeks. Although the increase is only five pounds, it's still too much. The problem is even more pronounced – and frustrating – with exercises that use smaller weights.

When working the external rotators of the delts, for example, you may find that you can perform 10 reps with 10 pounds on one exercise, but when you increase to 15 pounds you can't even complete a single rep! As for selectorized exercise machines, often the only progression with heavier weights is by 10- and 20-pound increments, which means you may be stuck on the same weight for months.

## **The Kaizen Method**

In the Japanese language, the word *Kaizen* means “constant and never-ending improvement.” This word is used in all areas of Japanese life, whether it is relationships, learning judo or improving the balance of trade. The point here is that the Japanese look for constant and gradual improvement. The Japanese believe that very small refinements made on a daily basis will compound with interest to bring about in the long run progress that most people will envy. Interestingly, there is no equivalent in English for the word *Kaizen*.

By following the Kaizen philosophy, Japan progressed from a war-torn country to a dominant economic power. Kaizen also describes the way in which the legendary Greek wrestler Milo of Croton built his tremendous strength and physique. Milo purportedly carried a calf every day until it was a full-grown bull. Although the Milo story may itself be a bunch of bull, such an approach to training can help you achieve your goals.

Coach Pat Riley of basketball fame is another person who has used the Kaizen method to his advantage. Instead of asking his team for large increases in one aspect of the game, he asked every player to increase each skill level by only one percent. Multiply the number of skills by the number of players, and you can understand his secret of success.

Applying the Kaizen method to weight training means that instead of making a jump of five pounds, you can make an even smaller jump (such as by just one pound). This makes the weight both physiologically and (even more important) psychologically easier to handle. The Bigger Faster Stronger organization uses the idea of breaking personal records to help motivate kids, and by accounting for set and rep records their programs promise that you can “Break eight personal records a week!” Although the BFS program is marketed primarily to high school and junior high athletes, with the Kaizen method such results are possible at any age. And just think about this: Imagine if you could increase the weight for reps by half a pound a week – in one year that would represent a 26-pound gain! Gets you psyched, doesn't it?

You can apply the Kaizen method to your training by using a combination of kilo plates, pound plates and EZ bar solid collars. For example, 1.25 kg and 2.5 kg plates weigh 2.75 and 5.5 pounds respectively, and 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 can apply the Kaizen method by increasing the weight in the following manner:

## **When Muscles Meet Magnets**

The easiest way to apply the Kaizen method is to purchase magnetic add-on weights, such as PlateMates sold by Benoit Built, Inc. The idea was inspired when their inventor, Ken Benoit, injured his biceps doing a heavy dumbbell curl on a Scott bench. During rehabilitation, Ken made the painful discovery that the standard five-pound increase in dumbbells put excessive stress on his injured arm. By duct-taping 1 1/4-pound weights to each end of a dumbbell, he was able to achieve a 2 1/2-pound increment that allowed him to progress in his rehab steadily and safely.

Later on, Ken came up with the idea of using magnetized plates to save the time and hassle of taping weights. The product was first used in gyms in the New England area and was later mass marketed. Ken made even smaller magnetized disks so they can be used when training smaller muscles with poor leverage, such as the rear delts and the rotator cuff muscles.

Another benefit of having these magnetic weights is that you can correct the weight of poor-quality weight plates. For example, if you have a 25-pound dumbbell that weighs only 23 pounds, you can add on a two-pound plate to increase it to the standard of 25 pounds. Although two pounds may not seem like such a big deal, you may experience a subconscious fear of injury when you realize that your weights don't weigh accurately, a fear that may manifest itself in an injury if it disrupts your concentration when you lift.

There are other practical uses for the Kaizen method if you have access to the add-on magnetic weights. In particular, we'd like to discuss how they can be useful when using drop sets and wave loading cycles, and even for modifying strength curves.

**Drop sets.** With drop sets you perform as many reps as possible with one weight; then you immediately proceed to the next-lowest available increment and complete as many reps as you can with that weight. This process usually continues for at least one more set. This method exhausts a greater percentage of the available motor unit pool and gives you a great pump! The problem with performing drop sets with dumbbells is that you must have access to several sets of dumbbells. With an adjustable dumbbell, this procedure could take several minutes, preventing you from properly using this technique. With the magnetic weights, all you have to do is peel off the additional weight, a process that takes about a second.

Another problem with drop sets is that with some exercises the normal five-pound drop in weight may be too much, allowing you to perform too many repetitions to achieve the desired training effect. This is especially true for the third and subsequent drop sets. Magnetic weights will enable you to use the exact amount of resistance to produce the optimal training effect.

**Wave loading cycles.** With a wave loading cycle you work up to a maximum weight for a specific number of reps, back down in weight for one or more sets, and then work your way up to even heavier weights. Especially effective with elite athletes, this method allows you to handle heavier weights than you could otherwise.

One of our coaches saw an elite weightlifter who competed in the lighter bodyweight classes use this method with front squats. On his first wave during the workout, he barely

completed 350 pounds, but after several of these waves he was able to lift 413 pounds! Although you would think that an athlete would be tired after such a first wave, what happens is the undulation in intensity stimulates the nervous system in such a manner as to allow heavier weights to be used as the workout progresses – so much for that kooky idea of achieving maximum overload with just one set!

To show you an example of this method, let's say a male powerlifter can bench press 400 pounds. His wave loading cycle might progress as follows:

First wave: 135 x 5, 225 x 3, 315 x 3, 355 x 2, 375 x 2, 390 x 1, miss 400

Second wave: 325 x 3, 365 x 2, 385 x 2, 400 x 1, miss 405

Third wave: 335 x 3, 390 x 2, 405 x 1

Now, enter the Kaizen method. If this athlete had used magnetic weights, on the second wave he could have made a personal record of 400.5 pounds, thereby psyching himself up for the 405 (or more) on the next wave.

**Modifying strength curves.** One of the problems with many exercise machines is that they often have poor strength curves. The prone leg curl machine is one obvious example. For most of these units, the weight is easy to lift at the beginning of the exercise and virtually impossible to complete at the end of the range of motion. Electing to use the heaviest weight possible, most bodybuilders simply accelerate the weight at the beginning and use momentum to allow them to complete the movement. Thus, regardless of the weight selected, you effectively overload only one section of the movement.

However, by adding a magnetic weight plate to the lever arm of the machine, you effectively make the exercise more difficult at the beginning; then, as the lever arm passes neutral, gravity works to decrease the resistance on the way down. Let's say you are lifting 50 pounds on the leg curl and add a five-pound magnetic weight to each end of the lever arm. On the way up the resistance is 60 pounds, and on the way down it's 40 pounds. What is happening is that you are modifying the strength curve to be more in line with the natural strength curve of the hamstrings, enabling you to more effectively overload the muscle.

The application of Kaizen will bring security to your training life because you know you are improving in some way every single training day. Don't worry about maintaining the quality of your workouts if every day you are working on improving them. Long live Kaizen!

## SECTION 2: Applying the Poliquin Principles



Poliquin Group Gymnasium, East Greenwich, Rhode Island

## Chapter 10: Quads



Joe Weider began publishing *Flex* magazine in 1983. Many Poliquin Group instructors have contributed to this popular publication devoted to hardcore bodybuilding.

There is a sacred code among bodybuilding writers that with every mention of leg training they must use the expression “The squat is the king of all lower body exercises.” That infamous line joins the ranks of other overused slogans such as “If you don’t have the



squat in your program, you don't have a program," "If you don't squat, you don't know squat about leg training," and "Machines were made to keep geeks away from squat racks." Fine, fine – we get the message.

The simple deep knee bend is unquestionably the single most productive leg exercise you can perform. No other weight training exercise works as many major muscle groups, including the quads, as thoroughly or with greater intensity. Additionally, due to the number of muscle groups involved, the squat burns more calories than any other weight training exercise and positively stimulates the cardiovascular system. But despite its versatility and effectiveness, the squat still has its critics.

## **To Squat or Not to Squat**

One outspoken critic of the squat was '60s bodybuilding guru Vince Gironda. He was nicknamed "Trainer to the Stars" because his clientele included many Hollywood celebrities, including Cher, Denzel Washington, and Clint Eastwood; but he also trained Larry Scott, who won the first Mr. Olympia in 1965, and Mohamed Makkawy, who twice won the runner-up position in the '83 and '84 Olympia. Gironda made many valuable contributions to bodybuilding, but his idea that squats widen the hips was not one of them because anatomically such a comment makes no sense.

Yes, it's true that squats work the gluteus maximus, but because neither its insertion nor its origin attachment is at the hips, when it develops, it grows back, not out. All you have to do is look at the proportions of Olympic lifters, who devote as much as 25 percent of their training volume to squats, to see that as a group they do not necessarily possess exceptionally wide hips.

Other outspoken critics of the squat are college professor Karl K. Klein and medical doctor Fred L. Allman, Jr. In 1961 a study was published by Klein that suggested squats decrease knee stability, thus increasing the risk of injury to the joint. In 1971 Klein and Allman's book, *The Knee in Sports*, was published by Penn State Press. Although many students of the iron game believe that Klein and Allman did not like squats at all, the truth is they were fine with the parallel squats (i.e., thighs parallel to the floor) practiced by powerlifters, and they acknowledged parallel squats have benefits to athletic performance. The squats they disapproved of were the full squats practiced by weightlifters.

Klein's study wound up being a great marketing tool for the manufacturers of leg extension machines. But the fact is that every legitimate study on this subject has shown that squats will improve knee stability and, therefore, reduce the risk of injuries. The National Strength and Conditioning Association has an excellent position paper on this subject if you want more information, and there is an article written by Dr. Terry Todd that details the flaws in Klein's work, most notably that Klein's findings could not be reproduced. Further, data from Canada's national team of Alpine skiers suggest that regular squatting appears to reduce not only the number of injuries but also the length of time necessary to recover from injuries.

Critics of the squat are finding it hard to support their assertion that it is hard on the knees, but some are saying that the squat is bad for the back. The reality is that if someone has a

back problem from squatting, usually it can be traced to poor form. For example, some aerobics instructors have their students perform squats with a tail-under posture to increase glute development (which it doesn't). Lifting with this posture places excessive strain on the ligaments and connective tissues of the back, especially when the athlete hits the lowest position of the lift.

Some trainers recommend squatting with a flat back, a form that is often taught in aerobics classes. In his self-published book *Facts and Fallacies of Fitness* (1998), the late Dr. Mel Siff gave his perspective on that technique: "Keeping the back 'flat' is common advice in the gymnasium training environment, yet its validity is rarely questioned. A flat back devoid of any curvature is not only virtually impossible for a normal person to achieve, but it also reduces the ability of the spine to absorb or distribute shock and stress effectively. The healthy spine is meant to have several different curvatures, whereas the straight spine suggests the presence of a specific type of pathology."

To protect the ligament structures of the back, always keep a slight arch in the lower back when you squat. This technique does increase the stress on the lumbar muscles, but a muscle can recover from a mild tear in 3-8 days, whereas a ligament strain requires at least 21 days. Also, many muscle injuries can be avoided simply by following a sensible training program.

As for upper back or neck injuries, these problems usually occur only when someone is using poor technique, such as looking down or looking up excessively. Also, some beginners find squats uncomfortable on the upper back area and may try to minimize their discomfort by rolling a towel around the bar. This is a bad idea. The larger diameter of the bar can be harmful to the neck and increases the risk of the bar rolling down the back. As for overcoming the discomfort of having a naked bar on your back, work on building up your traps and realize that just as with a bicycle seat, most individuals will simply get used to it with time.

Finally, there should be no concern that the squat will damage the heart. Although it's true that performing the squat will temporarily raise blood pressure, the heart adapts to this stress in a positive fashion by hypertrophying the left ventricle. Interestingly, the increase in blood pressure is three times higher when performing leg presses at a 45-degree angle than when performing squats. Obviously, if you suffer from cardiovascular disease or if it runs in your family, you should consult an experienced sports medicine practitioner before engaging in a serious squat program.

Although we started this chapter praising the squat as the king of exercises, we're going to throw a wrench into this discussion: the deadlift.

## **Squats vs. Deadlifts**

Paul Anderson popularized the squat, performing feats that to this day could only be matched by a few. He was that good, and although his records have been broken, his legacy as one of the strongest men of all time will endure forever. And just as Anderson popularized the squat, there is one person who popularized the deadlift: Bob Peoples, the first man to deadlift 700 pounds.

Born in northern Tennessee on August 2, 1910, Peoples grew up admiring strength. Peoples did not have an inspirational background of being a weakling and having to overcome that adversity, as he was always strong. And although he grew up on a farm living a modest life and didn't have a gym, he made do at first with a few dumbbells his father had. Later Peoples improvised, making homemade resistance training equipment that included a set of 50-gallon barrels that he filled with rocks and joined with a pipe.

When he was 25 years old, Peoples could deadlift 500 pounds. In 1940, he established a Southern record of 600 pounds in the deadlift, and in 1946 he lifted a world record of 651-1/4 pounds at 175 pounds bodyweight. And on October 4, 1947, he hit the big 7-0-0 – at least, he thought he did, as the lift was officially weighed at 699. But the lift Peoples was most remembered for occurred on March 5, 1949, when he did 725-1/2 pounds at 178 pounds bodyweight at a competition in Johnson City, Tennessee. This record stood for over two decades.

Peoples was a master of the deadlift, and his accomplishments secured his legacy in iron game history. But just how valuable is the deadlift? To answer that question, let's see how the deadlift stacks up against the squat.

**Convenience.** Because you can squat more weight than you can lift from the ground to overhead, to use enough weight in the squat you need to have a power rack or a pair of squat racks. And although weightlifters use bumper plates and will simply dump a squat onto the platform if they miss a lift, this technique takes some skill. It's better to have spotters. With the deadlift, spotters are not necessary – you just lift the weight.

**Technique.** The deadlift is much easier to master technique-wise – it is a more natural movement to bend over and pick up an object than to squat down. Yes, there are some athletes who lack the body awareness (proprioception) to arch their lower back to get into the proper set position for the deadlift, but this problem usually is easily corrected. Those who find arching the back a major issue can use a hex bar that places the hands at the sides, making it easier to arch the back. Also, with the squat, those athletes who are relatively tall or who have tight calves often have trouble mastering the lift.

**Versatility.** Just as there are many types of squats, there are many types of deadlifts. A hex bar enables greater emphasis on the quadriceps, and long-range deadlifts (such as by using a snatch grip and standing on a small platform) increase the involvement of the VMO (the vastus medialis oblique). It's also relatively easy to perform eccentric contractions.

**Muscle group stimulation.** The deadlift works the same muscles as the squat, but because you hold the bar in the deadlift, you are working more on the upper body muscles, especially the traps and the grip. Yes, upper back strength is needed to squat, but supplementary lifts are often needed because the lift doesn't adequately develop upper back strength.

**Strength curve.** By performing the deadlift in a power rack, you can overload all areas of the strength curve. Negatives certainly can be performed in the squat, but they are not as convenient and should be performed with spotters. After the finish of the last rep of a

set of deadlifts, you are in a perfect position to lower the bar slowly to focus on eccentric contraction.

**Repetitions.** It's much easier to perform higher reps in the deadlift. The squat causes breathlessness, especially the front squat.

**Core development.** To develop the so-called core muscles, try a one-arm deadlift, placing the bar at your side. With the squat you would add more weight to one side than the other, but due to the compressive forces on the disks this may not be advisable.

**Honesty.** One thing that attracts people to the deadlift is that it is a pure test of strength, as assistive gear does little to help the lift. The use of gear is one reason that world records in the squat occur more steadily than world records set in the deadlift. But with the use of gear, and also individual differences in judging depth, it's difficult to determine just how strong an athlete is. With a deadlift, you either make it or you don't.

**Intensity.** It's easier to go all out in the deadlift – again, you just lift the weight. With the squat, you have to guess how much you can lift.

The bottom line is that the deadlift is a valuable exercise that can help an individual enjoy significant gains in overall strength and muscle size. Yes, the squat is the king of lifts, but as Bob Peoples' accomplishments suggest, the deadlift runs a close second.

## Mastering the Squat

One common myth in bodybuilding is that there is one single way to perform an exercise. The truth is that variations in technique force future adaptations for growth, so you should vary the types of squats you perform. The two squats that are used most often are commonly referred to as the Olympic lifting (or bodybuilding) squat and the powerlifting squat. With the Olympic lifting squat, the back is kept as vertical as possible and there is considerable forward movement of the knees. In the powerlifting squat there is considerable forward bending from the waist and minimal forward movement of the knees. Also, to use more weight, powerlifters often do not squat as deeply as Olympic lifters.

Which style is best? Neither and both. The fields of biomechanics and neurophysiology tell us that even slight variations of movement (e.g., how deeply we squat, how much we bend forward from the waist, or how much we move the knees) stimulate different muscular recruitment patterns. Therefore, to stimulate the most motor units, and, therefore, stimulate more growth, bodybuilders will benefit from occasionally squatting like powerlifters. Conversely, deep squats will help a powerlifter because they will increase development of the VMO, thereby increasing knee stability.

If squats are the mainstay of your leg training routine and you want to increase the recruitment of the vastus medialis muscle, you have the choices of (a) using a specific foot position, and (b) overloading the bottom position.

The foot position that maximizes the recruitment of the vastus medialis calls for placing the load over the arch of the foot. This is best accomplished by using a narrow stance and

elevating and moving the center of gravity of the body forward by using something to elevate the heels. Doing more work in the bottom position increases the recruitment of the vastus medialis muscle, which plays a major role in getting you out of the bottom position.

To develop the vastus medialis muscle, there are two techniques we use with Olympic athletes that you may want to try.

**Cyclist squats.** Olympic-level cyclists use these to attain world record performances in track events. In this variation of the back squat, you want to use a board to rest your heels on in a narrow stance (four to six inches between the heels). The best type of board for this is wedged, so that the pressure on your foot arch is minimal. The higher the wedge, the more recruitment of the vastus medialis you will get. You will also find that you will squat more upright when using the wedged board so less recruitment will occur in the gluteal muscles.

**One-and-a-quarter squats.** This exercise has been used in training Olympic skiers to offset the enormous development of their vastus lateralis muscles and prepare their knees for the lateral stress of skiing. Squat down for a 5-second count until you hit the bottom position, come up a quarter of the way at a slow and deliberate pace, go back down, and then come up until your knees are just short of lockout. That one-and-a-quarter movement consists of 1 rep. Performing 4-5 sets of 4-8 reps of the one-and-a-quarter squats will stimulate record growth in your vastus medialis muscles.

Regardless of the type of squat performed, there is no reason to believe that an intense squat workout will always result in vomiting, a belief that is often promoted in hardcore muscle magazines and is discussed in detail in Samuel Wilson Fussell's controversial book *Muscle: Confessions of an Unlikely Bodybuilder*. If vomiting is a problem, you can usually avoid it by not eating too close to a squat workout and by not consuming slow-to-digest protein foods.

## The Case for Front Squats

The back squat is universally accepted as the single best exercises for total body strength. However, the best way to assess an athlete's lower body strength is the front squat. Here are five good reasons why:

1. First, there is the force-velocity curve to consider, which is represented by a graph showing an inverse relationship between force and speed (Figure 4). As such, movement speed will decrease as the weight increases. A power snatch will assess the velocity side of a force-velocity curve; the front squat will assess the force side.

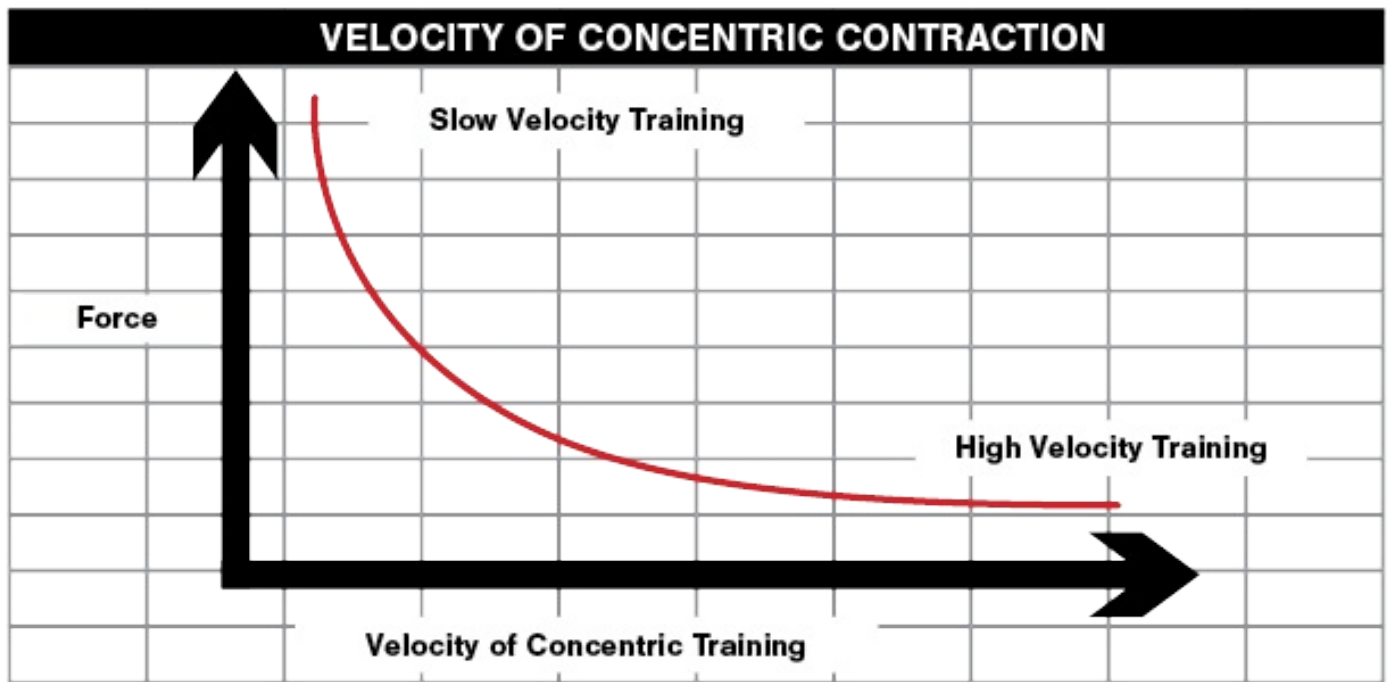


Figure 4

2. Second, the front squat is the most honest test for lower body strength. That's because if you cheat, you can seriously injure yourself. If you cheat on the front squat, such as shooting the hips back during the concentric contraction, you will likely drop the bar. This increases the odds of a serious injury; thus, the incentive to be honest is very high in the front squat. Cheating is easier in the back squat than in the front squat, so the front squat provides a more objective interpretation of maximal strength levels.

3. A third reason we like the front squat is it will immediately access your flexibility because you will not be able to perform the exercise properly unless your flexibility is superior in all the major joints. When coaches give strength tests that require flexibility, their athletes have a strong incentive to train for flexibility. This is obviously not the case when performing the back squat, but it is particularly true for bench press addicts who have problems supporting the bar in the correct position on the clavicles. If an athlete has very tight forearms and external rotators of the shoulder, it will be very hard to hold the bar. This deficiency can be corrected by learning proper technique from an experienced weightlifting coach.

4. A fourth reason can be found in sports science research. EMG data suggest that the front squat is more effective than the back squat for activating the vastus lateralis and the rectus femoris. Further, biomechanical analysis indicates that the front squat places less compressive forces on the knee. In other words, the front squat works the quads harder with less stress on the knees.

5. A fifth reason is that the front squat is a favorite among strength coaches worldwide. In one survey of top European coaches who were asked to list their three favorite strength exercises, the consensus was the power snatch, the incline bench press and the front squat. And based upon the emphasis on the power clean among American strength coaches, especially at the college level, the front squat would be a more appropriate selection than the back squat.

When comparing the front squat to the back squat, weightlifting coaches believe the front squat has more transfer to making improvements in the clean and the power clean. This makes sense, as the starting position of a front squat more closely approximates the start position of a clean due to the trunk being more upright than in the back squat. The back squat would be considered more specific to the snatch, as the wider grip forces the athlete to start with a back angle that is closer to parallel to the floor. For a competitive weightlifter, the front squat will obviously help in recovering from the bottom “rack” position of the clean. As such, if an athlete’s power clean or clean is considered relatively weak compared to their other strength tests, it would be appropriate for that athlete to focus more on the front squat.

What is considered a good result in the front squat? Top super heavyweight weightlifters such as Paul Anderson, Vladimir Marchuk, Alexander Kurlovich and Mark Henry front squatted at least 317.5 700 pounds!; and absolute clean and jerk world record holder Leonid Taranenko did 661 pounds for 3 reps. Two other weightlifters who deserve mention are three-time Olympic champion Pyrrros Dimas of Greece and Dursun Sevinc of Turkey; both weighed 187 pounds and lifted more than 600 pounds in the front squat. The all-time record appears to be held by Derek Kendall, who did 823 pounds using the technique with his arms crossed in front.

What ratio should you expect between your front squat and the back squat? If you are going all the way down in both exercises, generally the ratio of front squat to back squat is about 85 percent. So if you can back squat 200 pounds, you should be able to front squat 170 pounds. One reason few athletes achieve this ratio is that they do not back-squat all the way down, thus inflating the amount they can lift in this exercise.

To perform the exercise, use a pronated (palms down) grip as you would for a power clean. Squat down until the hamstrings completely cover the gastrocnemius (upper calf) muscles. You should not be able to see daylight between the hamstrings and calf muscles. Keep your trunk upright, and push your elbows up and in. If you cannot keep your elbows up and in, the external rotators of the humerus are too tight. Find a good soft-tissue practitioner who can help you develop rapid increases in mobility. There are many forms of these techniques available to give the soft tissues the proper elasticity, from ART™ to Applied Kinesiology, and the FAT tool.

Athletes who have a tight shoulder girdle may want to try using lifting straps to hold up the bar. To use them, hook the straps around the bar at shoulder width, or whatever position you find most comfortable. Place your shoulders under the bar and grasp the straps with your palms facing each other (i.e., semi-supinated or neutral). How high up you grab the straps is determined by your flexibility, such that those with poor flexibility will have more space between the bar and their hands. Now lift the weight off the squat rack and start squatting. You’ll find that using straps in this manner enables you to keep your elbows high without discomfort.

During the front squat two spotters are best, but an experienced coach can safely perform a single spot.

## Squatting Alternatives

Although the squat is a great exercise for improving knee stability, for some individuals the compressive forces that the squat places on the lower back make it uncomfortable to perform the exercise for prolonged periods. Also, some people get burned out on the squat and begin looking for alternatives to keep their interest piqued. For these individuals, there are several devices that may provide variety to keep the legs growing big and strong with minimal stress on the lower back – and without resorting to geek exercises like knee extensions.

Regarding machines that attempt to duplicate the squat, the basic problem is that although they may reduce the pressure on the back, they may place significant stress on the knees. Take, for example, the ever popular Smith machine, which forces the barbell to move along a straight, guided path.

Most Smith machines have the bar moving strictly vertically while another version has the bar moving at a slight angle. The design of the Smith machines makes it possible to squat in a manner that allows the user to lean back against the barbell, thereby supporting the back and minimizing hip extension during the exercise. What this does is take the hamstrings out of the movement, which is bad because the hamstrings help stabilize the kneecap. The result is unnaturally high shearing forces that try to pull the joint apart, as well as tremendous stress on the anterior cruciate ligament (ACL), one of the primary ligaments in the knee capsule that provides stability to the knee. For this reason, our advice is to use the Smith machine infrequently or not at all.

All the squatting-alternative devices have this factor in common: they displace the center of mass of the resistance to reduce the stress on the skeletal and muscular structures. Let's examine a few other alternatives to traditional squats.

**Barbell hack squats.** This exercise was popularized in the bodybuilding world by Russian wrestler Georg Karl Julius Hackenschmidt. Of German and Swedish descent, Hackenschmidt was born in 1878 in Estonia and walked the talk of physical and athletic fitness until his death in 1968 in England. When he was 18 years old, he could lift 200 pounds overhead with just one arm, and in 1898 he exceeded strongman legend Eugen Sandow's world-record one-arm overhead lift of 255 pounds with a best of 269 pounds – later he did 279. That same year he also snatched 196.5 pounds with his right hand, a world record.

The hack squat – a low-cost alternative to back squatting – will promote top-level growth in the vastus medialis, a muscle of the lower leg that crosses the kneecap. Granted, using a barbell instead of a machine makes the movement uncomfortable and reduces the amount of weight that can be used, but its effectiveness overrides the concern about comfort.

To perform a true barbell hack squat, you need a barbell and an adjustable rack so you can place the barbell at an optimal height for picking up and racking the bar. Your heels should be elevated by a wedged board or a two-by-four so you can squat with a straight back and so your hips will be under your shoulders in the bottom position (we prefer to use a wedged board instead of a two-by-four, so the exercise is more comfortable for the



arches).

Set the wedge or two-by-four in the middle of the power rack. Set a barbell on the rack so it is about 4-6 inches lower than your gluteal line. Standing with your back to the bar, grab the barbell, preferably with straps. This is one of the rare instances in which we recommend the use of straps.

Walk forward until your heels rest on the board. Initiate the squatting motion by allowing your knees to travel as far forward as possible, without allowing your glutes to move back. Keep a slight arch in your lower back. Once your knees have gone as far forward as possible, lower your hips to the bottom position of the squat. Be sure to keep your back upright by pushing the bottom of your sternum up. Don't allow the shoulders to round forward, and be certain your hips are under your shoulders in the bottom position.

**Buffalo bar.** Some trainees will complain of the following when using a straight bar during squatting: sore wrists and shoulders, and uncomfortable pressure on the neck. The buffalo bar is in fact just a very stiff, slightly cambered bar that makes squatting more comfortable for people who have a hard time supporting a straight bar. It provides a more comfortable variation of the back squat for those who are trapezius challenged.

The buffalo bar is also great for high-rep squatting. Bodybuilding programs tend to work in cycles, with so-called revolutionary new programs evolving every five to ten years. One of these programs is high-rep squatting, often superseded with pullovers to expand the rib cage. This method was first promoted in the '70s by Peary Rader, *Ironman's* founding publisher, and then by the late-great Don Ross in his many books and articles, and most recently by Randall Strossen of *Milo* magazine in his late-'80s book *Super Squats*. Although there is still no concrete evidence that the pullover will expand the rib cage any more than will breathing hard after exercise, for short-term purposes this can cause extreme soreness and serve as a satisfying introduction to non-bodybuilders about how hard weight training can be.

Supersetting pullovers aside, there is still some merit to high-rep squatting. The downside is that most bars will undulate when you perform multiple reps, which can hurt the tempo and place some jarring compressive forces on the lower back. Because the buffalo bar is stiff, there is no undulation of the bar when doing fast, multiple reps. We recommend the bar for high-rep squatting or even high-rep lunges. The stability also makes the bar ideal for the good morning exercise.

**Magic Circle squats.** The Magic Circle came to life as the Douglass Frame. It was a rectangular frame draped over the shoulders with supporting harnesses. Later on, its inventor, James Douglass, further refined his invention by shaping it into a circle. The new design was popularized by Ironman's Peary Rader, who sold it through his Body Culture Equipment company. It has been resurrected periodically by various authors, such as American weightlifting coach Carl Miller in the mid-'70s and later by Randall Strossen in *Super Squats*. Compared to barbell squats, the Magic Circle lowers the center of gravity dramatically, thus reducing the stress on the lower back. It is another favorite of those authors who endorse high-rep squatting for bulking up.

The Magic Circle is an apparatus that can be used for the home gym owner, but it will never become a popular item in a commercial gym because of the space it would take up as a permanent station, not to mention the liability of squatting in a circle of steel with no safety supports. Also, it takes time to get in and out of it and requires a good sense of balance.

**Front harness squats.** The front harness squat allows you to squat without struggling to hold the bar. Some people like to use the harness on the Smith machine, but as you've already learned, we hold a poor opinion of any work done on the Smith machine. The front harness is good for people with weak rhomboids that limit their squatting poundages. People with large arms (over 18 inches) may still find it hard to use.

**Manta Ray.** The Manta Ray was designed originally to protect the upper vertebrae of beginning lifters. Powerlifters who strain their shoulders or their brachialis muscles by doing scores of reps with low-bar squatting will benefit enormously by shifting to Manta Ray squats until their injuries recede.

The Manta Ray provides at a very low cost an effective variation for the back squat. By displacing the center of mass of the resistance, you change the motor recruitment pattern, thus fostering further adaptations in the squatting muscles. Also, those with large trapezius development may find it uncomfortable because it's a "one size, fits all."

**Safety squat bar.** The safety squat bar was developed in Germany more than 40 years ago, yet there are people in the US who claim to have invented it about 15 years ago. Bobsled superstar Pierre Lueders has used this bar to improve his squatting poundages. It is very good for people who have encountered injuries in the L-5 vertebra region, as it lowers the center of mass of the resistance. There are three ways to use the bar:

- Holding on to the racks in front of you
- Using locked arms, parallel to the ground in front of you, with the fingertips brushing against the racks (this style ensures that your back stays as upright as possible)
- Holding on to the yoke

There are some flexibility restrictions with this bar. Some people complain of pain in the wrists, elbows or shoulder girdle. However, the safety squat bar has many advantages. When using a straight bar, there is always a chance that you will lean forward or round your back, thereby increasing the potential for serious injury to the lower back. With the safety squat bar, the center of mass of the resistance is lower and more in line with the midline of the body. This prevents the excessive forward leaning associated with straight-bar squatting.

In some instances, trainees have lost balance forward or backward, greatly compromising their safety. Once again, since the resistance is closer to the center of gravity when using the safety squat bar, it is much easier to balance high loads. The padded yoke reduces compressive forces by redistributing the load.

With the safety squat bar you can spot yourself if you get stuck in a position by simply pressing on your quadriceps or pulling up on the racks since your hands are free to help

you go through the sticking point. There are varying degrees of quality in the safety squat bars available.

**The Zane Leg Blaster.** This device was first introduced to the bodybuilding world as the Moore Leg Blaster; however, it didn't become popular until it was endorsed by Mr. Olympia Frank Zane. We guess nobody had ever heard of Moore? In a short time (and by being mentioned in a few issues of *Muscle and Fitness*), it became known as the Zane Leg Blaster.

Whether it's called the Moore or the Zane Leg Blaster, it is still a toy. If you have access to it, it can provide variety to your leg workouts; but it is certainly not necessary for ultimate leg development. And if it allows anyone to get down to full squats, all the better. As with the Magic Circle, it is more likely to be bought by the home gym fanatic than by the gym owner.

### **For Your Consideration: Step-ups**

OK, relax. We're not going to tell you to stop squatting, but we want you to take a look at one lower body exercise that we commonly prescribe to our clients to complement squats or serve as a substitute for them. It's a class of exercises called step-ups.

Gin Miller is credited with creating step training in 1989, a choreographed aerobic training program that incorporates the use of low step platforms. Step training became so popular that now the exercise is often associated with aerobic fitness and so-called muscle toning. But the truth is that the step-up and its many variations are versatile lower-body exercises that can be used for rehabilitation, structural balance, body composition training and high-performance athletic fitness.

*Cross training* refers to the concept that because individual sports each focus on certain muscles more than on others, an athlete can achieve balanced muscle development and thereby help avoid injuries, especially overuse injuries, by varying the sports they play. As such, a distance runner could swim in the off-season to develop their upper body, and a golfer might play tennis to balance out the muscles in their back and abdominals. But the issue with most athletes is that regardless of the sports played, the lower body muscles do not receive a lot of work throughout a full range of motion, and this creates muscle imbalances. Consequently, step-ups have always been a part of our structural balance programs.

To recap, structural balance refers to the major muscles of the body being in balance with each other. This means the balance between opposing muscle pairs (such as the biceps and triceps for the arms, and quadriceps and hamstrings for the legs) and also between the limbs (such as the right leg and the left leg). So it's not enough just to have the proper strength ratio between the hamstrings and quadriceps, for example; the strength of the quadriceps and hamstrings on the right leg should be equal to the strength of those muscles on the left leg.

One example of the consequences of structural imbalance can be seen in the increasing number of knee injuries among female athletes. The American Orthopedic Society for Sports Medicine reports that each year more than 20,000 high school female athletes

suffer serious knee injuries, usually involving the anterior cruciate ligament (ACL). Developing structural balance in all the muscles that affect the knee is one important step to dealing with this problem. However, the concept of structural balance extends beyond injury prevention; it can also help with knee rehabilitation.

The progression of step-ups we use now in our training, and which is taught in the PICP Level 2 class, consists of the Poliquin step-up, Petersen step-up, step-up and side step-up. The progression of implements used to add resistance is dumbbell, barbell on back, barbell on front. From there, we move into split squats, lunges and then squats. From a periodization perspective, this progression would best be applied at the end of a sports season, when structural imbalances are usually at their worst.

The step-ups with weights is an exercise that has been heavily promoted by Angel Spassov, who was a strength coach in Bulgaria. However, former Bulgarian national team head coach Ivan Abadjiev says that this exercise was not used by any member of the national teams he coached. That being said, it was reported that Russian weightlifter Leonid Taranenko, who still holds the record for the all-time best clean and jerk with a lift of 586.4 pounds, performed high step-ups when he felt his lower back was excessively fatigued from squats. This makes sense. Compared to the body position in squats, during step-ups the torso is more perpendicular to the floor, requiring less work from the erector spinae muscles that help extend the spine.

Performing step-ups with a barbell on his shoulders, Taranenko reportedly lifted as much as 396 pounds. However, we recommend that anyone who performs this exercise with heavy weights should have at least one rear spotter (but preferably one rear spotter and two side spotters). What spotters must know is that lateral stability is compromised on this exercise, so they must be aware of tilting. And for maximum safety, trainees should perform heavy step-ups inside a power rack, with the safety rods set at an appropriate height so that in the case of a miss, the barbell doesn't drop more than a few inches.

Regarding teaching tips, the important point is that the top leg does all the work. One of our trainers worked with a female figure skater of 115 pounds who could perform 255 pounds in a step-up with the front leg parallel to the ground. But the catch is she was pushing off with the back leg – an impressive lift, but it's not what we're looking for. Next, the rear leg must be kept straight (of course, it will be flexed slightly when landing), and the toes of the bottom leg will lift (dorsi flex) to help prevent the trainee from pushing off. The top leg is turned out five degrees, which is anatomically more in line with how the upper thigh bone inserts into the pelvis.

With few exceptions, we've found that among the elite athletes we work with, one leg is often significantly stronger than the other. We've found that starting these athletes with a cycle of single-leg exercises results in greater long-term progress in the squat than if they perform only squats. One variety of step-ups we often use with athletes is the side step-up. The start position of this exercise is with the body sideways to the platform, with the leg closest to the platform resting on the platform. Again, the athlete steps up until the working leg is straight. The side step-up places more emphasis on the vastus lateralis and also on the inner thigh muscle groups called the adductors, which are important for

athletes because they help stabilize the leg during movement.

There are many other useful varieties of step-ups. Additionally, there are adjustable step-up platforms that help the user perform these exercises conventionally and safely. But be aware that not all platforms are equal regarding safety: Several years ago a lawsuit was filed against a D1 college when a female athlete suffered a serious injury when performing barbell step-ups on a technique platform attached to a power rack.

This platform had a V-shape that did not provide optimal support for the foot, and in fact this platform was not designed for this purpose. In contrast, the Atlantis Leg Platform, for example, is adjustable in one-inch increments, from 7 inches to 31 inches. It has a nonslip platform, and a handle is positioned at the front of the unit to enable the upper body to assist with the concentric portion of the exercise, making it invaluable for rehabilitation. Again, the squat is still the king of all exercises, but the versatility of the step-up makes it a key exercise in any physical and athletic fitness training program.

## **The Road Less Traveled: Split Squats**

In the PICP courses, we spend a considerable amount of time not only discussing the value of split squats but also having our students perform many variations of these exercises in the practical portions of these classes, as they are seldom performed properly.

Because there is some confusion about terminology, it's important to recognize that the difference between a split squat and a lunge is that with the split squat, you use a stationary stance where you go up and down on the forward leg.

Split squats (along with lunges) have been popular among women because they are promoted as being good for working the glutes. In the '90s, one popular women's program called Freestyle promoted split squats and lunges as the primary leg exercises for women. The program evolved into a book (which, we learned, sold reportedly 50,000 copies), a DVD and a certification course.

In the weightlifting community, barbell split squats were heavily promoted by Angel Spassov when he lectured in the US in the late 1980s. In the variation he favored, the back leg is elevated on a low platform (about four inches), a position that puts greater stress on the quadriceps because there is more weight on the front leg. Spassov believed split squats were great exercises for athletes, and apparently they were used for a time by junior weightlifters in his country to develop leg strength for the classical lifts. Many personal trainers promote a back split squat for athletes, but the back foot is placed on a platform that is much higher than either Spassov or we recommend. The result is that this type of squat places the lower back in extreme hyperextension, which should provide chiropractors with many new clients.

Properly performed split squats should make you sore not only in the glutes but also in the hamstrings, quadriceps, and adductors. We have seen many sprinters, jumpers and bobsledders add inches to their already well-hypertrophied legs by supplementing their squatting programs with lunges or split squats.

We also like to use them if the athlete's lower back has not yet recovered from a squat or

deadlift session. They provide plenty of leg training without overloading the spine. In our opinion, in lower-body-dominated sports like soccer and American football, they are the best prevention tools against groin pulls.

Regardless of the set-rep protocol you use with this exercise, always start with the weaker leg first to help correct muscle imbalances faster. And now, here is how to perform split squats properly:

## **Starting Position Setup**

- Stand facing away from a barbell placed on a squat rack.
- Using your index fingers, set up a reference point on the bar (use the knurling to determine the width of the grip).
- Keep your index fingers as close as possible to the outside of the shoulders.
- Duck under the bar and place the bar on the thick area of the trapezius muscle.
- Keep your chin up slightly.
- Focus your eyes on the opposite wall at a point that's slightly higher than your eyes to maintain proper neck alignment.
- Keep your feet shoulder-width apart.
- Take a big step directly forward with your nondominant leg to reach the initial starting position.

## **Descent**

- Move your front knee directly forward, maximally before lowering your hips.
- Lower the hips, keeping your back as erect as possible and your chest up.
- Lower your body under control until your hamstrings come in contact with your calves.
- Make a conscious effort to keep your elbows under the bar throughout the movement. This will ensure that the load is kept as close as possible to the center of gravity.
- Make sure your knee travels forward and over your toes throughout the descent.
- Inhale through your mouth throughout the descent.

## **Ascent**

- First, raise the hips.
- Keep your torso as perpendicular to the floor as possible throughout the ascent, particularly at the sticking point.
- Exhale throughout the ascent.

## **Watch-Fors**

- Keep your trunk as erect as possible throughout the movement.

## Safety Concerns

- Keep the eccentric lowering under control.
- Do not lean forward.
- Because heavy weights can be used and lateral stability is compromised, you should perform the exercise inside a power rack with the safety pins set at the appropriate height to catch the weight should you lose your balance. Of course, a spotter can also help you maintain control.

To change the resistance curve on this movement, you place the barbell on the clavicles using a front squat grip. You can also perform the exercise either with dumbbells or by holding a single-handle cable hooked to a low pulley using the contralateral hand.

The squat is unquestionably the most effective exercise for increasing muscle bulk in all the major lower body muscles, so it has earned its title of “king.” Additionally, the squat is one of the most effective exercises to improve knee stability, rehabilitate knee injuries and develop overall strength.

# Chapter 11: Hamstrings



Robert Kennedy founded *MuscleMag International* in 1974, a popular hardcore bodybuilding magazine. The magazine ceased publication in 2013, approximately a year after Kennedy died.

Ask gold medal decathlete Dan O'Brien what the most important body part in his weight training regimen is and he won't hesitate in answering, "Hamstrings." It's true – the hamstrings are essential to a track and field athlete's speed and dynamic power.



Elite-level bodybuilders also know the importance of fully developed hamstrings, where every detail of this powerful muscle group stands in relief. Yet for many bodybuilders, the hamstrings fall into the don't-train-what-you-can't-see category, and they may know only one or two exercises to work these muscles. Thanks to new information and new equipment, there are many more options now.

A properly designed hamstring specialization program can, in as little as 12 weeks, dramatically change the appearance of your legs. We're not saying your inner thighs will touch when you're standing with your feet apart, but you'll have delineated muscle where none was before. What's more, such a program can increase your bodyweight 10 to 20 pounds and reduce your risk of injury – a must if you're using weight training to improve performance in another sport. Now let's take an in-depth look at serious hamstring training.

## **Functional Anatomy of the Hamstrings**

The hamstring muscle group is composed of three separate muscles: the semimembranosus and the semitendinosus, which collectively are referred to as the medial hamstrings; and the biceps femoris, which is often called the leg biceps.

The medial hamstrings cross the hip and the knee joint and are involved in extending the hip and flexing the knee; they also assist in turning the knee inward (medial rotation). The leg biceps, like its cousin the biceps brachii, consists of two heads: the long head and the short head. The long head crosses both the hip and the knee joint and is, therefore, involved in extending the hip and flexing the knee. The short head also flexes the knee, but because it does not cross the knee joint, it cannot extend the hip. However, both heads assist in turning the foot outward (lateral rotation of the knee).

In addition to these three hamstring muscles, there are additional muscles that are considered synergistic to the hamstrings in that they assist in flexing the knee and extending the hip. The muscles that assist the hamstrings in their knee flexor function are the sartorius, gracilis and gastrocnemius. The muscles that assist the hamstrings in their hip extensor function are the glutes and the erector spinae muscles. Track and field coaches tailor their training to capitalize on the fact that the hamstrings are connected as a chain to the glutes and back extensors – or, to be more specific, a posterior chain of muscle.

This anatomy lesson is not just academic. First, the information above implies that for complete development, your hamstring workouts should involve exercises for both the hip extension function and the knee flexor function. Also, understanding these specific muscle functions enables coaches to determine which muscles are weak and need remedial specialization. Here are a few examples.

If the knee flexion function is deficient, you might prescribe variations of leg curl exercises such as seated, prone, kneeling and standing. MRI studies show the biceps femoris, semitendinosus, sartorius and gracilis are recruited when performing this movement.

## Myths About Hamstrings

There are many myths about hamstring training that prevent many bodybuilders and other athletes from achieving maximum development in this area. Here are four of the most common statements that are simply wrong:

**“Bodybuilders have the best hamstring development of all athletes.”** Not quite. Without question, the athletes who possess the best hamstring development are sprinters – just look at the development of these athletes the next time there’s a track competition on television. Mr. Olympia finalist Robby Robinson has some of the best hamstrings in the bodybuilding world in his era, and it comes as no surprise that he did lots of sprinting in his youth.

Sprinters achieve excellent hamstring development because the hamstrings are one of the primary muscle groups used in running. Sprinting also requires extreme force production and, because the athlete leans forward during the start of a sprint, the fast-twitch fibers of the hamstrings must contract with maximum intensity to propel the body forward.

Bobsledders also have excellent hamstring development because not only do they sprint, but they do so while pushing a sled that can weigh over 600 pounds! The hamstring development of Ian Danney, a 180-pound bobsledder who can front squat 418 pounds for 2 reps, is equal to that of any professional bodybuilder. Incidentally, Danney is now one of the most sought-after pro football strength coaches in the US, training as many as 60 NFL players every off-season.

**“Leg curls are the best hamstring exercise.”** For knee joint integrity, most physiotherapists recommend a 66 percent hams-to-quad ratio – which means that the hamstrings can produce 66 percent of the force of the quadriceps. When the skiers on the Canadian Olympic team performed only half squats, the average ham/quad ratio was 58 percent. After 11 weeks of deep squats, it improved to 79 percent. (Incredibly, the best sprinters will have 125 percent, almost twice the percentage physiotherapists recommend.)

A simple way to determine your ham/quad ratio is to test your maximum front squat, which ideally should be 85 percent of your back squat. If you want your ham/quad ratio assessed in a laboratory, make sure it’s done on a Kin-Com machine. Not only is the Kin-Com machine the best available, but it also measures eccentric strength.

**“Cams provides an ideal resistance curve for the hamstrings.”** During knee flexion, the hamstrings express a force curve of a descending shape; that is, the muscles produce less force at the end of the movement. Most shell-shaped cams provide increasing resistance, so by overloading the weak points of the movement and underloading the strong points, you disturb the force production of the hamstrings and therefore increase the risk of injury.

Besides having the wrong force curve, the first leg curl machines with cams had a flat surface that could aggravate or cause a low-back injury, especially for individuals with a lot of fat stored in their abdominal wall. This machine should have been designed with a “hump” shape to position the hamstrings in a better pre-stretch position.

**“Hamstrings respond best to high reps.”** This is probably one of the biggest reasons that most bodybuilders do not have impressive hamstrings. Earlier we praised the hamstring development of sprinters. How far do sprinters run? Answer: Generally about 200 meters or less. How long does it take to run 200 meters? The world record is 19.19 seconds. Although the time under tension is short, these athletes show enormous hamstring development because the hamstrings are composed primarily of fast-twitch fibers and respond better to heavy weights and low reps.

Numerous studies on the relationship between maximal-strength tests and the number of repetitions performed (at a given maximum) have repeatedly shown that the hamstrings are not gifted for reps. Although you may be able to perform 10-12 reps at 70 percent of your maximum on the bench press, you will probably be able to complete only 7 or 8 reps at the same percentage on the leg curl. If you use 15-20 reps per set on hamstring exercises – a repetition range often promoted by the Nautilus disciples – your training intensity would be approximately 50-55 percent of your maximum. Such a low intensity level would not provide enough tension for these numerous fast-twitch muscles to grow.

## **Top 10 Hamstring Training Tips**

Now let's examine training methods that will help you achieve optimal hamstring development.

**Tip 1: Select exercises for both functions of the hamstrings.** Magnetic Resonance Imaging (MRI) technology has demonstrated that leg curls do only part of the job in recruiting the hamstrings. For example, the supine leg curl involves the biceps femoris, semitendinosus, Sartorius, and gracilis. The semi-stiff-leg deadlift and the good morning involve the adductor magnus, adductor brevis, biceps femoris, and semitendinosus. Therefore, your hamstring workouts should involve exercises for both the hip extension function (good morning and semi stiff-leg deadlift) and the knee flexor function (seated and prone leg curl).

**Tip 2: Include exercise variations that train one leg at a time.** When we test athletes on the Kin-Com unit, we often find strength disparities between the two legs, even among top-level athletes. The dominant leg of some athletes is as much as 20 percent stronger than the nondominant leg – these athletes need single-limb training to prevent injuries. (Incidentally, the dominant leg is not necessarily on the same side as the dominant hand; in other words, it is not because you are right-handed that your right leg may be dominant in the lower body.) Also, because of a neurological effect called the bilateral deficit, the hamstrings will contract harder if they are trained one leg at a time.

**Tip 3: Stretch the hamstrings at both the hip joint and the knee joint to facilitate recruitment.** This means the knees must be extended and the hips flexed in the starting position. Thus, before lifting the weight in the standing leg curl, you would need to bend forward from the waist and start with the legs straight.

**Tip 4: Stretch the quadriceps between sets of hamstring work.** Increasing the range of motion of your hamstrings will increase the amount of muscle mass used during

the exercise and, therefore, the effectiveness of the exercise. Stretching the quadriceps, which is the antagonist of the hamstrings, is one way to increase your range of motion because this will reduce muscle tension that can shorten the muscle.

**Tip 5: Use eccentric training.** Eccentric (negative) training refers to the lowering portion of an exercise, as opposed to concentric (positive) training, which refers to the lifting portion. The hamstrings respond well to eccentric work. Triple jumpers and long jumpers are known for their hamstring development. Besides the sprinting they do, these athletes have to absorb high-impact landings that prompt high levels of eccentric contractions from the hamstrings.

**Tip 6: Emphasize low reps and multiple sets.** Because of the high fast-twitch composition of the hamstrings, there is little point in training with high repetitions. When you use more than 8 reps during hamstring exercises, you are training below 70 percent of your 1RM (one-repetition maximum), an intensity level that will not create sufficient tension to elicit increases in hypertrophy and strength.

**Tip 7: Strive for balance between the medial and lateral heads of the hamstrings.** The body never lies. To test if there is a head of the hamstrings that needs remedial specialization, select a weight you can do for 6RM in the leg curl with your feet in the neutral position. As you reach muscular failure, your feet will rotate in one direction if there is an imbalance between the two heads of the hamstrings. If they turn towards the midline of the body (medial rotation), your biceps femoris is weaker in comparison to your semitendinosus and your semimembranosus. If your feet turn away from the midline of the body (lateral rotation), your semitendinosus and semimembranosus are weaker in comparison to your biceps femoris.

**Tip 8: Even if you have balanced hamstring development, vary your lifting position frequently.** Variety is an essential requirement for maximal hamstring development because each exercise offers a unique pattern of overload. You probably have more hamstring exercises at your disposal than you think. Let's say that your gym has the four major types of leg curl units: seated, lying, standing and bent-over kneeling. This will give you an arsenal of 12 hamstring curl exercises: 4 machines x 3 foot positions (neutral, inward, outward) = 12 permutations.

**Tip 9: Train the hamstrings first in your leg workout.** There is plenty of empirical evidence that muscles trained early in a workout make greater progress than muscles trained at the end of a workout.

**Tip 10: Use strategies for optimal recovery.** The hamstrings have a high fast-twitch makeup and thus take a long time for recovery. A 30-day hamstring specialization cycle for someone with great quads would look like this:

Notice that the number of sets is significantly lower during the last two workout days of the cycle. Why? To comply with the unloading principle. If you lower the volume after the third week yet maintain or even increase the intensity, your supercompensation (gains) will be of a greater magnitude than if you keep the volume constant. The exact

physiological mechanism is somewhat unclear but appears to be of a neuroendocrine nature. This is the same mechanism that accounts for the boost in muscle mass and strength when people first embark on a low-volume training schedule.

Incorporate these 10 tips into your routine and you'll immediately begin to see and feel the results. Keep in mind that optimal hamstring development requires more than just a few sets of leg curls at the end of your workout. You need to make hamstrings a priority in your training and work them as hard as you would your arms or chest.

Now let's take a close look at two exceptional hamstring exercises, one focused on knee extension and one on hip extension. Let's start with knee extension.

## **Knee Extension Function**

### **The Glute-Ham Raise: You Can Have it All**

We often talk about the benefits of focusing on exercises that give you the most bang for your buck. These are exercises that involve a large amount of muscle mass and create high levels of muscle tension. Cable crossovers? No, despite the fact that they look good in photo spreads. Triceps kickbacks? Hell, no! Squats and deadlifts? Yes, absolutely. Add to that list the glute-ham raise (Figure 5).



Figure 5 - Glute-Ham Raise (BFS Photo)

The glute-ham raise – or, more appropriately, the glute-ham-gastrocnemius raise, because it also works the calves – enables an athlete to work two functions of the hamstrings: knee extension and hip extension. It also works the entire length of the erector spinae muscles, especially the middle portion, which is often exposed to high forces in athletics. The back extension is a good exercise, but because the legs are straight throughout the exercise, it works only hip extension and not knee extension. Further, some sports scientists consider the glute-ham raise a more natural movement because in this exercise the hip and knee extensors work together instead of in isolation.

What many trainers don't realize is that although the quads are impressive muscles, it's been estimated that approximately 40 percent of the power for sprinting comes from the glutes, 25 percent from the hamstrings, and about 5 percent from the calves. That's why it's imperative that all athletes concentrate on strengthening these muscles with assistance exercises such as the glute-ham raise.

The glute-ham raise to be one of the most important exercises for preventing back and

knee injuries. The spine is exposed to great compressive forces in many sports, and we've found that athletes who are weak in the hamstrings, glutes, and lower back not only are more likely to injure their lower back but also are especially prone to tearing their ACL. Because the glute-ham exercise increases muscle mass and strength in the back, glutes and hamstrings, athletes who include this exercise in their programs are better able to withstand the compressive loads and other disruptive forces that occur in sports such as football and Alpine skiing. Further, the glute-ham raise strengthens the spine without the high compressive forces that exercises such as deadlifts place on the spine.

For trainees who think they can do fine by focusing on core lifts such as power cleans and squats, consider the adage that a chain is only as strong as its weakest link – and in power cleans and squats that weak link is often the lower back and hamstrings. In those exercises, the lower back muscles help transfer the force from the legs to the upper body and then to the bar, so neglecting the back will compromise a trainee's technique or will force them to use lighter weights. If heavy weights are used without adequately strengthening the muscles of the spine, the back will round, placing harmful stress on the ligaments and disks of the back.

**The Russian advantage.** Russian weightlifting coaches placed a great deal of emphasis on the erector spinae muscles. In fact, at the 1968 Olympic Games in Mexico City, US weightlifter Tommy Suggs observed that the Russians would assess their competition by the thickness of their erector spinae muscles. As a Russian coach or athlete shook a competitor's hand, he would reach behind the athlete with his free hand and touch the athlete's back muscles to check their tone and thickness. Another US weightlifter who attended training hall sessions in Russia said that he saw the Russian athletes perform back extension movements such as the glute-ham raise twice, once at the beginning of the workout as a warm-up with no additional resistance and again at the end of the workout with resistance as a strengthening exercise.

The first appearance of the glute-ham raise in American print media was in 1971 in *Strength and Health* magazine, which showed photos of Russian weightlifters performing the lift on a pommel horse, with the athletes securing their feet on wooden stall bars. The rounded edges of the pommel horse allowed the athletes to flex their knees at the top to achieving a greater range of motion. In later years, they would secure their legs with straps attached to the stall bars.

**Design.** Because most gyms in the US did not (and still do not) have stall bars and pommel horses, eventually a special exercise unit was developed to perform the glute-ham raise. Rather than having a flat bench on which to rest the upper thighs, the bench was curved to facilitate the bending of the knees – we especially like the versions that have two pads, separated down the center, making it more comfortable for men. The better units have a footplate that secures the ankles between two roller pads; also, the footplate is adjustable vertically and horizontally to accommodate all body types.

**Adjustments.** Before performing the glute-ham exercise, it's important to adjust the machine for your height. Start by adjusting the footplate so that when your feet are secured, your upper thighs are resting on the center of the bench and you can hang your

upper body over the edge of the bench so that it is perpendicular to the floor. Next, adjust the height of the footplate to a comfortable position – if the footplate is too low, the pad will dig into your thighs.

Begin by lying facedown on the unit. Using the hand grips for support, place your feet on the footplate with your toes pointed downward. Hang over the bench, bending at the hips so your upper back is at a 90-degree angle to your lower body. Place your hands across your chest, and raise your trunk so your upper body is perpendicular to the floor – keep your back straight (i.e., in a neutral position) throughout the exercise. From here, continue raising your trunk by flexing your knees – you should be pushing the footplate with the balls of your feet to activate your calves, as they are involved in knee flexion. If you are not strong enough to lift your trunk to this position, try the exercise with your hands on your hips, as this will lower your center of mass. If it's still too difficult, a training partner can essentially reduce the weight of your upper body by standing in front of you and pushing upward on your shoulders.

**Adding resistance.** When this version of the exercise becomes easy, perform the eccentric portion of the exercise with your hands placed behind your head – this moves the center of mass closer to your head. In other words, perform the concentric portion with your hands across your chest (which will make the movement easier), and at the top of the movement place your hands behind your head for the eccentric portion (which will make the exercise harder). Soon you will be able to perform all the reps with your hands behind your head. You also can make the exercise more difficult by placing your knees on the pad (which requires moving the footplate closer to the pad) and raising the height of the footplate.

When you become strong enough to add more resistance, you have several options. For example, you can hold a medicine ball, weight plate or dumbbell against your chest. If you are strong enough, you can place a barbell behind your shoulders; position the bar the same as you would when doing a back squat – not on your neck. We do not recommend bands or chains because the glute-ham movement has a descending resistance curve, meaning that this exercise becomes harder as you reach the top of the movement. Using chains or bands would make the exercise too difficult at the end of the movement instead of at the beginning, where you are stronger.

Besides changing your hand position from the chest to behind your head, you can change the position of the additional weight to increase the eccentric overload. Here's how to do it: Grasp a weight plate or dumbbell and hold it against your chest. Perform the concentric portion of the exercise, and then at the top position extend the weight in front of you and slowly return to the start position. Extending your arms increases the lever arm, thereby increasing the resistance during the eccentric portion of the exercise. This is surprisingly difficult. If you can perform 10 perfect repetitions of this exercise in the normal fashion, you might find that just five pounds of additional resistance is all that is necessary to sufficiently overload your muscles. Because the hamstrings are composed primarily of fast-twitch muscle fibers, they respond well to this variation because you can create a higher level of muscle tension with eccentric contractions.



Because you are weaker during the second portion of the exercise, you can perform a form of pre-exhaustion to more effectively match the strength curve of the muscles. For example, you can perform 5 repetitions of back extensions (i.e., the first part of the exercise) with resistance, and then immediately perform 5 reps of the full movements – what you’ll find is that during the last several reps, the exercise will feel “smooth” throughout the entire movement. You also can use a form of post-exhaustion by performing 5 full repetitions without resistance, and then grasping a weight and immediately performing 5 back extensions.

We should also mention that the glute-ham raise can be used to resolve structural imbalances between the medial hamstrings (semitendinosus and semimembranosus), which rotate the foot inward, and the lateral hamstrings (biceps femoris), which rotate the foot outward. For example, if an athlete runs with their feet turned excessively outward, we would have them perform the glute-ham raise with their feet turned slightly inward. If they run with their feet turned excessively inward, we would have them perform the exercise with their feet turned slightly outward.

The glute-ham raise is a must for athletes who want to run faster and jump higher. But more than that, it is an exercise that will help improve athletes’ structural balance so they can perform better with less risk of injury.

Now let’s look at an exercise that will focus on the hip extension function of the hamstrings.

## **Hip Extension Function**

### **The Evolution of Lower Back Training**

For nearly two decades we have been promoting the reverse hyper exercise. Although a relatively simple movement, it has multiple benefits in terms of spinal health and athletic performance. Here we’ll take a closer look at these benefits and at how the design of reverse hyper machines continues to evolve.

In the early days of the iron game and the strength coaching profession, athletes would perform many great exercises that worked the lower back – powerful multijoint movements such as squats, deadlifts, good mornings and power cleans. But these exercises gradually were de-emphasized, and now the lower back is often a weak link in an athlete’s development.

One individual we can point to for this unfortunate trend is Arthur Jones. Jones said it would be better for athletes and muscle builders alike to avoid squats and instead focus on isolation movements with machines. Jones’s observation was that since muscles function in a rotary fashion, barbells are inadequate tools because they provide unidirectional resistance, which is why barbell exercises have sticking points. As such, his opinion was that the only way to work the muscles evenly through a full range of motion was with machines possessing shell-shaped cams that provided heavier resistance when the athlete was stronger. Jones figured that an ideal lower body workout would include just one set of four exercises; namely, leg extensions supersets with leg presses (using the Nautilus

Compound Leg Machine), leg curl (Nautilus Leg Curl machine), and the hip and lower back machine (Nautilus Hip and Back Machine). The last machine, which is no longer manufactured, produced a motion resembling that of a squat but performed from a supine position. Nice try.

According to German sports scientist Dietmar Schmidtbleicher, machine exercises (especially when performed on variable resistance machines such as those produced by Nautilus) are not as neuromuscularly challenging as complex exercises with free weights. In other words, drawing on Gestalt psychology, the “whole” of a complex exercise such as a squat or a deadlift “is greater than the sum of its parts.” In fact, one of our colleagues came across a bodybuilder who could routinely pump out sets of 10 reps with 800 pounds on the incline leg press but struggled trying to do 3 reps with a parallel squat with 225 pounds – that’s just wrong.

What Jones did get right was the importance of training the glutes and hips, especially for athletes. The three major gluteal muscles are the gluteus maximus, medius, and minimus. They are a key muscle group for running, jumping and kicking because they work with the hamstrings and lower back muscles to extend the trunk and pull the pelvis backward. The erector spinae contains three parallel sets of muscles (iliocostalis, longissimus and spinalis) that run from the sacrum to the base of the neck. These muscles extend and laterally flex the spine.

Although squats and deadlifts strengthen the erector spinae muscles in compound exercises, if these muscles are relatively weak they will hold back your progress in these exercises. For example, a weakness in the erector spinae muscles could result in an athlete rounding their spine during the squat or deadlift, increasing the risk of injuring the disks of the spine. You are only as strong as your weakest link, and this explains the search for special assistance exercises that target these muscles.

Further, strengthening the erector spinae creates what is known as an “irradiation effect,” such that when you strengthen this muscle group, you also strengthen many other muscle groups. For example, by strengthening your lower back you can increase your performance in the military press and biceps curl. Nevertheless, many strength coaches persist in focusing their lower body training on exercises for the quadriceps.

## **The Reverse Hyper, Then and Now**

The reverse back extension has been used in gymnastics for a long time. There are two gymnastics books, one from East Germany and the other from Hungary, that show this exercise being performed with resistance over a pommel horse, with the athlete holding a medicine ball between their feet or, alternatively, having a kettlebell strapped to their ankles. The German physiotherapy book *Training Therapy: Prophylaxis and Rehabilitation* by Rolf Gustavsen and Renate Streeck shows the performance of this exercise using cables for resistance.

Another interesting variation was developed by American weightlifter Roger Quinn. At a bodyweight of 181 pounds, Quinn snatched 303 pounds, clean and jerked 385 at the 1972 Olympic Trials, and attempted a 402 jerk to try to make the US Olympic Team.

Impressive, but even more so was the fact that chronic knee injuries prevented Quinn from squatting heavy. As such, he would focus on the Olympic lifts and then substitute a combination of other exercises for squats. One of these was a reverse hyper using manual resistance.

Quinn describes this exercise in an article he wrote that was published in the March 1974 issue of *International Olympic Lifter*. Lying facedown on a pommel horse, Quinn had his coach, Bob Hise, Sr., apply manual resistance to his legs. Quinn's legs were straight throughout the exercise to avoid stressing his knees. "These reverse hyperextensions... seem to work the buttock muscles in the same fashion that the two-hand curl works the biceps," said Quinn. "I feel that this exercise comes close to really isolating the buttocks while at the same time employing the spinal erector muscles of the lower back."

In a physical therapy textbook from Australia published in the early '80s called *Posture Makes Perfect*, Dr. Victor Barker provided an illustration of a reverse hyper performed on a specially designed bench that enables the user to anchor the torso and lift the legs. The resistance was applied to the back of the lower legs with the roller pad of a leg extension machine. As for the first working prototypes of a reverse hyper machine, powerlifting guru Louie Simmons received the first patent on a machine.

Simmons also suffered a back injury and sought to rehab it by developing a reverse hyper extension machine. The resistance was applied by a strap that wrapped around the ankle. The strap attached to a lever arm that had a pivot point under the bench. This design enabled the legs to be pulled in line with and even under the hips, increasing the range of motion of the exercise and thus providing traction on the erector spinae. In 1993, Simmons received a patent for the first reverse hyper machine, and it became a hit with powerlifters and, later, with strength coaches.

Because so many basic weight training movements require the lower back to be arched, using the reverse hyper can help decrease muscle tension in the lower back. Further, the movement is ideal for many individuals with disk injuries because the compressive forces on the spine can be much lower on a reverse hyper machine than on conventional back machines. Research by Alf Nachemson of Sweden in 1975 showed that leaning forward about 15 degrees from a seated position can nearly double the compressive forces on the L2-3 vertebrae. We should also note that because the feet are not in contact with the floor or a footplate, the reverse hyper is an ideal exercise for those with a foot injury.

Many design changes have been made in reverse hyper machines to make the exercise more comfortable. Instead of positioning the pivot point of the lever arm under the chest, some machines place it in line with the axis of rotation of the hips. Ultimately, the strap was replaced with roller pads, some of which are adjustable, as the strap would often slip during the performance of the exercise. Some newer units have a step to make it easier to enter and exit the machine.

Another valuable feature, one that is included on the Atlantis version, is a range-limiter device. For those with flexibility issues, this design prevents the lever arm from swinging too far forward and causing injury. Finally, there have been many changes in the machine's support pad.

The first hyper extension machines had the chest pad horizontal to the floor. In later versions, the chest (or torso) pad is tilted downward so that the head is lower than the hips. This latter design has two advantages. First, it reduces the stress on the lower back by posteriorly rotating the pelvis and flattening the lower back into a neutral spine. With a conventional chest pad, lifting the legs to parallel can place a high level of stress on the L3 to L5 vertebrae – a situation you want to avoid; it's important not to hyperextend the spine (and as such, the exercise should be called a reverse back extension). Also, this position changes the resistance curve so that more resistance is felt earlier in the movement; in the Atlantis version, two weight holders are provided to overload either the beginning or end range of the exercise. But this pad has evolved a step further.

Many chest pads have a slit in the center at one end, making it more comfortable for men. Atlantis took it a step further with what we would describe as a half-moon pelvic bench rather than a chest pad to reduce the stress on the abdomen, a common complaint among users (especially women) of other reverse hyper machines. Those who experience abdominal discomfort when performing this exercise usually are improperly positioned on the chest pad.

**Expanding your options.** Although the reverse hyper is a valuable exercise, we still recommend the performance of other back exercises such as conventional and incline back extensions. For example, from a muscle recruitment standpoint, it appears that incline back extensions and reverse hypers target more of the lumbar spine below L3, and conventional back extensions recruit more of the spine above L3. Thus, in a six-week program, a trainer could perform reverse hypers for two weeks, followed by two weeks of back extensions, followed by two weeks of incline back extensions.

Because the erector spinae are composed of both high-threshold motor units and low-threshold motor units, you should perform a combination of high-rep and low-rep protocols. The low reps will help with performance in heavy compound exercises such as squats, and the higher reps are important to help prevent and rehabilitate conditions that cause back pain. In fact, the current thinking in back pain rehabilitation is that muscular endurance is more important than absolute strength. For more on this subject, we highly recommend Dr. Stuart McGill's extensively researched but highly readable textbook, *Low Back Disorders, 2nd Edition* (Human Kinetics, 2007).

The reverse hyper has gone through many changes, especially in the past two decades, and all for the better. We strongly recommend you incorporate this exercise into your workout programs. Now let's look at a killer workout that works all aspects of the hamstrings.

**The morning workout.** The morning workout of this hamstring specialization program focuses on the knee flexor function of the hamstrings. The muscles involved in this function have a higher fast-twitch muscle fiber makeup, and as such, a low-rep tri-set method is best to develop them.

Tri-sets are effective here because they extend the training stimulus to a wider pool of motor units, along with increasing the total time under tension for the associated muscle fibers. Tri-sets entail performing three different exercises with minimal rest between sets.

Simply adding a 15-second rest between exercises makes a world of difference in terms of training response, as this short rest makes it possible to use significantly greater loads than if no rest is taken, thereby putting greater tension on the muscles. Hypertrophy is determined in large part by the product of time under tension and load. If you move immediately from one exercise to another (as opposed to taking a 15-second rest), the reduced loads that must be used produce a suboptimal training effect.

Finally, note that the foot position is different in every exercise. Because of the different line of pull of the various hamstring muscles, a variety of foot positions is necessary to maximize recruitment of the entire motor-unit pool of the hamstrings. Also, it is normal to have to reduce the weight 4-5 percent with each successive tri-set due to fatigue.

A1. Lying Leg Curls, Feet Inward, 4 sets x 4-6 reps, 40X0, rest 15 sec.

A2. Lying Leg Curls, Feet Neutral, 4 sets x 4-6 reps, 40X0, rest 15 sec.

A3. Lying Leg Curls, Feet Outward, 4 sets 4-6 reps, 40X0, rest 240 sec.

Another technique point that needs to be brought up with leg curl exercises is the flexion and extension of the calf. When your feet are pointed away from the body (i.e., plantar flexion), the gastrocnemius (upper calf muscle) is somewhat inhibited in its function as a knee flexor. The gastrocnemius is a biarticular muscle in that it crosses two joints, in this case the knee joint and the ankle. However, the muscle fibers are too short in the gastrocnemius to do both knee flexion and plantar flexion at the same time. Therefore, this calf muscle is more effective as a knee flexor when the toes are pulled towards the body (i.e., dorsiflexion) and more effective as a plantar flexor if the knee is locked in extension.

This muscle contraction effect can be clearly illustrated when driving a car while sitting too close to the steering wheel. When the knees are bent, the gastrocnemius becomes ineffective, and it is thus more difficult to apply the brakes. It is the same reason that seated calf raises are prescribed to recruit the soleus (lower calf) muscle at the expense of the gastrocnemius muscle.

Conversely, when you bend the knee with the feet in plantar flexion, the overload shifts from the gastrocnemius to the hamstrings, making it a more effective hamstring exercise. The cramping you are experiencing comes from the gastrocnemius, which is used to the old motor pattern trying to activate itself. This situation is only temporary. The way to get around the problem rapidly is to do the concentric contraction with the feet dorsiflexed and lower the resistance for the eccentric contraction with the feet plantar flexed. And because you are stronger eccentrically than concentrically, the hamstrings will start getting a greater overload during that eccentric lowering because the gastrocnemius will be inactive due to the plantar-flexed position. This is a much more effective way to do leg curls. But we have a few more tips before getting into the evening workout.

You should stretch the quadriceps between sets of hamstring exercises. Increasing the range of motion of your quadriceps before a leg curl exercise will increase the amount of motor units used in the hamstrings during the exercise and, therefore, the effectiveness of the chosen exercise. The quadriceps is the antagonist muscle to the hamstrings, so stretching the quadriceps will allow the hamstrings to relax. Thus, the force of the

contraction in the hamstrings will be much greater in the subsequent contraction.

Finally, consider that this leg curl workout is designed for someone who is structurally balanced for knee flexion strength. You can determine this by using the simple structural balance test described in Tip 7 earlier in this chapter: Select a weight you can do for 6RM in the leg curl with your feet in the neutral position. As you reach muscular failure, your feet will rotate in one direction if there is an imbalance between the two heads of the hamstrings. If they turn towards the midline of the body (medial rotation), your biceps femoris is weaker in comparison to your semitendinosus and your semimembranosus. If your feet turn away from the midline of the body (lateral rotation), your semitendinosus and semimembranosus are weaker in comparison to your biceps femoris.

**The evening workout.** The evening workout focuses on the hip extension function of the hamstrings. The synergistic glutes and erector spinae are added into the mix to extend the time under tension for the hamstrings, and a higher rep bracket is used to exhaust all available motor units. As with the morning workout, this program uses tri-sets, but you can expect to reduce the weight about 6-7 percent on each successive tri-set of these exercises.

A-1. Standing Good Mornings, 4 sets x 6-8 reps, 4020, rest 10 sec.

A-2. Romanian Deadlifts, 4 sets x 8-10 reps, 4020, rest 10 sec.

A-3. Reverse Hypers, 4 sets x 15-20 reps, 20X0, rest 120 sec.

After this workout you will probably find yourself feeling as though you are six inches shorter because of the “pump” in your lower back muscles. To prevent this from happening (and to help avoid potential muscle spasms later in the evening or the next day), simply stretch your hip flexors statically between sets. Also, because the hip flexors are the antagonists to the hip extensors, stretching the hip flexors will increase the force of the contraction of the hip extensors.

A word of caution: If during the evening workout you are forced to drop the initial load by more than 20 percent for any of the given exercises, you are doing too much work for your level of conditioning. For example, if in A1 you were using 100 pounds for your first set, and by the second round you could use only 75 pounds in the good morning, you would stop. By the next workout, you should be able to do at least a second round of tri-sets. It is not uncommon for trainees to do poorly in the evening workout, as they are still wiped out from the morning workout. Hence, we strongly recommend taking a shake with Quadricarb and Whey Stronger right after the morning workout. Quadricarb will replenish glycogen stores, and Whey Stronger is one of the purest forms of whey protein on the market. Using these products will make a significant difference in how you handle the evening workout.

If you can't train twice a day, do the full morning routine unchanged, followed immediately by the evening routine for only two sets. Also, do not do this routine more than once every five days, and for no more than six weeks.

Now you're prepared to turn your hamstring training around. Very soon, you'll see some

amazing results – and once you’ve developed these monster muscles, you’ll enjoy showing them off.

## Chapter 12: Calves



Sultan Rakhmanov was the 1980 Olympic Champion. Twice he broke the world record in the snatch with a best result of 443 pounds.

In all the classical statues from ancient Greece, the strongest and most powerful heroes had great calves – and with good reason. The calves are the focal point of the entire



physique. At all levels of bodybuilding competitions, from local shows to the Mr. Olympia, the calves are the first place the audience and judges look to evaluate the contestants.

Yeah, right.

Although well-developed calves are an essential aspect of a symmetrical physique, they are not given much attention by the average bodybuilder, or any other athlete for that matter. The calves are not a showy muscle and are often overshadowed by the muscles of the arms, chest and shoulders. However, great calves can make a big difference on the posing dais, even creating an illusion that the thighs are bigger than they are. Arnold, for example, did not have exceptionally large thighs, but his calf development was so amazing that you seldom heard anything negative about his legs from bodybuilding writers of the day.

As for symmetry, bodybuilding guru Vince Gironda, and later Nautilus founder Arthur Jones, believed that the body is resistant to unsymmetrical development, which Jones called an “indirect effect.” As Jones said in his first book on training, *Bulletin #1*: “While it is certainly possible to build an obvious degree of disproportionate muscular size through the employment of an unbalanced program of exercises – and a training program limited to squats would be just that – there seems to be a definite limit to the degree of such disproportionate development that the body will permit; for example, it is difficult to build the size of the arms beyond a certain point, unless the large muscles of the legs are also being exercised.”

In addition to the factor of symmetry in calf development, you should consider genetics. True mesomorphs are born with naturally developed calves. Long-term kinanthropometric studies on more than 40,000 Polish students revealed that to be born with great calves, more than any other anthropometric measure (i.e., shoulder width, wrist girth, etc.), points to having an advantage in building greater overall muscle mass and strength throughout one’s life. The most important factor for calf mass is the length of the muscle belly. The lower your muscle belly inserts on the bone, particularly the gastrocnemius, the greater your bodybuilding potential. Turn-of-the-century French naturopaths had a saying: “Short tendons, big muscles.” It’s true.

Chris Dickerson, who won the 1982 Mr. Olympia at age 43, had low muscle bellies and reportedly trained his calves only twice a week because any more frequently would have made them too large for the rest of his body. Arthur Jones wrote in *Nautilus Bulletin #2* that Dickerson was one of two surviving triplets. Jones met Dickerson’s surviving brother, and although the brother didn’t train, Jones said the brother had better calves than Chris did. There was also a rumor that one finalist in a Mr. Olympia competition demanded that one of his competitors be x-rayed for calf implants because his lower leg muscles had grown unbelievably fast during the previous two years.

Upon hearing such stories, those who have poor calf development may use them as an excuse not to train the calves. Or they may even seek out the alternative of calf implants. Once only whispered about in professional bodybuilding circles, calf implants are becoming more common among the average population.

According to the American Society for Aesthetic Plastic Surgery, “Increased fullness of the calf can be achieved using implants made of hard silicone which are inserted from behind the knee and moved into position underneath the calf muscle.” Because this surgery is considered elective, it’s unlikely that health insurance will cover the expenses. Also, consider that there are health risks associated with any surgery, and that there is no guarantee that the results will be exactly what you expect.

We don’t want to make an absolute statement that we’re against calf implants, especially because there are many medical issues, such as polio, in which calf augmentation surgery is the only answer to achieving normal calf development. But the fact is, plateaus in calf development can often be overcome by using the appropriate training protocols. In fact, gains of 1.25 inches in calf circumference in just eight weeks are not uncommon when using the approach we’re about to share with you.

If you have short muscle bellies and are into athletic activities other than bodybuilding, you’ll be happy to hear that short muscle bellies are an advantage. A calf developed mainly near the knee area, on the other hand, has a great moment of inertia, thus favoring faster leg turnover, and provides better leverage for jumping.

One widespread myth about calf training is that people’s calves are accustomed to a lot of work from standing and walking for several hours a day, and, therefore, they must perform high-volume calf work to shock them into growth. The reality is that other than letter carriers, who else does that much standing around and walking today? There is indeed a relationship between volume and hypertrophy, but it’s also true that one good calf workout in your weekly training schedule should produce impressive calf development.

Another myth about calf training is that because the calves are so far away from the heart, it’s hard to get a good pump because of the poorer blood supply. Nonsense. Any cardiologist or vascular surgeon who hears this will probably rupture their spleen with laughter. Although there is no physiological basis for this faulty belief, it has been passed on to many generations of gym rats. The truth is that the blood supply is ample enough, and the pump is dependent upon nutrient storage (i.e., glycogen).

## 6 Ways to Fail

There are several reasons that bodybuilders have problems in improving their calf development. Here are six of the most common:

**1. Giving up too soon.** Many bodybuilders buy into the “Calves can’t be built – you’ve got to be born with them” nonsense, and as such do not commit to consistent training. If a law were imposed in gyms that for every set of biceps curls you do you must also perform a set of calf raises, a year from now you would see the average calf measurement increase by at least two inches!

**2. Lack of stretch when performing calf raises.** Most bodybuilders who complain about poor calf development use short, bouncy movements. On the contrary, range of motion is critical to fully develop the calf muscles, which is why we recommend exercising the calves on blocks that are at least six inches high and slightly rounded.

Rounding also makes the exercise more comfortable, as straight boards can dig into your arches. The best calf blocks are covered with rubber so that you can do your calf training in bare feet for an even greater range of motion. Because many bodybuilders are not accustomed to working the calves through a full range of motion, for your next six calf workouts you should hold the bottom position for at least four seconds to relearn how to stretch.

**3. Insufficient eccentric overload.** Volleyball players and dancers are known for their superb calf development, and some exercise scientists suggest that it comes from jumping. This is partly true, but we believe the hypertrophy comes primarily from the landing portion of jumps. Studies in the field of biomechanics have shown the calves take a major portion of the load created during the landing of a jump. Negative accentuated training, in which you raise with two calves and lower with one, is particularly good for calf training.

**4. Bending the knees during straight-leg calf exercises.** Bodybuilders who unlock their knees as they perform standing calf raises are cheating. To convince their poor egos that they are strong, they transfer the bearing of the load to the quads and glutes by bending the knees.

**5. Blocked neural supply.** An impingement of the nerve supply by a traumatized spine can block the neural output to the calf, forcing you to use loads that are not heavy enough to elicit a hypertrophy response. A simple spine-screening process and subsequent adjustments by a qualified health practitioner such as an osteopath or a chiropractor can often help your calves achieve additional levels of growth in just a few weeks.

**6. Excess connective tissue.** If there is too much connective tissue in the calf region, there is no room for the muscle to grow. To resolve this problem, there is a surgical procedure available which entails opening up the fascia with a scalpel to allow room for the muscle to grow. However, sports medicine pioneer Dr. Mike Leahy can accomplish the same results with his Active Release Techniques® Treatment, and clients can often achieve visible results after their first visit!

## **Overcoming Sticking Points in Calf Training**

Your calves can grow, but you must have not only the knowledge of how to train them but also the desire to endure the pain required to make them grow. For those willing to make a serious commitment to developing the calves, here are six practical tips (you can call them secrets if you like) that will vastly increase the effectiveness of your training.

**1. Use the appropriate repetition protocols.** How many reps you should perform in calf work depends on which exercise you are doing. In exercises where the knee is bent, such as seated calf raises, the soleus muscle handles most of the load. The soleus is part of what kinesiologists call the anti-gravity muscles, that is, the muscles that fire when you are in the standing position.

Muscle biopsies and autopsies have revealed that the soleus is composed of approximately 88 percent slow-twitch muscle fibers, and, therefore, responds better to high reps. As such,

performing sets that can be completed in less than 40 seconds won't do much for optimal development of the soleus. In exercises where the knee is straight, such as donkey calf raises and standing calf raises, the gastrocnemius handles most of the load. The gastrocnemius is composed of approximately 60 percent fast-twitch muscle and responds best to sets that can be completed in approximately 20-40 seconds.

**2. Pause in the bottom position.** This simple trick will do a lot to promote growth in the calf muscles. After you have completed the eccentric (lowering) part of every lift, pause in the bottom position before performing the concentric (lifting) part. The length of the pause should be 1-4 seconds (depending on the repetition bracket); and the higher the number of reps, the shorter the pause. To give you an idea of how this can work, for sets of 35-50 reps you may only pause 1 second at the bottom. For sets of 6-8 reps, the pause may need to be extended to 4 seconds.

**3. Reduce lifting speed.** One effective method to stimulate calf growth is to take 5 seconds to lift the weight and 5 seconds to lower it. Because you won't use a significant amount of momentum to help you complete the exercise, after 6-8 reps at this slow tempo you will feel a significant buildup of intramuscular tension in the calf muscles.

**4. Vary foot placement.** The width of foot placement has more to do with calf recruitment than foot orientation. However, there are MRI studies showing that turning the foot in or keeping it neutral during donkey calf raises decreases the recruitment of the medial (inside) portion of the calves and increases recruitment of the lateral (outside) portion. In contrast, turning your feet out may increase the involvement of the lateral head and reduce recruitment of the medial head.

**5. Stretch your calves.** Tightness in your Achilles tendons may be holding back your calf development. Here's what you can do:

First, establish a marker of your flexibility by squatting down with an empty bar on your back. Once you reach the bottom position, pay attention to your body mechanics by assessing the angle of your shin in relation to the floor. Now you are ready to perform a workout to stretch your calves maximally.

The conventional static calf stretches won't just cut it. The calf complex tends to be very hard to stretch compared to other muscles, such as the hamstrings. You will need the extra resistance provided by weight machines. The best way to stretch your calves is to use two calf machines, typically the standing type and the seated type. Let's start with the standing variation.

Start by positioning your shoulders under the pads of the standing calf raise machine. Lock your knees, and then lower your heels as low as possible, keeping your knees locked as you do so, as this will ensure that both the soleus and the gastrocnemius are fully stretched. If you unlock the knees, the gastrocnemius will not be stretched fully. Hold the stretch for a full 15 seconds. Bend your knees to lower the shoulder pads, and take a 5-second break during which you increase the weight by 2-3 plates. Repeat this "stretch-rest-add weight" process for another 3-5 reps.

When stretching calves in an upright position, a great way to increase the stretch in the bottom position is to contract the glutes at that bottom-range point. Because the fascial planes extend throughout the entire lower body posterior chain, tightening the glutes enables you to feel the intensity of the stretch build up in the calf muscle complex.

From here you proceed to the seated calf raise machine to give your soleus muscles a greater stretch. Use the same training methodology by holding the stretch for 15 seconds, resting 5 seconds, adding weight, etc. Repeat this for a total of 5-6 reps. By this time your calves should have achieved their maximum length for the day. Now go back to the squat rack and test your marker again. If your knees are moving farther than before your stretching routine, this indicates your flexibility was a limiting factor in your calf development.

**6. Try unilateral training.** If you have difficulty feeling your calf muscles when training, you should find yourself in a new growth spurt once you start unilateral calf training. Experiment with single-leg calf raises on the standing calf raise machine or single-leg calf presses on the leg press. Concentrating your neural drive on a single limb will enable you to maximize the load on the calf muscle.

**7. Perform calf raises on a hack squat machine.** Since both your body and the calf block are at a 45-degree angle, it will be easier mechanically to reach the top portion of the range. This effect will change the resistance pattern of the calf muscles, thereby promoting new growth.

**8. Train the muscles involved in dorsiflexion.** For maximum lower-leg development, all areas of the lower leg should be trained – and this includes the muscles on the front of the calf. When you perform these exercises, be sure to pause in the bottom position for 1-4 seconds. Also, it's important to stretch the gastrocnemius and soleus muscles between every set of tibialis anterior work. Since the calf muscles are rather resilient to stretch, we would use the standing calf machine to provide enough load to stretch the calf.

Now that you have some insight into some solid training theory, let's look at two workout protocols to get you started: the Explosive Calf Training Workout and the Luke Sauder Calf Workout.

**Explosive Calf Training Workout.** When standard resistance training protocols fail to work, what we find often resolves the problem is changing the tempo of the exercises by working the calves explosively. If you need proof, look at the calf development of elite volleyball players, ballet dancers or even weightlifters. Yes, weightlifters.

When weightlifters pull weights off the floor or drive a barbell during the jerk, they flex their calves explosively – after all, in weightlifting, as in many sports, speed kills! The weightlifter who had the most impressive calf development in the history of the sport was Belgium's Serge Reding, the first man to snatch 400 pounds (in 1973). Reding was one of the most physically impressive athletes of all time, in any sport. At a height of 5 foot 8, Reding had calves that measured over 20 inches and thighs over 31 inches. And talk about explosive calves – he reportedly could do multiple jumps of more than a foot off the

ground while holding 286 pounds!

However, before you perform any explosive calf work, we suggest you pay attention to thoroughly warming up your calves by doing progressively heavier sets of standing calf raises. Make certain you perform a full range of motion on every rep. Don't go to failure on these sets; just warm up. Here's how to do it:

The first exercise is a jump squat. Place a barbell across your traps – a loaded barbell that represents 25 percent of your bodyweight. As an alternative overload implement you can use a sandbag with handles. You want to stay away from doing jump squats with dumbbells, because upon landing, the dumbbells will place undue stress on the soft tissue and joint structures of the shoulder girdle. Jump up and down for a set of 12 reps. Rest for two minutes between sets, and do 5 total sets. Make sure to keep the duration of ground contact to a minimum, and go for maximal height, keeping the involvement of the knee extensors to a minimum. In other words, you want your heels to touch the floor for the very strict minimum amount of time.

One very important tip: With this exercise air time is more important than load, so don't go for heavy loads – go for air time. Those who use loads that far exceed their stretch-shortening cycle capabilities will encounter problems. In other words, they spend way too much time on the ground, which negates the positive transfer of this exercise. The hypertrophy and strength gains in your calves will be coming from the fast eccentric loading caused by the landings. Jump squats performed with too much weight do not provide sufficient acceleration, and, therefore, ground contact lasts too long, which entirely defeats the purpose of this exercise.

We prefer you use the same load on the barbell for six workouts and do *not* increase the load for the duration of the cycle. You should just concentrate on increasing the acceleration of the barbell. You should be consistent with each landing. Often, in athletes who have structural balance issues or who are plagued with coordination problems, the landing patterns are inconsistent from one rep to another. So for example, someone whose knees buckle in for both the pre-loading and landing of jump squats is not ready for jump squats or is using too great a load to maintain proper jumping mechanics. When you try these jump squats, you can expect soreness in your calves over the next few days.

After completing six workouts of 5 straight sets of 12 reps, you can perform another six workouts but with a different protocol. Specifically, jump for 6 reps with a barbell representing 30 percent of bodyweight, then put the barbell on the floor and immediately perform another 6 reps with just your bodyweight. Perform 5 of these drop sets, resting three minutes between drop sets.

These exercises may not seem like much work, but the rewards will surprise you. Best of all, you won't have to make any more excuses for poor lower leg development.

**The Luke Sauder Calf Workout.** Luke Sauder was an alpine skier who competed in the Winter Olympics in Nagano who developed impressive calves. Sauder had wanted a calf routine because big calves prevent knee injuries in alpine skiing (they provide a cushion to prevent the skier's knees from reaching too acute an angle as they jet down a

mountain). Here is the workout he used with great results.

### **Day 1: High Volume**

A1. Seated Calf Raise, 3 x 10-5-5 (one set of 10 reps, followed by 2 sets of 5 reps), 1010, no rest

A2. Donkey Calf Raise, 3 x 30-50, 10X0, rest 120 sec.

B: Standing Calf Raise, 10 x 10-30, 11X0 tempo, rest 10 sec.\*

\*In other words, do one, long, extended set, resting 10 sec. between each mini-set and lowering the weight in between.

After day one, you'll probably have to call the fire department to extinguish the fire in your calves. You may also find that you have the same walk as Homer Simpson's 80-year-old father.

### **Day 2: Low Volume (to be performed 48 hours after Day 1)**

Exercise A: Triple Drop Standing Calf Raise, 3 x 10-10-10 (i.e., 3 drop sets) at a 1210 tempo,\*\* resting 90 sec. between sets.

\*\*The pause is taken in the bottom stretch position, and be sure to take the full 2 sec.

This routine produces freaky size increases. As you can see, it uses a great number of total reps. Building calves require both a high frequency of training and high volume, but you can't have both high volume and high frequency in a short time period. Therefore, we advise training them twice over a five-day cycle, one workout being very high sets (16) and high total reps (250-510 reps), and the other being low sets (3) for a low number of total reps (90). We've known people to gain 5/8th inch to a full inch with this routine in as little as 30 days.

Whether or not calves will ever achieve the respect of other muscle groups is a question that we're sure will be covered by other writers who can't think of anything else to write about. Our intent is to show those who want to develop bigger calves how to do it. Calf development probably won't change your life, but you'll be surprised – and perhaps even shocked – at how much your calves can grow.

## Chapter 13: Chest

The image shows the cover of the April 2015 issue of Muscle Media magazine. The central focus is a photograph of bodybuilder Dexter Jackson, who is shirtless and showcasing his highly developed chest and shoulder muscles. He has a serious, intense expression. The magazine title 'MUSCLE MEDIA' is prominently displayed at the top in large, bold, red letters. Below the title, the text 'FITNESS MAGAZINE APRIL 2015' is visible. Several headlines are scattered across the cover: 'PREMIER ISSUE' and '3 TRICEPS MOVEMENTS YOU AREN'T DOING' at the top left; 'INCREASE TESTOSTERONE WITH CARBS' on the left side; 'SECRET CLUSTER SET TRAINING BUILD SIZE & STRENGTH' on the right side; '4-WEEK FAST TRACK TO LEAN MASS' in red text on the right side; and 'EAT THIS! PROTEIN PANCAKES' with a small image of a stack of pancakes topped with raspberries and blueberries in the bottom right corner. At the bottom of the cover, a large headline reads 'DEXTER JACKSON AIMS AT MAKING HISTORY' in bold white and red text.

*Muscle Media 2000* was a popular print magazine founded by Bill Phillips in 1992 and has continued as an online magazine under the name *Muscle Media*.

We often get questions such as “What are the best exercises to target the upper and lower pecs?” The first step in being able to answer this question is to look at the anatomy of the



chest muscles.

The pectoralis major is one muscle with two heads, clavicular and sternocostal, that cover the chest and insert on the upper arm bone (humerus). The clavicular head originates at the center portion of the collarbone (clavicle), and in lay language, this area is referred to as the upper pecs. One of its primary functions is to raise the arm. The sternocostal head originates at the costal cartilage of the first six ribs and the adjoining section of the breast bone (sternum), and the area is called the lower pecs. One of the primary functions of the lower pecs is to lower the arm.

One method of determining how muscles are activated during an exercise is called electromyography (EMG), a diagnostic tool with a history that spans several centuries and includes a working prototype first presented in 1890, at which time the term electromyography was introduced. In its present form, an EMG involves placing small electrodes in the skin with a needle, or on the skin with surgical tape. These electrodes collect information about the electrical activity of the muscle and send this information to a machine that translates this into data representing the degree of muscular contraction.

In researching the upper pecs/lower pecs question, we found a study that compared muscle activation between the incline bench press and the decline bench press. The authors concluded that the lower portion of the pectorals was more active during decline presses than during incline presses, but that neither exercise completely isolated these muscles. From this data, you can conclude that exercises that position the hands farther from the center of gravity (e.g., incline bench presses), will more strongly work the upper pecs, and exercises that position the hands closer to the center of gravity (e.g., bench presses) work the lower pecs. However, this study did not look at the flat bench press, a consideration that turns out to have significant ramifications in exercise selection.

Another study that did EMG measurements of the incline, flat, and decline presses found that the maximum recruitment of the upper pecs was with an incline press, and the maximum recruitment of the lower pecs was with a flat, not decline, press. The study also looked at hand spacing, and what's interesting is that a wider grip did not significantly increase the involvement of the lower pecs in flat bench presses. With this information, we could now confidently answer this pec training question by saying that incline presses would be best for the upper pecs, and flat bench presses would be best for the lower pecs. But there's more.

One EMG study that examined the differences between muscle activation during the barbell bench press, the dumbbell bench press, and the dumbbell fly. What the researchers found was that the dumbbell fly had less muscle activation time than either the barbell bench press or the dumbbell bench press. With this information, we could expand our answer by saying that the dumbbell fly is an inferior exercise for developing the lower pecs.

The next step was to search for research that looks at various hand positions, and one study that looked at the differences in hand positions using a special bar called a Football Bar. What this two-month study found was that of three grips tested, the thumbs-out grip produced the greatest increases in strength (a 12.3 percent average improvement compared

to a 6.2 percent improvement in the conventional bench press). Again, this gave us more practical information to use in program design, and also regarding exercise equipment purchases.

Hopefully, this discussion has given you an appreciation of the amount of education that is required to become an elite personal trainer or strength coach. The idea is to give the best answers on how to train properly, not the simplest ones. Our experience has shown that a variety of angles is necessary to achieve maximum development. This is because each angle taps into different motor units, and varying the angles will be less stressful on the rotator cuff muscles.

Regardless of the angle used on the bench, it's important to pay attention to head posture while pressing. To lift the highest load, the back of your head should make contact with the bench's upholstery – in fact, you should be pressing your head into the bench (as in performing a neck extension). Pressing your head into the bench increases your strength by creating a neural response that activates the muscles used in the bench press.

## **Pressing Secrets**

Now we're going to share some little-known facts about training presses. First, improving dumbbell pressing strength improves barbell pressing strength, but not necessarily vice versa at the same percentage. Because of the physiological law of specificity, strength is gained only in the range in which it is trained. Dumbbell work, if performed properly, increases strength through a greater range than barbell work. We are not suggesting that you should stay away from barbell exercises, of course, but that if you are pressed for time, dumbbell pressing provides a greater return on your investment than barbells. As a rule of thumb, for fast increases in pressing strength we use dumbbells in the accumulation phases and barbells in the intensification phases. Dumbbells also offer the advantage of correcting the bilateral deficit often seen in trainees.

Next, supine presses have the greatest transfer effect to all presses. All pressing exercises have some degree of transfer to the other ones. If you concentrated on dips, for example, your overhead presses would increase and vice versa. But all factors being equal, the supine press (i.e., bench press) is the pressing exercise that transfers the most to the other extremities due to the combination of the amount of weight used, the intermediate motor pattern, and the muscles recruited.

Another interesting observation about presses, which relates to our concept of structural balance, is that all factors being equal, incline presses are the best predictor lift of all presses. Incline presses have been shown to be the pressing exercise with the least percentage of improvement growth. Interestingly enough, it is also the pressing exercise most related to all throwing patterns. But let's make something clear before we go any further. Incline pressing 600 pounds does not guarantee you a gold medal in the shot put at the Olympics, but improving your incline press strongly correlates with improving shot put performance. Thus, if you already have good mechanics in putting the shot or throwing baseballs, concentrating on improving incline presses will do more for your shot put performance than spending hours at the dipping station will.

Next, throughout the years, for all lower body sports that require speed, we have found there is an optimal ratio that, when achieved, translates into short-distance improvement. For example, in short-track speedskating, when the incline press reaches 85 percent of the front squat, you get the best potential speed for the 500 meters. Of course, the skater should also work on getting their front squat numbers as high as possible.

Finally, we've also found that using accommodating loading devices accelerate progress in pressing exercises. Presses share this common force pattern: The end portion of the concentric range is much stronger than the start portion. Therefore, using bands and chains allows for a greater overload in the end range by more closely matching the strength curve. From experience, for every workout using chains, one workout should be done with bands. Using bands in every workout tends to result in overused tendons. Very strong athletes often get better results with this progression:

Workout 1: barbell plus chains

Workout 2: barbell plus bands

Workout 3: barbell only

Any strength coach who uses the advice given above will make faster gains with their athletes, and bodybuilders will develop a much more balanced physique.

Regarding exercise machines, regardless of your training goal, we would advise you to avoid Smith machines. Because the shoulder operates in three planes, the fixed-bar pathway of a Smith machine does not allow alteration for efficient movement of the joint, thereby predisposing the shoulder to harmful overload via lack of accommodation. If you are interested in training longevity, you are far better off sticking to standard barbell and dumbbell exercises.

Another problem is that because the Smith machine balances the weight for you, shoulder stabilizers such as the rotator cuff muscles do not need to work hard. This creates an imbalance in these muscles, predisposing the individual to injury. In contrast, due to the mechanics of the human shoulder joint, during a free-weight bench press the body will alter the natural bar pathway to accommodate efficient movement at the shoulder.

## **Keys to Bench Press Success**

Although the bench press seems like a simple lift, to achieve optimum results you must consider all the variables that contribute to success. The first step, therefore, is to learn proper form from a qualified powerlifting coach. In the sport of powerlifting, there is only one coach whose worldwide acclaim and accomplishments have rightfully earned him guru status, and that man is Louie Simmons. Simmons has trained more athletes to achieve 1,000-pound squats, 700-pound benches or 800-pound deadlifts than any other coach. Because we get a lot of letters from bodybuilders and other athletes who are obsessed with improving their bench press, we thought we'd share some of Simmons' ideas on this topic.

Simmons says that correct bench press form should be practiced on every rep and in every set of every training session. One of his favorite teaching techniques is to tell his athletes

to imagine pushing themselves through the bench – that is, pushing away from the bar. He says it's also important – and this has been proven by biomechanical studies on elite athletes – to emphasize controlling the descent of the bar. In addition to giving you greater control of the bar path, lowering the weight slowly and under control at all points of the exercise will minimize the stress on the shoulders.

A major mistake that Simmons says most athletes make is that they train the bench press too often and too heavy. In fact, he believes that you don't have to perform the bench press to improve it. "The bench press itself does not stall," says Simmons. "When your bench press fails to go up, what is holding you back is a weak muscle – and the way to strengthen a weak muscle is with assistance exercises." The secret, then, to improving your bench press is to determine which muscles are the weak links in your bench press, and then perform the appropriate exercises to strengthen them. "It should also be clear that the body is always changing; therefore, the training of the lifter should also change," says Simmons. Now let's look another reason for a lack of progress in the bench press: injuries.

One obvious reason for injuries in bench pressing is poor form. We can get insight on this factor from Dr. Richard Dominguez, an orthopedic surgeon who worked with top bodybuilder Bob Gajda, who won the 1966 AAU Mr. America and later earned a Ph.D. Dominguez and Gajda co-authored *Total Body Training*, a fitness training book published in 1982 that was ahead of its time. In one interview with the editor of a popular strength training magazine, Dominguez said that among the athletes he's seen who needed shoulder surgery from lifting weights there were two major reasons they became injured performing bench presses: lowering the bar too quickly (and often, as a result, bouncing the barbell off the chest) and using too wide of a grip. Further, it's important to have a training partner help you lift the bar to the correct position, rather than lifting it off the supports yourself and placing excessive stress on the rotator cuff muscles, particularly the subscapularis.

The bench press places a lot of stress on the joints, and this may be largely because the shoulder blades are not allowed to move freely during the exercise because they are pinned against the bench. This would explain why Olympic lifters, despite the dynamic nature of their sport, in which they basically throw weights overhead, usually are less likely to suffer from shoulder pain than powerlifters. As such, the higher the volume and frequency of training, the more at risk the athlete is of developing shoulder problems.

One of the highest-volume training programs is that used by many Russian powerlifters. The Russians, who have been dominating the sport of powerlifting for the past decade, often use programs that are characterized by lots of sets, high frequency and very few assistance exercises – training that is modeled after Olympic lifting programs. One accomplished Russian powerlifting coach who promotes such training is Boris Ivanovich Sheiko.

Sheiko has published many sample workout programs. In one preparatory program we saw, he recommended up to 40 sets of bench presses per week, sometimes even performing the bench press twice in the same workout (a method we first heard about from Canadian weightlifting coach Pierre Roy, who called this method *Double*, which is a French word that means "done twice"). Because of the high volume, the load was

generally low, focusing on weights that were about 70-80 percent of the 1-repetition maximum.

In American powerlifting, the most famous and successful powerlifting coach is Louie Simmons of the famous Westside Barbell Club. In contrast to the Russian system, Simmons would focus much of the training on assistance exercises that worked on the weakest part of the bench press. If a lifter had an especially hard time driving the barbell off the chest, Simmons might suggest work with a cambered bar. However, because the newer bench press shirts assist so much with the start of a lift, the primary assistance exercises for the bench press have been on the lockout portion of the exercise, such as board presses. How much do shirts help the bench press? Well, one powerlifter who broke the absolute world record in this lift said that during the training cycle the barbell never touched his chest once and that the only time it did was during the competition!

Our approach is to simply incorporate more variety in the exercise selection and also change these exercises more frequently. A general guideline we use is to change the exercises every six workouts. As such, an athlete may do bench presses for two weeks, followed by incline presses for two weeks, and then dips for two weeks, and then go back to the bench press. Such an approach prevents plateaus, and also the variety reduces the risk of overuse injuries.

## **Pain-Free Bench Pressing**

Training programs notwithstanding, there are several common reasons for shoulder pain from bench pressing. For example, if the strength ratio between two muscle groups is off-kilter, you can experience faulty alignment. If the strength of your pecs is far greater than that of the external rotators of the humerus (teres minor and infraspinatus), you'll likely feel a sharp pain in the superior anterior portion of the upper arm (this problem is often misdiagnosed as bicipital tendonitis).

You should also consider that a muscle imbalance may be not only in the pressing muscles but also in the agonists and the synergists – if the antagonists are too weak, they send a message to the brain to shut down the agonists. So if your upper back is not as strong as your pecs and your triceps, your potential to improve in the bench press is compromised. It may seem odd to improve your bench press with rows and even chin-ups, but having worked with many elite athletes, we can tell you this is the case.

One reason many athletes don't achieve their goals is that their approach to training is too simplistic, especially among stronger athletes. The basic rule is "The stronger an athlete is, the more complex the program should be." Case in point: Most athletes with a big bench know that rotator cuff training is important to prevent injuries from bench pressing, so they may occasionally include a few light sets of rotator cuff work in their workouts. However, this approach is simply not good enough for serious athletes.

Our research has found that rotator cuff strength should be about 9.8 percent of what you can lift in the bench press. Such a strength ratio is not going to be accomplished by tacking on a set of some external rotation exercise with a five-pound dumbbell. In fact, former pro hockey player Jim McKenzie, improved his 14-inch, close-grip bench by 49

pounds in nine weeks, from 281 to 330- pounds, by focusing on rotator cuff strength – in fact, he did no benching at all during this training program! He then switched to a bench press specialization program, and three weeks later he did 380 pounds in this exercise.

To help determine structural balance you can use radar graphs, which are so-named because they resemble a radar screen. A radar graph displays values that revolve around a central point. The central point is zero, and increasing values are represented farther out from the center. Unlike bar graphs or pie charts, radar graphs enable you to display values that are on different scales to illustrate symmetry.

## **The Value of Bands**

Training with bands is a very effective method to improve both maximal strength and power, particularly for the extensor chains. Therefore, presses, deadlifts, and squat variations benefit greatly from band training. Here are six special considerations to know about band training:

1. Use in only one workout out of two. More often than that tends to bring on tendinitis.
2. Concentrate on acceleration.
3. Make sure the bands are anchored properly. The Poliquin racks provide attachments that will suit your biomechanics in a matter of seconds.
4. Make sure you have a spotter. Getting pinned with bands can make your life miserable.
5. Sets/reps: 8-10 sets of 1-3 reps works best. We consider band training more suited for neural drive training. If, for example, you are incline pressing with bands, we would pair them with wide-grip pulls for 8-10 sets of 1-3 reps. Rest 2 minutes between pressing and pull-ups; rest 2 minutes after pull-ups before returning to presses.
6. Bands are well suited for the pressing and squatting exercises for the neural drive of the Modified Hepburn method, as seen on this site.
7. In essence, band training is another variation of tempo training you can use to accelerate your gains.
8. Use band training for training the extensor chains, as they have ascending strength curves in the concentric ranges, meaning that you get stronger as you shorten the muscle. Therefore, they help match the resistance curve to your natural strength curves.
9. Band training for the flexor chains (e.g., curls) should be of high resistance, so much that they only allow you to overload the early start of the concentric range. They are a great addition for the development of functional hypertrophy. For example, in chin-ups you can do 6 reps to failure, and then immediately attach the band to your chinning/climbing belt and do 4-6 short-range partial reps in the stretched position; hold the top position for 4 seconds.

## **Rediscover Dips**

Although there has been a recent upsurge in the popularity of chin-ups, we haven't seen much enthusiasm for parallel bar dips. Bodybuilders say this exercise tears apart the

shoulders, personal trainers say it's too difficult, and strength coaches complain that it's not sports specific. As such, it's time for a closer look at an exercise that was once a staple in athletic and physical fitness programs.

If you go back to the early days when YMCAs were the gym of choice, you'll find that dip stations – or perhaps gymnastic parallel bars – were often available. But now, except for those revolutionary “suspension rings” that have been hitting the strength circuit, gymnastic equipment, and dedicated dip machines simply are not available. At least with chin-ups you can use a crossbar in a power rack. However, even if you wanted to perform dips, you now lack the means to do them.

When you think of dips, you usually think of chins. When dips are combined with chin-ups, as they often were in bygone days, you have a great upper body combo. Even if you don't do a single fly, pulldown, triceps pressdown or biceps curl – you can develop great upper body strength and muscle mass with chins and dips. If you doubt us, just look at the upper body development of gymnasts, whose conditioning programs never includes barbells and dumbbells. Chins and dips are exercises that give you the most bang for your buck. And the old-time bodybuilders knew this – especially Brooklyn's Marvin Eder.

Eder's most significant bodybuilding accomplishment was placing third in the 1951 AAU Mr. America, considered one of the most prestigious competitions at the time. He weighed 198 pounds at 5 feet 8 inches and sported 19-inch arms. As with many bodybuilders in his era, Eder complemented his muscle building workouts with Olympic lifts and power lifts – pound-for-pound, Eder had few equals. Among his most notable strength feats were a 355 clean and press, 285 snatch, 345 clean and jerk (with a 365 clean), 665 full squat and (just for fun) 300 pounds for squats for 50 reps! But it was his upper body strength that was especially impressive. Here are some of his lifts: bench press 515 (raw); wide-grip chins, 8 reps with 80 pounds; 8 consecutive one-arm chins with one arm; and a parallel bar dip with 400 pounds for 7 reps plus 1 rep with an additional 434 pounds (accomplished by having two men hang from his feet).

In the area of muscular endurance, in 1954 Jack La LaLanne completed 1,000 vertical dips in less than 35 minutes without leaving the bars. And although Simon Kent completed 3,989 dips in 1998 for a Guinness world record, we've seen a video clip of his performance showing that his arms never came close to being parallel to the floor.

Powerlifters used to be big on dips. Pat Casey, the first man to officially bench press 600 pounds (raw), weighed 340 pounds and could perform a parallel bar dip with an additional 380 pounds. However, now that bench shirts help with the drive off the chest, the exercise has been replaced in favor of board or towel presses. And while pressdowns and French presses are fine for bodybuilders, as they offer different recruitment patterns, such isolation movements are not nearly as effective as dips. But the primary reason most athletes avoid dips is laziness – they are hard work!

As for terminology, the standing position is with the arms extended so that the body is balanced by the hands on the bars. The movement begins with the extensor muscles, such as the triceps, contracting to control the descent of the movement. As with the descent of the bench press, the descent in dips must be controlled to avoid injury. *Total Body*

*Training* author Dr. Richard Dominguez said that rapid descent in the bench press was a primary cause of injury among his bodybuilding clientele who required shoulder surgery.

Dips work the anterior shoulders, pectorals, and triceps – many of the same muscle groups worked by the bench press. In our list of best-ever triceps exercises, we would be hard-pressed to find one equal to dips. According to MRI research by Per A. Tesch, Ph.D., dips are superior to close-grip bench presses for developing all three heads of the triceps. As a bonus, the trapezius and many other back muscles are involved in dips to provide stability.

Dips are hard work, and women and heavier individuals often have trouble performing a single repetition. Let's start with the easy way out. If you are not strong enough to do dips, there are many variations of dip-assisting machines that will help you. With some designs, you stand on a footplate, and with others, such as one manufactured by Atlantis, you kneel on a platform. With these devices, the platform connects with a pulley mechanism to a weight stack. Increasing the weight, in turn, produces more upward force to the platform, such that virtually anyone can perform the exercise through a full range of motion.

But you don't need a high-tech machine to do dips. Here are two variations: (1) Starting with the arms extended in the locked position, flex one knee and have a training partner grasp that ankle and provide as much assistance as needed – be careful not to knee your training partner. (2) Stand inside a power rack and place a barbell on the safety pins, set slightly above mid-thigh level. Both of these variations effectively reduce the amount of weight your upper body must lift.

Vince Gironda recommended using a reverse grip in dips. The trainee would round the upper back, chin to chest, elbows pointed straight out, feet together, toes pointed down and under the face. Such a variation was a bit harsh on the shoulders. And regarding those who encounter shoulder injuries from dips, the problem often can be traced to structural imbalances. Further, dips are best performed on a V-shaped dip apparatus, which accommodates a greater variety of body types.

As your dipping strength increases, you will need to increase resistance by (1) having a training partner pull down on your ankles, (2) holding a dumbbell between your ankles or (3) using a chin/dip belt (alternatively, the belts used by mountain climbers are good for this purpose). Holding a dumbbell securely is more difficult to coordinate compared to using the belt, and eventually the weights you will use on this exercise will become too heavy to hold in this manner.

Another great variation is to attach lifting chains to a chin/dip belt, as the chains will make the exercise more difficult at the top of the movement, where you are strongest.

Dips are a great exercise for bodybuilders, powerlifters and anyone who just wants to be strong. For old times' sake, at least, give this "old school" exercise a chance – you might just love it!

## **The Pullover Effect**

The pullover was a key exercise in the early days of the iron game. One early 20th century strongman and professional wrestler who excelled in this exercise was Georg Karl Julius



Hackenschmidt.

Hackenschmidt, who was born in 1878 in Estonia, won wrestling tournaments all over the world and is credited with developing the bear hug. One of Hackenschmidt's favorite exercises was to assume a wrestler's bridge, supporting his upper body with the strength of his neck muscles, and from this position perform a pullover and press – that is, pulling the bar to the chest and then bench pressing it. Just performing a wrestler's bridge is hard enough for the average person, but Hackenschmidt was so strong he once did it with 311 pounds, a world record that stood for 50 years.

Before discussing the many variations of pullover exercises that you might want to consider adding to your workouts, we must mention the Nautilus pullover machine. Of course, the individual who designed the Nautilus pullover was the company's founder, Arthur Jones. It was a remarkable invention.

Jones's pullover machine was a good idea, but with a little creativity, you can adequately stress all areas of the strength curve. Before we go into some of these exercises, recognize that free-weight pullovers work more than the lats, biceps, and forearms.

In addition to working the lats, the pullover develops the pectoralis major and pectoralis minor, as these chest muscles are involved in many shoulder movements. The pullover also works the muscles attached to the ribs called serratus anterior – serratus is Latin for "saw" (which is a fair description of a rib). The serratus also pulls the scapula (shoulder blades) forward, such as when throwing a punch (which is why the serratus is also called the boxer's muscle), and produces an upward rotation of the scapula when lifting the weight overhead. If you lift one arm in a pullover motion, by placing your other hand over the serratus you can feel it contracting. Also, the rectus abdominus is activated during pullovers, contracting primarily isometrically.

Now let's look at a few pullover variations.

Three ways to provide resistance in pullovers are with barbells (an EZ curl bar is usually more comfortable than a straight bar), dumbbells and cables. Because bands overload only the end range of an exercise, their use is limited. Barbells tend to be the best, as the stability required to use dumbbells reduces the weight you can use.

The key to getting the resistance curve of an exercise to overload a specific part of the strength curve is to change body position. As such, you can perform pullovers on a flat, incline or decline bench. In the early days of the iron game, rounded benches called "moon benches" were commonly available, and they increased the range of motion of pullover exercises. Swiss balls can be used for this purpose, but the instability of these balls not only increases the chance of injury but also reduces the intensity of the exercise because they force you to use less weight.

Two basic types of pullovers are straight-arm and bent-arm. Considerably less weight can be used with the straight-arm pullover; with the bent-arm pullover, it's especially important to have the feet anchored. Many popular bodybuilding writers have advocated the use of high-repetition squats supersetted with pullovers to expand the rib cage by lengthening the costal cartilage. However, the costal cartilage gradually ossifies as

adolescents mature, and, therefore, exercise will have little effect on lengthening it in adults. Also, consider that the heavy breathing caused by heavy squats may be enough to cause lengthening of the costal cartilage – but again, only in adolescents.

When performing pullovers on a bench, it's important to have your head supported to avoid straining your neck. One popular bodybuilding writer suffered severe nerve damage from performing dumbbell pullovers across a bench with her head hyperextended – this caused her chronic pain for many years and required a considerable amount of physical therapy to manage – this is another reason to avoid performing the exercise with Swiss balls.

One interesting variation of the pullover used in the early days of bodybuilding was to perform it from a supine (face up) position with a barbell resting behind the trainee on an elevated platform (6-10 inches). This limited the range of motion and (as with a box squat) dissipated the kinetic energy that developed as the weight was lowered behind the head. As such, a trainee could superset a set of these types of pullovers with a full-range type of moment – thus more effectively overloading more areas of the strength curve.

We mentioned cables. By using an overhead pulley system and performing the exercise seated or kneeling, you can perform a pullover motion from a vertical position. If you're facing the machine, this would primarily overload the midrange portion of the strength curve. The late sports scientist Dr. Mel Siff cited a study that found this type of exercise creates a stronger contraction of the rectus abdominus muscle than conventional sit-ups do. For those with back pain, such an exercise could strengthen this muscle without aggravating their condition. Further, those with back pain should avoid hyperextending the spine during the stretched position of conventional pullover exercises, as this action places considerable stress on the lumbar vertebrae.

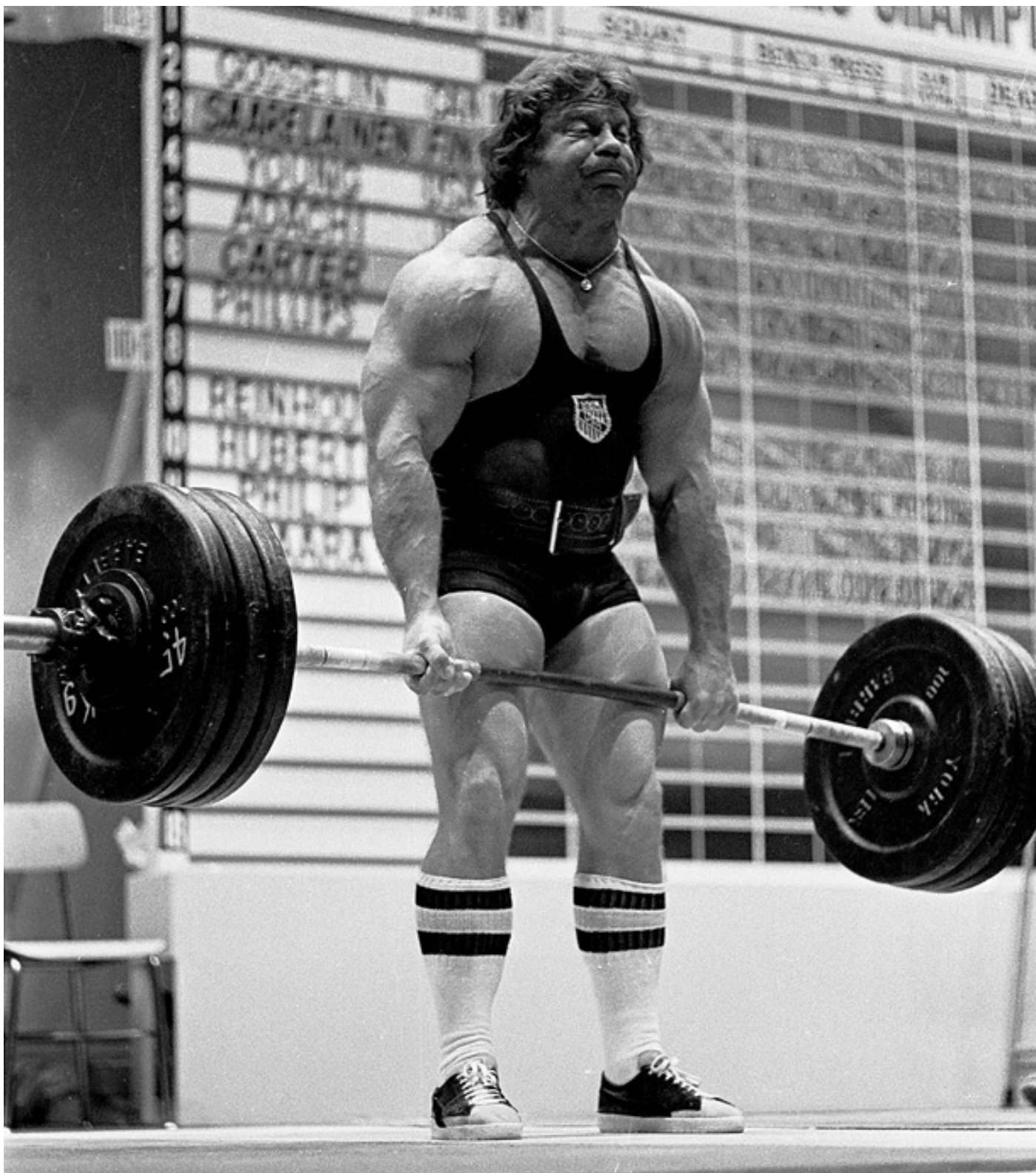
In the early days of the Iron Game, the pullover was a key exercise for bodybuilders or anyone simply wanting to get strong. It's been all but forgotten in today's world of strength and conditioning, but the pullover and its many variations deserve a second look.

Many exercise machines require you to start the exercise in a biomechanically weak position. If you lift the first repetition too quickly, trying to jerk the weight to get the weight moving, you put yourself at a high risk of injury. Examples of such machines include many pec dec and incline leg press machines.

Most pec dec machines start with the shoulder in a position of external rotation with the forearms perpendicular the floor, rather than a stronger position in which the forearms are parallel to the floor. The shoulder joint is extremely vulnerable to injury in external rotation. If you are going to perform this exercise, either start the movement very slowly or have a training partner pull the lever arms forward for the first repetition so you can begin the exercise in a stronger position.

We haven't given you a simple answer to the question of how to develop a chest that is thick, wide and high, but that is because there is no simple answer. You have to become a student of the game because – to borrow from that series of public service announcements – “The more you know, the more you grow!”

## Chapter 14: Shoulders



When he was seven years old, Marvin Phillips had his right arm torn completely off just below the shoulder. Doctors were able to reattach the arm, and eventually he built that arm up to 20 ½ inches and could bench press 500 pounds.

The modern-day version of the sport of weightlifting consists of two lifts, the snatch and the clean and jerk. For a time, there were three lifts. The press was adopted as a competitive weightlifting exercise after the 1928 Olympics (and was eliminated in 1972), and was considered more of a test of strength than the other two lifts. The result was that extremely strong men who did not excel in the snatch, which was considered more a test

of speed and agility, could make up the difference with a good result in the press.

## Heyday of the Press

Besides being performed by competitive weightlifters, overhead presses were also key exercises for bodybuilders – and for that matter any athlete who wanted to be strong. They did military presses, behind-the-neck presses, dumbbell presses – if you wanted to get strong, you lifted weights overhead. So whereas the typical weight trainer today often has accelerated chest and biceps development from an overemphasis on bench presses and curls, their predecessors often had exceptional development of the chest and shoulders. This pattern even carried over to the physique competitors.

Two of the most famous bodybuilders of their era were John Grimek and Steve Reeves. After Grimek won his second AAU Mr. America title in 1941, the organizers of the event established a rule that a competitor could not win the title more than once, as it was obvious to the organizers of the event that no one could defeat Grimek. Reeves won the AAU Mr. America title in 1947 and the Mr. Universe title in 1950, and when Reeves appeared in a series of *Hercules* movies, many young men were bitten by the bodybuilding bug. Moreover, both Reeves and Grimek were extremely strong.

Grimek was a champion weightlifter, having represented the US in the 1936 Olympics, and had overhead pressed 285 pounds in competition. Grimek used a pressing style in which he started from a layback position, but his technique was within the rules, as he maintained that layback throughout the press. Although Reeves was not a competitive lifter, he did show raw potential to become a good lifter. Reeves could clean 225 pounds from a kneeling position, and he once did a 400-pound deadlift by grasping the outside lip of the inside 45-pound plates with just his fingers!

Reeves and Grimek were the best bodybuilders of their day, but if you look at physique photos of them in their prime, you'll see that they had relatively weak pectoral development compared to their delts. This was perhaps a result of concentrating more on overhead press movements – more specifically, “strict” overhead press movements.

## A Question of Speed

In Grimek's era, the performance of presses was extremely strict and relied mainly on tremendous shoulder and triceps strength – until the rules relaxed and the game changed.

After cleaning the weight, a lifter had to assume an upright position with the legs straight – at this point the referee would give the lifter a signal to begin the press. Then, using the dynamic start, the lifter would lean back, explosively whip the weight up with the strength of their abdominals and hip flexors, and then lean back again – a whipping movement that could be described as a slingshot. It was possible to cheat by starting with the legs slightly flexed (a posture that was difficult for the judges to see if the lifter had extremely large quads), and then straightening them as he finished the extension of the torso. The US lifter who excelled in this lift and is credited for introducing it in the US was Tony Garcy.

Garcy represented the US in the 1960 and 1964 Olympics, and broke American records in the press in both the 148- and 165-pound bodyweight divisions. In 1967 Garcy broke

Tommy Kono's clean and jerk record with 375.75 pounds – in comparison, consider that at the 2011 Senior Nationals, the second highest clean and jerk in the 169-pound class was 341 pounds. Here is how Don Reed, a former editor for *Strength and Health* magazine and member of the York Barbell Club, described Garcy's technique:

“I remember hearing Steve Stanko [former US heavyweight champion] describe the initial reaction to the Garcy press. He power cleaned the weight and sank into the forward-leaning slouch. The three judges looked at each other, and then the head judge shrugged and made the handclap signal. The weight flashed up, almost as fast as a jerk – boom, there it was! Again the judges looked at each other and then three thumbs lifted (no white lights yet). The crowd roared, and the modern Olympic press was born.”

The combination of the dynamic start and layback enabled the lifter to drive the weight more easily through the sticking point. It was also a difficult technique to master, and the result is that the weightlifters who had tremendous upper body strength lost much of their advantage. It also led to more record-breaking over the years.

In 1936, the 300-pound barrier was broken in the press by German heavyweight Sepp Manger, and 19 years later Paul Anderson exceeded the 400-pound mark, a remarkable lift, as it surpassed the world record held by Canada's Doug Hepburn by 22 pounds. Anderson broke the record twice more, finishing his career with 408.5, and then Russia's Yury Vlasov took over in 1962 with a new standard of 410. But just 10 years later, after changes in judging criteria, the great Vasily Alexeev bumped the record to 521. That represents an increase of 111 pounds, compared to an increase of just 55 pounds in the clean and jerk during that same period. Likewise, the 198-pound press record was 351.5 pounds in 1962 by Russia's Vasily Stepanovs, but 10 years later his comrade David Rigert kicked that up 85 pounds with a best of 436.5 pounds – a huge jump compared to an increase of only 39.5 pounds in the clean and jerk in the same 10 years.

No discussion about overhead pressing would be complete without mentioning strongman Doug Hepburn, who in the 1950s could press 175 pounds overhead with his right hand and could do a 350-pound behind-the-neck press. When was the last time you saw anyone in your gym doing any overhead presses with three 45s slapped on each end of a barbell? Back then even bodybuilders were strong. For example, Reg Park could perform standing dumbbell presses with 140-pound dumbbells, a one-arm dumbbell press with 165 pounds for 2 reps, and a behind-the-neck press with 300 pounds; Bill Pearl could perform a 310-pound seated behind-the-neck press and a 320-pound military press. Both these men – who were as strong as they looked – did these lifts nearly a half century ago!

## **Stop the Presses!**

The Olympic press was eliminated from competition in 1972 for several reasons, one possibly being the tremendous stress the lift put on the lower back. One of the most common complaints among lifters was not an injury to the shoulder or knee, but lower back pain (one former US champion described the sensation of doing a press as having a little man jump up and down on his fifth lumbar vertebra). However, Dr. Mel Siff examined the research on this subject and found that the major cause of back pain

appeared to be from rising out of the clean, not from pressing.

Another possible reason for the elimination of the press was time. In the days of the press, athletes were allowed two minutes' rest between attempts – three minutes if a lifter was following himself. With three lifts, and three attempts allowed for each lift, the competitions often finished late in the day. All this concentrated lifting was quite an ordeal. At the 1972 Olympics, over the span of several hours Vasily Alexeev pressed 518 pounds, then snatched 385, and finished with a clean and jerk of 507. Can you imagine having to clean a maximum weight, then having to come back perhaps two hours later and do it all over again?

But the number-one issue with the press was the difficulty in judging it, which led to many accusations about political shenanigans among referees. During the 1972 Olympics, US middleweight Russ Knipp pressed a world record, one that would have lived forever in the record books, but it was turned down due to Knipp's apparent use of a knee kick. We should note that the motion to eliminate the press had been brought up after the 1964 and 1968 Olympics as well.

With the press eliminated, the popularity of the sport of weightlifting declined and was replaced by enthusiasm for powerlifting and even bodybuilding and strongman. During the '70s, the popularity of Arnold Schwarzenegger boosted those pursuits, and it is not surprising that the US saw a gradual decrease in interest in weightlifting.

Getting back to our point about presses being potentially bad for weightlifting, this is true – especially if they are overworked. Although you would think that presses would help lifters, they can hurt them because of the timing. With the press, the upper body will be tense at the start, and tensing the shoulders reduces the amount of tension that can be produced by the legs. In fact, historically many of the best jerkers have been terrible pressers – one of our trainers jerked 335 off the racks, but the same day got pinned with a 205-pound bench press! This same phenomenon applied to throwers.

In the '70s and '80s, one of the most noticeable differences between the European throwers and their US counterparts was in upper body hypertrophy. Whereas many US throwers displayed tremendous upper body development, the Europeans had relatively smaller upper bodies with more of a “Christmas tree” type of shape.

As for push presses and push jerks, these exercises teach the athlete not only to use the arms differently from how they are used during the jerk but also to position the hips behind the bar rather than directly under the bar as during a jerk. A few weightlifters have reached elite level using this style in competition, such as three-time Olympic champion Pyrrros Dimas and Russia's Viktor Sots, a two-time world champion who broke six world records using this style, but they are the exceptions – and some people question whether Sots was actually human, as he reportedly could military press 413 pounds from a full squat position!

The main issue is with the timing. In the jerk, the arms and shoulders should achieve their most powerful contraction after the leg drive, not at the initial drive off the chest as with the press (which is needed to help drive the bar past the sticking point). Here is another

way to describe it: Just as one of the primary purposes of the arms in lifting should be to help pull the body under the barbell, the major contribution of the arms and shoulders in jerking should be to push the body under the barbell. There's more.

Russian researcher L.N. Sokolov believed that weightlifters who were good pressers were limited in the jerk because their upper body "muscle tonus" affected their speed of movement. In an article, he wrote for *Tyazhelaya Atletika* that was published in 1971 Sokolov said, "...strengthening the muscles of the arms and shoulder girdle (and this is an obligatory condition to obtain high results in the press) has a negative influence on the assimilation of the technique of the tempo exercises."

Due to the negative effects on the jerk caused by having high levels of strength in the upper body pressing muscles, weightlifters were forced to rethink the way they designed their workouts. Many of the auxiliary exercises were eliminated, and soon the trend in lifting (pioneered by Bulgarian coach Ivan Abadjiev) was to focus simply on the classical movements and squats.

Even so, during an off-season training cycle for a weightlifter – as well as for anyone involved in throwing sports – we believe it would make sense from a structural balance standpoint to perform some overhead presses, preferably with dumbbells.

## **The Pros of Pressing**

Even if you're not a competitive weightlifter, there are many other good reasons to include presses in your workouts. Here are five:

**Reason #1: It develops the deltoids, traps and triceps.** Sure, you can isolate each of these muscles, but an overhead press does it all at once. This makes it a very economical exercise, which is great for those who need to keep their workouts brief. Do the math. Either you can perform 3 sets of a standing overhead press or you can do all this: 3 sets of lateral raises (for the deltoids), 3 sets of upright rows (for the traps) and 3 sets of standing French presses (for the triceps). Even if you perform a tri-set, the workout time saved by performing an overhead press is considerable. What's more, multijoint exercises often work single muscle groups harder due to the inferior force curves involved in many isolation exercises. For example, the triceps kickback and the dumbbell lateral raise only apply a large amount of tension during a very small part of the midrange portion of these exercises.

**Reason #2: It improves results in the bench press.** One of the best ways to get a great bench press is to train overhead pressing strength. Because of various inhibition mechanisms, your bench press progress is often stalled until you spend time on the overhead press. Powerlifting legend Ed Coan said he was able to break a lengthy plateau by working on his overhead strength.

**Reason #3: It can prevent shoulder injuries.** Training only the bench press shortens the subscapularis muscle, puts pressure on the shoulder joint and may injure the shoulder.

**Reason #4: It's a great conditioner for the lower back and other core**

**muscles.** A weakness in the lower back becomes obvious during the performance of the overhead press. One could argue that other predictors such as external rotator strength pinpoint the cause, but overhead pressing strength is a better predictor.

**Reason #5.** It's a great diagnostic tool for strength coaches. Nick Liatsos, a Boston-based physical therapist who has treated many strength athletes, has made the same observation. Liatsos also believes that one should be able to press behind the neck to demonstrate healthy shoulder function and that the strength ratio of the behind-the-neck press to the bench press is a predictor of shoulder health. When we perform upper-extremity structural balance testing as outlined in the Level 1 PICP practical course, we can identify a strong correlation between shoulder pain and lack of overhead strength. Here are two ratios that apply to this correlation:

- **The ratio of the seated dumbbell overhead press to the bench press.** The weight done for 8 reps on each dumbbell should represent 29 percent of the close-grip bench press measure. In other words, a man able to close-grip bench about 220 pounds for a single would use a pair of 65's for 8 reps in the seated dumbbell overhead presses.
- **The ratio of the behind-the-neck press to the bench press.** The weight for a 1 RM behind-the-neck press from a seated position should represent 66 percent of the weight used for a 1 RM in the close-grip bench press. That load is lifted from a dead-stop position with the bar resting on the traps, not from a weight handed off in the lock-out position.

The ultimate message here is that coaches must be very careful to limit the time spent on exercises that have little carryover to an athlete's sport. Overhead presses can have a place in any athlete's strength and conditioning program, but some athletes need to be careful not to overemphasize them in their training. Athletes need to train hard, but they also need to train smart.

## Getting Serious with Shoulders

The typical male superhero always possesses wide, full deltoids. In fact, while preparing for the title role in the 1978 film *Superman*, Christopher Reeve underwent a strenuous weight training program that emphasized shoulder width to produce the much-admired V-taper associated with his character. David Prowse, the weightlifter who trained him for the role, said that he had Reeve do minimal chest and trapezius work so as not to detract from his delt development – a strategy designed to make Reeve look more like a gymnast than a bodybuilder. It worked, and Reeve's *Superman* movies inspired many of us to "Fight for Truth, Justice and the American Way." Or at least, to do a few extra sets of delt work.

For a bodybuilder, interest in shoulder work seems to come only after a prolonged period of chest specialization. The primary reason is that the chest muscles develop quickly and receive considerable development from bench pressing, an unfortunate (and unnecessary) mainstay of the routines of most bodybuilders. In fact, it's rare to find a gym that doesn't have at least a dozen rookie male bodybuilders whose misguided training methods make them look as though they have breasts instead of pecs.



## Symmetry and Structural Balance

The first thing we do when a bodybuilding consults with us we look for the weak points in their physique and strength levels – a process called structural balance. Then we develop a short-term plan, usually six weeks for experienced bodybuilders and four weeks for beginners, that addresses those weak points. We believe this is the best way to approach training for today's physique competitor. Although Tom Platz's freaky legs helped him place high in the Mr. Olympia many years ago, he would have had a more symmetrical physique (and might even have won the competition) if he had focused less on his legs and more on his upper body.

Balanced development is also important because often a body part looks small when adjacent muscle groups are small. For example, increasing the size of your calves will give the illusion that your thighs are bigger than they are. This effect also works in reverse – women will wear high heels so that their calves and their thighs look smaller. In addition to making the waist look smaller, having well-developed deltoids makes the arms look bigger as you get more of a 3-D look.

### Keys to Shoulder Girth

Wide shoulders are a result of (1) bioacromial width and (2) how much muscle mass you possess.

**1. Bioacromial width.** This is the technical term for the length of the bones of your shoulders. Although there is speculation that weight training can increase bone length, we haven't seen any convincing studies on this subject. By the age of 21 your shoulder bones will be about as wide as they're going to get, and there's probably nothing you can do to influence their growth beyond what will be obtained by having a diet that contains adequate amounts of calcium.

Although there is apparently nothing you can do to increase your bioacromial width, there are ways (other than malnutrition) to decrease it. If anabolic steroids are taken before the age 21, steroids can prematurely close the growth plates located in the bones and thereby reduce growth potential. Injury that occurs from improperly designed workouts could also cause the growth plates to prematurely close, but such injuries are rare. After all, many weightlifters start lifting weights in prepubescence, especially in European countries, without suffering from these effects. The studies available on this subject conclude that two of the major causes of such injuries are poor lifting technique and use of maximal weights by individuals who are not adequately prepared to lift them. For more on this subject and on other injuries that could occur to youngsters who lift weights, we recommend the second edition of the excellent weight training textbook *Designing Resistance Training Programs* by Steven Fleck and William Kraemer.

**2. Muscle growth.** The second factor that determines shoulder width, and the one that is more under your control, is muscle growth. The deltoid is a muscle group with three heads: anterior (front), medial (side) and posterior (rear) heads. To achieve that melon-like deltoid shape, you need to develop each head equally, and later in this chapter we will present several effective workouts to help you accomplish this. But first, we believe it's

important to look closely at what most strength training experts (and self-proclaimed experts) consider the most basic shoulder exercise, the military press.

## **The Military Press**

This is a tremendous shoulder exercise for all levels of strength trainers. Because your elbows are flared out during the exercise, most of the work is done by the lateral head of the deltoids; the anterior deltoid works only at the beginning of the movement. The military press is also an excellent exercise for the serratus anterior because one of its functions is to pull the scapulae upward.

## **Pressing Problems**

One common story we hear from frustrated individuals is that they don't perform either the military press or the behind-the-neck press because it hurts their shoulders. Here's the typical scenario: They start with the behind-the-neck press; then when that exercise becomes too painful, they switch to the military press, which in short order pinches so badly they try the incline press and finally the bench press. Eventually, even the bench press causes pain, and they are forced to regress to a geek routine of lateral raises. Let's take a closer look at the real cause of shoulder pain.

There are several reasons the shoulder can become injured from overhead presses such as the military press. The first is a lack of attention to training the external rotators of the humerus. These muscles need special attention to prevent injury. According to sports medicine guru Dr. Mike Leahy, a muscle imbalance between the prime movers of the shoulders and the external rotators is one of the major causes of shoulder injury. Although it means setting aside your ego and performing exercises that don't allow you to use heavy weights, a few minutes a week performing exercises for the external rotators will do wonders for preventing chronic shoulder problems.

Another reason many bodybuilders develop problems from overhead presses is muscle imbalances. If bodybuilders don't perform enough work for their upper-back muscles, particularly those that help extend the spine, they develop a humpback appearance that is more appropriate for lower primates. This type of posture puts considerable stress on the shoulder capsule when they perform behind-the-neck presses or behind-the-neck pulldowns, a stress that can eventually cause permanent instability in the joint.

Regarding lifting technique, the most common technical fault is not performing the exercise throughout a full range of motion, preferring instead to lower the weight only to ear level. Although you will get considerable triceps training out of this practice, you will get very little in terms of shoulder development, and this may contribute to the development of postural problems that can eventually cause injury.

## **Tips on Shoulder Workout Design**

Unless you are a powerlifter or a weightlifter, we really can't see the need to perform any isolation work for the anterior deltoid with exercises such as the front dumbbell raise. The anterior deltoids usually receive more than enough development from the high volume of chest work that most lifters employ; additional work will probably result in overtraining.

What most bodybuilders need is to work very hard on exercises for the lateral and posterior heads of the deltoids.

Regardless of the exercises performed, one of the most confusing aspects of designing a shoulder workout (or any workout, for that matter) is determining how many sets and reps to perform. Powerlifters and weightlifters have built impressive shoulders using low reps for multiple sets, whereas there are plenty of bodybuilders who have achieved fantastic deltoid development by concentrating on high reps and fewer sets. We believe that the best approach is a combination of both methods, which means that you would perform periods of high reps, alternated with periods of lower reps.

If you need to get into a shoulder specialization program, you will have to cut back on the amount of work you devote to other body parts, particularly the chest muscles. For maximum results, the shoulders should be trained first in a training session.

First-time clients of mine are surprised about how little shoulder work we prescribe in our bodybuilding programs. This is because if you train properly in the major compound movements such as presses and chins, there is no need for direct deltoid work. However, if you've found that your shoulders need special attention, experiment with the following routines.

**Pre-exhaustion shoulder routine.** This routine is particularly effective for bodybuilders who lack medial and posterior deltoid development. To maximize the pre-exhaustion effect, it is designed so that there is no rest between the first and second exercises of each superset.

**Notes:** Regarding standing lateral raises: (1) We call these lateral raises rather than the redundant name side lateral raises; (2) you should maintain a 5-degree bend in the elbows; and (3) concentrate on accelerating the dumbbells during the concentric contraction, not swinging the weights with the help of the lower back.

When performing the cable upright row, grip the bar so your thumbs are just outside your lateral thigh sweep, and pull the bar only until it is level with the clavicles. Also, if you find this exercise strains your wrists, try using the rope handle normally used for triceps extensions instead of a straight bar. For the bent-over lateral raises, rest your forehead on an incline bench and bend your knees slightly to alleviate the stress on your lower back.

**Heavy-light pressing routine.** This method will improve both mass and strength in the motor units involved in pressing movements – but expect to experience some deep soreness from it. The rationale is that you knock off high-threshold motor units in the first exercise, and proceed to further exhaust the lower-threshold motor units as you go through your routine. Also, by switching slightly the groove of the fundamental exercise as you go through the routine, you will be able to draw from a wider motor unit pool.

Make sure to rest 4-5 days between these workouts, and never perform this routine for more than four workouts in a row.

**Notes:** When using any of the Hammer equipment, consider that the leverages are such that you can often handle 2-3 times as much as you could in the barbell version of the

same exercise.

Everybody wants wide shoulders, but bodybuilders need wide shoulders to set off the rest of their physique and give it balance.

## **16-Week Pressing Specialization Program**

If you have at least two years of training experience and have been neglecting overhead presses and want to make amends, we have just the training program for you.

This specialization program consists of a series of four workouts, with each workout consisting of four training sessions. Once you've done the exercise for four workouts, move to the next phase. You should perform every workout from a phase every five days. Once you have done the workout four times, proceed to the next phase.

Pair each exercise with an antagonistic exercise of your choice. For the shoulders, antagonistic work could consist of vertical pulling exercises such as pull-ups, one-arm pull-ups, and one-arm pulley pull-ups. Be certain to use similar loading parameters for these exercises. With the first workout, for example, you could superset the presses with chin-ups for 5 sets of 6-8 reps on a 40X0 tempo followed by 90 seconds' rest.

When using any specialization program for the overhead press, make certain to include some rhomboid and external rotator exercises. Also, a great way to catch up on overhead work is to forgo the bench press and its variations for 12 weeks or so. Don't freak out – your bench press won't sink to abysmal levels. In fact, it'll jolt to new levels once you return to doing it!

**Workouts 1-4:** One-Arm Braced, Overhead Dumbbell Press, 5 x 5-8 reps, 40X0, rest 10 sec. between arms, rest 90 sec. after set.

You can apply the 5 Percent Solution to this set-rep scheme. This means you'll increase the amount of resistance by 4-5 percent each workout while simultaneously reducing the number of reps by 1 rep each training session, as follows:

- 1st training session, 8 reps
- 2nd training session, 7 reps
- 3rd training session, 6 reps
- 4th training session, 5 reps

This exercise allows for a greater range of motion in the pressing range than in the two-hand dumbbell press because the scapulae can move more freely. Throughout the exercise, you keep your hand in a semi-supinated position so your palms face your head. This hand position, which by the way is the position that places the least stress on the shoulder joint (and is one reason we like the way that log press apparatus are designed – with parallel grip handles – for strongman competitions). By training only one side at a time, you'll allow the scapulae to move over a greater distance.

The key technique point in this exercise is the word “braced,” because by holding on to a power rack post (or other sturdy object) with your free hand as you perform, you'll be able

to use more weight in the exercise. While standing, hold a dumbbell in your nondominant hand (always work your weaker limb first). If you're holding the dumbbell in your left hand, your right leg should be positioned slightly forward in a semi-lunge position; and your right arm is extended at shoulder level, holding on to the power rack post.

Make an extra effort to bring your biceps as close to your head as possible when you've nearly completed the concentric (lifting) range. Again, we said biceps-to-head, not head-to-biceps. Again, the extra range comes in handy to restore shoulder health. Do not wear a belt, and make sure you keep your legs out of the movement! Once your legs are in the starting position, don't move them until the set is over. And always match the reps performed with your dominant arm – don't perform more reps on your dominant arm, as it will accentuate the discrepancy between your two arms.

If you're structurally balanced, you should be able to do 8 reps at a weight that is about 29 percent of your best single in the bench press.

**Workouts 5-8:** Seated 80 Degree Barbell Overhead Presses, 5,3,2,5,3,2, 31X0, rest 2 minutes.

Start the exercise from the bottom position – you want to unrack the barbell from pins set up for the front squat – and sit down on the bench. Then, lift your feet and lock them up against the foot pad so your lower back is pressed firmly against the seat pad.

Make certain that your arms are in line with your ears when you reach the end of the concentric range. This will ensure optimal movement of the shoulder girdle and will promote shoulder longevity. Again, do not wear a belt.

**Workouts 9 to 12:** Seated Press Behind Neck with Chains, 3 x 5, 30X0, then 3 x 3, 30X0, rest 2 minutes.

You are performing a total of 6 sets for this exercise: 3 sets of 5 reps and then 3 sets of 3 reps. The chains will slow down the concentric range to 2-3 seconds, but the idea is to concentrate on moving the load as rapidly as possible. Intent is the key.

Whether you're doing presses behind the neck or in front, place your dominant leg about 10 to 12 inches forward of your other foot. This diminishes pressure on your lower back compared to the standard feet-aligned technique. Within the first workout, you'll know how effective your lower back training has been. Trainees with poor lower back strength will find it hard to stabilize their trunk during this exercise. Therefore, if you can sense that your lower back is limiting your overhead power, it's time you devote more effort to increasing the loads you can handle in lower back work.

Start the exercise from the bottom position – you want to unrack it from pins set up for the back squat – and sit down on a regular flat bench. Don't use lower back support; you'll be fine. No belt! Make sure your hands are as close as possible during the initial setup, so the range of motion is maximal.

**Workouts 13 to 16:** Standing Barbell Overhead Press, 8 x 1, then 3 x 3-5, 20X0, rest 2 minutes before doing the antagonistic exercise and another 2 minutes before returning to it. A 20X0 tempo is recommended.

Select a weight with which you can complete all 8 singles, and then drop the weight 15 percent and do 3 sets of 3-5 reps. When you can complete all 8 singles, increase the weight 5 pounds in the next workout for both the singles and the multiple-rep sets. Because the law of repeated efforts comes into play with this type of set-rep protocol, you can expect major gains in strength during this last phase. And because all these singles potentiate your nervous system, the functional hypertrophy work done at the end will pay off even more. This is brutal yet very rewarding work.

When you grip the bar, make sure your index fingers are just outside the medial deltoids in the start position to maximize the efficiency of the exercise. Keep your legs out of it – don't turn the exercise into a push press. Again, we don't want you to use a weightlifting belt for this exercise, so be careful about leaning back excessively because it places adverse stress on the lower lumbar vertebrae (and changes the training effect by turning it into a standing incline press).

Making overhead pressing a regular part of your training will help develop impressive and powerful shoulders. And if you follow the advice in this chapter and try this shoulder specialization program, overhead pressing will become one of your strengths.

## **External Rotators: Keeping the Shoulders Healthy**

If you scan old issues of *Muscle Builder*, you'll notice that physiques have changed radically over the years. Jack Delinger shocked the 1950s bodybuilding public with his awesome 50-inch chest. When Larry Scott's arms bulged past the 20-inch mark, he made history. However, placed side by side with physique photos of today, the stars of yesteryear are just tiny pinpoints of light. Today's obsession with big, bigger, biggest has produced dimensions and cuts that are truly mind-boggling. Unfortunately, this preoccupation with developing big, showy muscles has resulted in many a bodybuilder overlooking some of the smaller muscles, especially the external rotators of the shoulders. Such an oversight has put an early end to many physique careers.

When we speak about external rotation of the shoulder, we're referring to the motion of moving the biceps away from the body or backwards. When tennis pro Roger Federer follows through on a backhand, he's performing external rotation. When Cochise raises his hand to say "How!" to John Wayne, he's performing external rotation. Although many muscles are involved in these activities, the two most important ones are the teres minor and the infraspinatus. These muscles lie adjacent to one another, originate on the scapula and insert on the humerus, and comprise two of the four muscles known as the rotator cuff. From a biomechanical perspective, the teres minor and the infraspinatus help stabilize the shoulder and are therefore crucial for protecting this area from injury.

Injury prevention is only part of the benefit of training the external rotator muscles – these muscles can dramatically improve posture and enhance the physique. Interestingly, many individuals report that they feel more comfortable in their dress shirts after training the external rotators. This improved fit is a result of their shoulder blades moving back into proper alignment. Plus, the added mass on the lateral borders of the upper back finesses the symmetry of the back. One reason Robby Robinson possessed one of the best backs in

the business was that he had an impressive, three-dimensional look – every single muscle that makes up the upper back structure was fully developed. Such a level of physical refinement set Robinson apart from his competitors, and he deserves recognition for setting a standard that few have equaled.

To quote Dan Pfaff, trainer of Olympic gold medalist and world record holder Donovan Bailey, “There is a very fine line between physiotherapy and the training of the elite athlete.” What Pfaff means is that when training high-performance athletes, you must give special attention to keeping the body healthy. When we design off-season workouts for athletes, our first priority is to correct the muscle imbalances that develop from all the specific training that occurs in the athlete’s sport. Taking the example of an alpine skier, our first priority in the off-season would be to have him or her perform exercises to balance the quad strength developed from skiing.

Bodybuilders take pride in the fact that their sport requires its athletes to train every major body part. Major is the operative word here, and it has been our experience that the external rotators are among the most seriously neglected muscles in the typical bodybuilder’s routine. The following are categories of bodybuilders who most likely need to pay special attention to the external rotators:

**Anyone who does a lot of chest and back work.** Almost any exercise you perform for the pecs and lats places a lot of work on the internal rotators, so people who always begin their workouts with the bench press are prime candidates for external rotator work. And, because these individuals’ egos often discourage them from performing exercises that don’t allow them to lift heavy weights, they seldom work the external rotators and thus commonly complain of myriad shoulder injuries.

**Bodybuilders striving for the ultimate in back development.** When the infraspinatus and teres minor are fully developed, the contrast between these muscles and the lats is amazingly amplified. When a great bodybuilder hits a back double biceps pose, the deep etches between these muscles are visually stunning and give the look of muscle built on muscle.

**Individuals who want to increase their bench presses.** If the external rotators are weak, the prime movers of the upper body will shut down when exposed to high levels of tension. When we design workouts to improve the bench press, the first muscles we emphasize are the external rotators – sometimes we even start workouts with these exercises! As for the effectiveness of this strategy, we’ve seen many athletes improve their bench press and chin-up performances by as much as 15 percent in less than a month.

**Individuals with rounded shoulders.** Strengthening the external rotators will help improve the posture of the shoulders, thereby reducing stress on the skeleton. Often, such poor posture is the result of working long hours hunched at a desk, especially a desk that is not ergonomically designed. Rounded shoulders also seem more prevalent in tall individuals, who often fall into the habit of rounding their shoulders to help them look down at the vertically challenged.

Athletes in sports where the lats or pecs are the prime movers. These sports include

rowing, canoeing, swimming, baseball and volleyball. After many years of training, the bodies of these athletes adapt by progressively shortening the length of the pectoral and latissimus dorsi major muscle groups. For these athletes, part of their training must also include specific stretches for these muscles.

## Basic Concepts

To get the most out of training the external rotators, here are 10 basic concepts you must consider.

- 1. Exercise throughout a full range of motion.** Make sure to work your muscles through the full range of motion in all these exercises – if you shorten the range of motion, there is no point in doing the exercises. When using dumbbells or pulleys, pay particular attention to lowering the resistance completely in the stretched position.
- 2. Stretch the internal rotators between sets.** Between every set of exercises for the external rotators, stretch the pecs and the lats. You won't fatigue as quickly in the subsequent sets, plus you will increase your range of motion.
- 3. Perform relatively high reps.** Perform at least 6 reps per set for the external rotators, and in many cases up to 20 reps per set. The basic goal is to be certain that the muscles are loaded for at least 40 seconds but for no more than 70 seconds.
- 4. Avoid high-speed movements.** The external rotators respond best to slow-to-medium speeds of contraction – that is, 2-5 seconds for each concentric contraction and each eccentric contraction. Move the resistance smoothly at a constant speed throughout the entire range of motion.
- 5. Provide sufficient variety in exercise selection.** If you have neglected these muscles for a long time, you should do at least two exercises for 3 sets each. Rotate the exercises every six workouts. After 10-12 weeks of specialized work for the external rotators, you may only need to perform one exercise during each training phase.
- 6. Maintain correct head position.** You should always hold your head in the neutral position when performing exercises for the external rotators. The best way to ensure this posture is to be conscious of raising the bottom portion of the sternum.
- 7. Maintain correct wrist position.** When training the external rotators, keep the wrist in a neutral position to minimize the stress on the elbow.
- 8. Apply gradual overload.** The teres minor and the infraspinatus are relatively weak muscles. Most of you will have to use five-pound dumbbells or the smallest plate on the pulley device when you first try these exercises. Because most gyms don't have intermediate dumbbells such as the 7.5 pound and the 12.5 pound, we strongly recommend that you invest in a set of PlateMates, which are magnetized micro-increment weights that come in 5/8-, 1 1/4-, and 3 3/4-pound sizes. These plates enable you to progressively increase the resistance on the muscles, thus bringing about faster strength gains.



**9. Work the nondominant arm first.** The number of repetitions you can perform for your nondominant (and usually weaker) arm will tell you how many reps you should perform for your dominant arm. Thus, if you can complete only 8 reps per set with your left arm, perform only 8 reps with your right arm. As your left arm becomes stronger, you will be able to increase the workload on your right arm.

**10. Consider soft-tissue treatments.** If you have difficulty doing front presses because of a flexibility issue, ART may help. A qualified practitioner who will release the shoulder girdle muscles and a few forearm muscles should be able to set you on the right track in a matter of only a few treatments. To find an ART practitioner in your area, go to [www.activerelease.com](http://www.activerelease.com). Depending on his or her sports biomechanics background, the practitioner may choose one area over another to emphasize, but here is a list of muscles that are good starting points:

- deep and superficial forearm flexors
- infraspinatus
- latissimus dorsi
- long head of the triceps
- pronator teres
- serratus
- subscapularis
- subscapularis tied to serratus
- teres major
- teres major tied to latissimus dorsi
- teres minor

Although training the external rotators won't make as dramatic a change in your physical appearance as a hard-core specialization program of squats, chin-ups or bench presses, developing these muscles is important. The exercises and training principles we've outlined will increase your training longevity, increase performance in pressing and chinning, and improve your posture. Not a bad payoff for such small muscles, but as they say, good things often come in small packages!

## Chapter 15: Upper Back



*Mr. America* magazine was published between 1958 and 1973. Dave "The Blond Bomber," shown on this cover, was a popular bodybuilding champion who appeared in movies and television.

Isolation exercises such as reverse flys and upright rows are essential in the training of elite-level bodybuilders. Only by performing a wide variety of exercises, each of which stresses the various muscle fibers from different angles, can bodybuilders refine their muscles to achieve an aesthetic, symmetrical physique. The primary goal of non-elite bodybuilders, however, is to pack on as much muscle mass as quickly as possible. For that, they must concentrate on the basics. For the upper back, the best bulking-up exercises – exercises that we consider essential for all bodybuilders – are chin-ups.

## **Chin-Ups Rule**

Chins are exercises that many physique stars forget about or shy away from – perhaps because the exercises were associated with high school calisthenics classes or military training. But if you look at the physiques of male gymnasts, athletes who rely heavily on these exercises, you see that they possess a lot of beef on the chest, shoulders and upper back. As a matter of fact, look into the backgrounds of many physique stars and you'll find high school gymnastics – particularly among female bodybuilders.

Although we don't mind an occasional pulldown exercise for the sake of adding variety to your workouts, we strongly believe that the chin-up should be a key exercise for a bodybuilder.

The effectiveness of chin-ups is clearly seen in the superb upper-back development of Olympic gymnasts who compete in the still rings. Evidence is also available in the pictures of old-time strongmen who more often than not possessed tremendous lat development. Former Mr. America and circa 1980 strongman Mike Dayton held a world record for one-arm chins and often opened his show doing a hundred chins off a ceiling girder. Going back even further into the history of the iron game, you can read about the magnificent upper bodies of the Greek Olympians – all thanks to chin-ups.

Unfortunately, somewhere in the evolution of bodybuilding, we got distracted, and the chin-up has followed the way of the full squat and the standing military press, only reappearing in bodybuilding magazines when the editorial staff can think of nothing else to write about.

The fact is, the chin-up is one of the best all-around exercises for the upper body, involving the latissimus dorsi, teres major, posterior deltoid, rhomboids, the sternal portion of the pectoralis major, the lower portions of the trapezius, and the elbow flexors. A chin-up specialization program will not only add impressive width and thickness to your back but will also pack solid inches on your arms by promoting the growth of your biceps, brachialis, brachioradialis and pronator teres.

You only have to look at the arm development of Germany's Andreas Wecker and Italy's Yuri Chechi, Olympic gold medalists in gymnastics, to be convinced. These individuals are known not for their volume of training on the Scott bench but their countless chin-ups on the various gymnastics apparatus. Further, the chin-up is not just for gymnasts and bodybuilders. A wide variety of sports requires strength in these muscles, particularly sports that require powerful upper-body pulling actions, such as judo and wrestling.

We can already hear many lazy readers saying, "We'll just substitute pulldowns for chins."

Sure, go ahead, but you won't get the same results. There are many neurophysiological reasons that chin-ups are superior to pulldowns that we won't get into, but we can say for certain that a great back can be built much faster through chin-ups than through pulldowns. Very much the same way that squats and deadlifts cannot be matched for lower body development, chin-ups cannot be matched for upper body development.

Okay, what about the bent-over row – isn't that a great exercise for upper back development? Yes, it is, but not the way it is commonly performed by most bodybuilders. The two biggest errors we see in this exercise are rounding the back instead of maintaining a good arch, and cheating so that instead of pulling with the lats, the bodybuilder lets the legs do most of the work. As for the best grip to use and where to pull the bar, again a key training principle to development is variety: use wide grips and shoulder-width grips; pull to the chest and pull to the abdominal region.

There are many ways you can perform chins to emphasize specific areas. For example, you can get a tremendous biceps workout by performing chins with a narrower grip. In fact, if you include chins in your workout, you may not need to perform specific biceps exercises!

One reason chins are so effective is that you have to move your entire bodyweight, and the stabilization required to do this (as opposed to using pulldown machines) involves more muscle mass. It's also difficult to cheat when performing these exercises – for example, on the lat pulldown, you can cheat by crunching forward with the abdominals. This is also one reason the strength from chin-ups carries over well to pulldowns, but it often does not work the other way around. Now let's begin with a few basic concepts.

## **Chin-Up Basics**

Chin-ups are performed with either a semi-supinated grip (palms facing each other) or with a supinated grip (palms facing your body); when performed with your hands spaced shoulder-width apart, this exercise offers the greatest range of motion for the lats and biceps. Pull-ups are a variation of chin-ups and are performed with a pronated grip (palms facing away from you); one advantage is that they work the forearm muscles more and tend to put less stress on the wrists.

Regardless of the type of chin-up or pull-up you perform, your legs, torso and upper arms should remain aligned. Also, to achieve the fullest range of motion and thereby recruit the most muscle mass, at the start position your arms should be straight and your shoulder blades elevated. These exercises should begin with the combined bending of the elbows and squeezing of the shoulder blades, and should wind up with full contraction of all the muscles at the end of the exercise. The breathing pattern is to inhale (or hold your breath) as you begin pulling and exhale as you lower yourself.

Performing chins requires a base level of strength. Women and heavier persons of both sexes may not have enough strength to perform multiple repetitions properly. We don't advocate the use of the chin-up machine because it doesn't work the stabilizing muscles of the upper back. Instead, we prefer clients to develop adequate base chin-up strength by having a spotter assist them. Simply bend your knees and have the spotter lift your ankles

with just enough assistance to allow you to clear the bar. Another way is to climb onto a bench so that you can start with your chin over the bar, and lower yourself slowly – performing these negative repetitions will eventually enable you to perform chin-ups in the normal fashion.

**Variations.** The variations are what make chins such an agreeable exercise. For example, narrow-grip chins with your hands about six inches apart will work the biceps brachii while pull-ups with the same hand spacing will work the brachialis and brachioradialis muscles. Also, performing the exercise with a V-handle (so that your palms face each other), will enable you to increase the work on your rhomboids and lower lat region.

To add more resistance you can have a spotter pull down on your ankles, or you can wear a chinning weight belt or hold a dumbbell between your ankles. What's great about these methods is that as you fatigue, you can reduce the resistance by releasing the weight (but please, not in the top position).

**Grip.** There is no such thing as a “best grip” for performing chins. Empirically speaking, the athletes we know with the best upper-back development use a variety of grips to recruit as many back muscles as possible.

**Supinated chin-up.** The most basic chin-up is the supinated chin-up. Begin this exercise by grasping the bar with a supinated grip. Your hands should be spaced shoulder-width apart (or slightly narrower), and your arms should be fully extended with the torso in line with the upper arms.

Begin the ascent by drawing the elbows down and back, a technique that emphasizes the relatively strong muscles of the upper back and elbow flexors, and continue until your chin clears the bar. It's important during this portion of the exercise that the pulling and leaning-back actions be performed simultaneously. The legs should stay in line with the torso as much as possible, and there should be no flexion of the hips. At this point you lower yourself to the start position, fully extending your arms and elevating your shoulder blades. This last point is extremely important because to achieve a full range of motion, the upper arms and scapulae adductors must be stretched on every repetition. As for breathing, you should inhale when you start the exercise and exhale as you begin the descent.

**Wrist straps.** These can be used if you have weak forearms, and you are at risk of losing your grip or if you find that your forearms are fatiguing before your upper back. However, you should always perform at least one set of chins without straps to strengthen your grip. For athletes other than bodybuilders, we prefer that straps not be used. In the real world of sports, you need to use your lats without the help of crutches like straps.

An excellent way to improve your grip is to finish your chinning workout with one set performed on a thicker bar. If you don't have bars of different widths, simply wrap a towel or piece of foam rubber around the bar you normally use.

## Chin-Up Progressions

Undoubtedly, the chin-up requires a certain amount of strength. If you're a novice bodybuilder, or if you're returning to the weightroom after an extended layoff, using a progression series we designed will help you quickly develop this minimum strength level. Using this type of progression, one strength coach was able to increase the Women's Canadian National Ski Team's average number of chin-ups from zero to 12 reps in 11 weeks!

1. The first progression uses a spotter and starts by hanging from the chin-up bar with the knees bent. During the ascent, the spotter should support you by holding your ankles. If extra assistance is required during this phase, you can extend your legs against the spotter's base of support. Once you're able to perform 12 repetitions in this style with minimal assistance, you're ready to move on to the next progression.

2. In the second progression the same starting position is used, but this time, only one ankle should be in the spotter's hands – the extra weight of your free leg will increase the overload on the muscles. When you can perform 12 repetitions with minimal assistance, you can move on to the next level.

3. In the third progression the exercise is performed in the same manner, but this time, the spotter will hold you at your waist. As your strength increases, you will find that you require assistance only in certain parts of the exercise. At these parts of the movement, your spotter should offer only enough assistance to help you clear the bar.

When you can perform the full range of movement without any assistance, you're ready to use additional resistance. An increase in overload is accomplished by using the following methods:

1. Holding a dumbbell between the ankles
2. Wearing a power hook attached to a weightlifting belt
3. Wearing a chin/dip belt with weights attached to it

## **Chin-Up Variations**

As gymnasts, wrestlers and judokas have proven throughout the years, there are many effective variations of this exercise that can boost your strength and back development. Here are a few:

**Narrow Parallel-Grip Chin-Up.** A narrow, parallel grip provides a greater overload for the shoulder extensors, and many gyms are equipped with V-handles on their chin-up stations that are set 6-8 inches apart. Focus on bringing your lower chest to the handles as you pull yourself up. This variation is for the advanced bodybuilder.

**Narrow Supinated-Grip Chin-Up.** This variation increases the overload on your elbow flexors, and in fact, we consider it more of an upper-arm exercise than a torso exercise. In this chin-up the grip is supinated, and you leave only 4-6 inches between your little fingers.

**Medium Parallel-Grip Chin-Up.** In this variation, the chin-up handles are 22-24 inches apart, and your hands are semi-supinated (palms facing each other). This hand

position places your elbow flexors in their most effective line of pull, and therefore this is the type of chin-up in which you are most likely to be able to use additional resistance. You will also find that this grip creates the least amount of stress on your wrists, elbows, and shoulders.

**Sternum Chin-Up.** Popularized by Vince Gironda, this chin-up requires you to hold your torso in a layback posture throughout the entire movement. As you pull yourself to the bar, extend your head back as far away from the bar as possible and arch your spine. Towards the end point of the movement, your hips and legs will be at about a 45-degree angle to the floor. Keep pulling until your collarbones pass the bar, your lower sternum makes contact with the bar, and your head is parallel to the floor. You can use either a supinated or a pronated grip, and vary it from narrow to shoulder width, the latter requiring more strength.

We consider the sternum chin-up the king of compound exercises for the upper back. Not only does it create a great overload on the scapulae retractors, but it works more than just the lats. The beginning of the movement is more like a classical chin, the midrange resembles the effect of the pullover motion, and the end position duplicates the finishing motion of a rowing movement. If you are an advanced trainee, especially if you are pressed for time, make the sternum chin-up a staple of your back routine.

**Narrow Pronated Pull-Up.** With this pull-up, you use a narrow, pronated grip so that your hands are spaced 4-6 inches apart. Because in this anatomical position the biceps brachii have a rather ineffective line of pull, this grip increases the overload on the brachialis and brachioradialis muscles. The narrow pronated pull-up is another very effective upper-arm builder, particularly if your brachialis muscles are underdeveloped, and it tends to be easier on your wrists than the supinated grip.

**Mixed-Grip Chin-Up.** Here's one you may have never seen before. In this variation you use a mixed grip: one hand pronated, one hand supinated. For example, on your first set, with your left hand use a supinated grip, and with your right hand use a pronated grip – this variation places a greater portion of the load on your left arm. The stronger the trainee, the wider the grip. Make sure to perform an equal amount of work for both arms by reversing the grip on each alternating set.

**Mixed-Grip Chin-Up II.** This is an even more advanced version of the mixed-grip chin-up and is performed by placing your support hand on the wrist of your working arm. The stronger the trainee, the lower the hand is placed on the working arm.

**Subscapularis Pull-Up.** This is a brutal exercise. To perform the subscapularis pull-up you assume the starting position of the wide-grip pull-up and pull yourself to the bar until your upper pecs make contact with the chin-up bar. This is where the fun begins. At the top of the movement you push yourself away from the bar and lower yourself under control, a technique that will shock your subscapularis muscles.

Now let's pull everything together that we've covered so far by providing examples of two effective workouts.

**The Gymnast’s Extended-Set Back Routine.** This routine is for the advanced trainee only and is inspired by the routines that Olympic gymnasts perform to condition their powerful backs. You must be able to complete 12 shoulder-width supinated chins in strict form to do this routine.

1. Wide-Grip Pull-ups: as many reps as possible
2. Rest 10 sec.
3. Medium-Grip Pull-ups: as many reps as possible
4. Rest 10 sec.
5. Medium-Grip Chin-ups: as many reps as possible
6. Rest 10 sec.
7. Narrow-Grip Chin-ups
8. Rest 3 min.
9. Repeat steps 1 to 8 twice, and then cry and curse!

**André “The Flying Squirrel” Routine.** This routine is named after André Benoit, holder of the fastest start in luge doubles at the Lillehammer Olympics, who could do wide-grip pull-ups with a 120-pound dumbbell for a set of 3 reps on a 4010 tempo. It is reserved for people who can chin-up with at least 33 percent of their bodyweight as an additional load for 8 reps using a supinated, shoulder-width grip.

1. Sternum Chin-ups: 5 x 4-6 on a 6010 tempo, rest 4 min. between sets.
2. Subscapularis Pull-ups: 3 x max reps on a 5010 tempo, rest 3 min. between sets.
3. Negative Close-Grip Chins: 3 x 4-6, rest 3 min. between sets, lowering the body for a 6- to 8-second count on every rep. Use additional loads if possible.

Now that you understand why you should perform chin-ups and how to incorporate them into your workouts, you can rest assured that you will soon be able to achieve outstanding back development. Of course, you’re bound to get stared at when you start performing these exercises and routines, but those looks of puzzlement will quickly turn to looks of admiration as your back begins to take on new and pterodactyl-like proportions!

## **Crab-tastic Shoulders**

In the early days of professional bodybuilding, if the top competitors had stood behind a translucent white screen, you could have told who they were by their signature poses. There was Larry Scott’s one-arm biceps, Franco Columbu’s lat spread, Frank Zane’s abdominal vacuum, Mike Katz’s side chest and Schwarzenegger’s double biceps – and pretty much any position that had Tom Platz flexing his legs could be considered a signature pose. But if there is one signature pose that defined this golden age of bodybuilding, it was Lou Ferrigno at his most muscular, the so-called “crab” pose.

Although there are several variations, the basic crab pose is where you hunch forward, one leg slightly in front of the other, with your arms together in front and your fists together –



then you flex your muscles as hard as possible to emphasize your muscularity. In fact, the pose is so effective for bringing out the definition of your pecs, shoulders, delts and traps that it is also considered to be the mandatory “most muscular” pose.

Not everyone can do the crab pose well. Schwarzenegger has stated that he preferred a variation that was more aesthetic, involving him twisting his hips and laying one hand on top of the wrist of the other to bring out the arms. Likewise, Schwarzenegger’s training partner Franco Columbu preferred a most muscular shot with his hands on his hips. And although today’s bodybuilders have so much mass that they all tend to have impressive crab poses, Lou Ferrigno is the one who set the standard for this pose.

Ferrigno won the IFBB Mr. Universe title twice and placed second in the 1974 Mr. Olympia. Unlike Schwarzenegger, whose recent beach photos suggest that he probably needs to rethink his swimwear collection, Ferrigno has always been in shape. In 1993, despite being in his 40s and competing against a new standard of competitors, Ferrigno placed 10th in the Mr. Olympia – in fact, he looked as good, if not better, than he did nearly two decades earlier! Now in his 60s, Ferrigno still looks great, and he is always willing to hit a biceps pose with his fans at the many conventions he attends.

Ferrigno had roles in several movies, including the 1977 documentary *Pumping Iron*, but he became a household name when he was cast as the Hulk in the television series *The Incredible Hulk* (1977-1982). In this role, he often performed a most muscular pose before he would “Hulk out” and smash pretty much anything that got in his way. The result is that the crab became a standard pose in athletics. In fact, after tennis star Novak Djokovic’s win in the 2012 Australian Open, Djokovic did his own bit of hulking out by ripping off his shirt and hitting several most muscular poses. Although his win over Rafael Nadal had been impressive, Djokovic’s most muscular pose was, well – not so much.

The trick to doing the crab pose is to be able to “pop” your traps, giving the neck a somewhat freaky appearance. In the early days of bodybuilding, where trainees would often do Olympic lifting movements, specialized training for these muscles was not necessary. In fact, many top weightlifters were also competitors; Sergio Oliva was one, and his upper trap development gave him an especially impressive most muscular pose.

## **Lifting Styles and Shrug Variations**

Although most Olympic lifters now use the squat style of lifting, in the past the split style was favored by many lifters. The bottom position was more secure in the split style than in the squat style, and it took less effort to recover to the standing position – thus enabling the athlete to be fresher for the press or for performing the jerk. But to perform the split style, the athlete had to lift the bar higher to secure the weight overhead, as in the snatch or the clean. This meant the traps would have to be involved more in lifting the weight and shrugging the bar, in contrast to the squat style, in which the traps can help a lifter move under the weight more quickly.

In addition to helping develop the traps, shrugging exercises have a good carryover effect, especially to the neck muscles involved in extension, such as the suboccipitals, splenius capitis, and semispinalis capitis. For wrestlers, football players and athletes involved in

many other contact sports, these muscles play a vital role. Another little-known benefit of having strong traps is that it enables you to use heavier weights in standing curl exercises.

The shoulder shrug with a barbell is a simple exercise that will develop the upper traps. One key training tip is to slightly curl the wrists under so that the elbows point out, not back. This will help ensure that the bar travels straight up, and as such it will provide a greater range of motion for the traps. But although this exercise is a good one, there are several that are better: dumbbell, trap bar, and hex bar shrugs, in particular.

**Specialty bars and machines.** The hex bar and the Atlantis shrug and deadlift machine enable the use to perform shrugs with the arms at their sides with a neutral grip. The trap bar, which was invented by accomplished deadlifter Al Gerard, has a triangle shape. The hex bar is a later variation of the trap bar and has a hexagonal shape that provides more room for the legs and also tends to be more stable.

But the key advantage to dumbbells and these two specialty bars is that they enable the exercise to be performed with the arms at the side of the body and with the hands in a neutral position, thus providing a greater range of motion and a more vertical line of resistance than a straight bar provides. This technique helps correct the internally rotated shoulder and arm posture commonly associated with individuals who have bench pressed excessively for years. We should also mention that Atlantis makes a shrug machine that places the hands in this position; and because this machine is more stable than dumbbells or barbells, it enables athletes to work at a higher intensity level.

**One-arm barbell shrug.** One of our favorite shrugs is the one-arm barbell shrug. As opposed to dumbbell shrugs, it is a much smoother motion, as there is no friction from having the weights sliding up the legs. Also, with the trap bar and the hex bar, the range of motion is greater because the arms are positioned more perpendicular to the floor, not out to the sides.

Another reason we like the one-arm barbell shrug is that the exercise requires the infraspinatus and teres minor to be recruited isometrically so as to prevent the barbell from moving medially (towards the front of the body). This additional work develops superior shoulder integrity that is valuable for athletes such as football and rugby players, athletes who experience a high degree of disruptive forces to the shoulders during their sports.

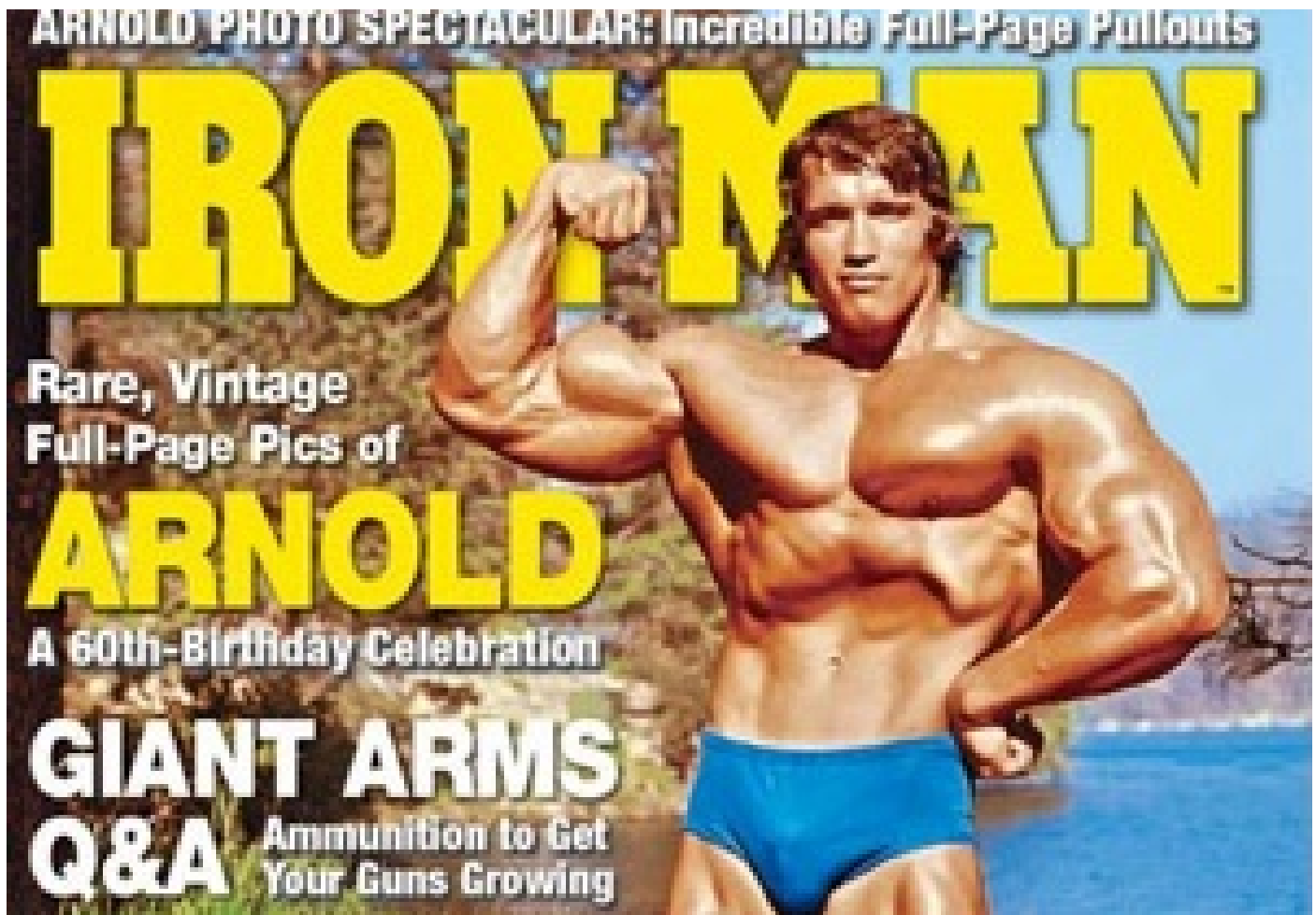
To get the most out of your one-arm barbell shrugs, perform the exercise in a power rack with the barbell set across the pins. You can then brace yourself with your free hand against one of the power rack posts, which will allow you to keep your torso in an upright position. Also, to increase time under tension – which favors the development of greater hypertrophy – pause for a predetermined time (one to six seconds, for example) at the end of the concentric range of motion. This paused variation is one that we prescribe for someone recovering from shoulder surgery, as these individuals often cannot handle high loads but still need the hypertrophy to rehabilitate quickly.

Regarding the use of straps, we would only recommend them if the weight is so heavy that your grip gives out – so no straps for sets of 1-3 reps.

Unless you are a weightlifter and have slabs of muscle on your upper back, be sure to

frequently include some shoulder shrugs in your workouts. After all, everyone needs to be able to hulk out every once in a while.

## Chapter 16: Arms



*Iron Man* magazine was first published in 1936. Arnold appeared on its cover 21 times, and as shown here had arms that were among the best in the business.

The muscles closest to the heart of a bodybuilder are not the pectorals but the arms. No other body part exemplifies strength and muscular development like big, sleeve-splitting arms. Seriously, would Arnold Schwarzenegger have become a box office cash cow without his high-caliber guns? Would Sergio Oliva have earned the nickname “The Myth” if he hadn’t had arms that exceeded the circumference of his head? And without his 22-inch, “bone-crushing pythons,” Terry Bollea would never have become Hulk Hogan. Massive arms are essential to a bodybuilder, but it takes a smart approach to get them to fill out your shirtsleeves.

In the past, the bodybuilding press would often list the poundages the top champions could handle in their favorite lifts. We knew that Reg Park was the first bodybuilder to bench press 500 pounds, that Bill Pearl could do 310 in a seated behind-the-neck press, and that Franco Columbu could deadlift around 780, which exceeded the world record at his bodyweight. But with the exception of Ronnie Coleman, it would be difficult to find the poundages hoisted by today’s best. Pictures in competition? Sure. Oiled-up training photos in a bikini? No problem. But for some reason we’ve lost interest in learning if today’s bodybuilders are as strong as they look.

One issue could simply be embarrassment. When Lou Ferrigno completed a 310-pound

jerk from the stands during the Superstars competition in 1976, the lay public was impressed. But, of course, the weightlifting community would jump on this by explaining that athletes who weighed at least 100 pounds less than Big Louie could exceed this poundage. And Reg Park's 500-pound benchmark doesn't seem so amazing when you consider that a 165-pound woman has hoisted 530 pounds in this lift and the absolute women's record is 600.8 pounds. Ouch!

There's the same issue with arm wrestling. You'd think that someone with large biceps would be the best arm wrestler, but it's not necessarily the case. John Brzenk is considered by many to be the greatest arm wrestler ever, and, in fact, the *Guinness Book of World Records* regards him as the "Greatest Arm Wrestler of All Time." But at Brzenk's height of 6 feet 1 inch, his right biceps measured 18 inches at its largest and his right forearm 16 inches – not exactly the type of arm that is featured on the cover of *Guys with Arms Larger Than Their Heads* magazine. Factors such as speed and technique are critical in arm wrestling, and in fact Brzenk himself will tell you that the best training for his sport is not biceps curls but arm wrestling.

One issue that often complicates the measurement of upper body strength is the enormous variety of exercises bodybuilders use. When you consider that using thick bars and bands increase the difficulty of an exercise without adding additional weight, it becomes increasingly difficult to determine exactly how much a trainee can lift.

Also, you've got to take into account that many of the exercises that were common in the early days of weight training are no longer being performed. When was the last time you saw a bodybuilder do a power clean or military press? Likewise, chin-ups have been replaced by lat pulldowns, bench presses by pec decs, and squats by leg extension machines. As for leg presses, as there is apparently not enough room on the weight pegs to handle those powerful legs, thus requiring the spectacle of having training partners standing on the machine.

Then there's the late Bob "Father of American Weightlifting" Hoffman of the famous York Barbell Club. Hoffman wrote *Big Arms: How to Develop Them*, which was first published in 1939 and was reprinted six more times (the last version in 1972). In this 240-page classic, Hoffman discussed many amazing feats of upper body strength by bodybuilders and weightlifters, but there was a conspicuous lack of information about performances in isolation movements such as barbell biceps curls. Maybe, just maybe, he didn't care?

Hoffman's training philosophy for developing mighty guns could be summarized in the following passage from his book: "...you can get all the arm that any man would want, a pair of arms, with Triceps and Biceps which will possess classical contours, that will symbolize great power and strength if you will practice just the two hands curl in its various forms, the side press, military press with dumbbells, bent press, alternate press; in briefer words, a variety of curling and pressing movements with the addition of a little upright and bent over rowing." Uh, thanks, Bob!

As a result of all this distraction, nobody knows what the heck a good result is in a barbell curl, much less a Scott curl with a dumbbell! And the result often is a lack of structural

balance that can compromise physical performance and increase the risk of shoulder injuries.

In the PICP Level 1 course, we devote a considerable amount of time to determining the optimal lifting norms for arm strength. The following are a few examples of our structural balance tests.

## **Structural Balance of the Arms**

A flexor is a muscle that reduces the angle between a pair of bones, so an elbow flexor is a muscle that bends the arm. An example of an elbow flexor is the biceps brachii.

Three basic exercises used in our structural balance program for the elbow flexors are Scott reverse curls, Scott supinated close-grip curls, and incline curls with dumbbells. We selected these exercises because they minimize the possibility of cheating. Every rep should be performed with full extension, and the forearms must make contact with the biceps at the top of the concentric range (also known as the position of peak contraction).

**Scott Reverse Curls.** A Scott bench is another name for a preacher bench, and the bench reduces the chance of cheating during the exercise. An optimal ratio would be 60 percent of bodyweight for 6 reps.

**Scott Supinated Close-Grip Curls.** The grip for this exercise is slightly narrower than biacromial width, which is the distance between the outside edges of your shoulders. In 1982 IFBB World Champion Jorma Rätty's performed multiple sets of curls for 6 reps on the barbell Scott curl using 154 pounds; he weighed about 198 pounds. Besides being a bodybuilder, he also had excelled at powerlifting and Olympic lifting. Ideally, you should be able to use 73 percent of bodyweight for 6 reps.

**Incline Curl with Dumbbells.** Use a 45-degree incline bench. Each dumbbell should represent 36 percent of bodyweight for 6 reps.

An extensor is a muscle that increases the angle between a pair of bones, so an elbow extensor is a muscle that straightens the arm (in the opposite direction from an elbow flexor). An example of an elbow extensor of the upper arm is the triceps. Here are two elbow extensor exercises used in our structural balance assessment:

**Close-Grip Bench Press.** Use a grip with the hands 14 inches apart, not a very narrow grip (4 to 6 inches) because a narrow grip creates tremendous stress on the wrists and elbows. Use 158 percent of bodyweight for 6 reps.

**Dips.** V-shaped dip bars are recommended; the athlete jumps from the foot supports to the arms-locked position. By the way, for a dip to be considered a dip, in the bottom position you should be able to pinch a sheet of paper between your elbow flexors and your forearms. If not, you are not going low enough. Use 185 percent of bodyweight for 6 reps – what this means is your bodyweight plus 85 percent tied to it, preferably using a loaded pin tied to a climbing belt.

Having strong arms is good. Having large arms is good. But the best of both worlds – and the true measure of success in bodybuilding and functional hypertrophy for athletic and

physical fitness – is an optimal balance of strength and size!

## 7 Principles of Superior Arm Training

To ensure that your workouts are on the right track, follow these seven principles:

**1. Plan variety in your training.** There's no such thing as a single, perfect workout. To continually shock your arms into growth you must experiment with a variety of workout programs, especially as you progress to the higher levels of arm development. Whereas beginners can make excellent progress by changing their workouts only once a month, advanced bodybuilders must alter some aspect of their program at least every two weeks – sometimes even every week!

Using a variety of exercises is especially important in arm training because each exercise targets a specific area. In the biceps, for example, Scott bench curls emphasize the first part of elbow flexion, standing cable curls stress the midrange, and concentration curls emphasize the end range.

Variety in your exercise selection is essential because the order of recruitment for motor units is fixed for a muscle during a specific exercise. This means that certain motor units within a muscle have a low recruitment threshold for exercise X and a high recruitment threshold for exercise Y. Varying the order of recruitment for motor units produces positive effects that reinforce the theory long argued by bodybuilders that full development of a muscle occurs only when it is exercised through all its possible movements.

There is a wide variety of arm exercises available to the bodybuilder. Curls can be performed seated, standing, inclined, lying or even kneeling. They can be performed with a variety of equipment: barbells, dumbbells, cables, EZ bars, parallel handles, Scott bench and the Spider bench. Even the width and thickness of the grip can be changed to recruit different motor units and experience accelerated growth.

Changing the exercise also allows you to emphasize specific parts of the strength curve. How many times have you seen guys do both standing barbell curls and seated dumbbell curls in the same biceps workout? What a waste of time! Both exercises overload the midrange of the elbow flexors strength curve. Scott curls at a 45-degree angle overload the first third of the elbow flexors strength curve; concentration curls stress the top part of that strength curve.

**2. Stress form, not weight.** Due to impatience (and sometimes ego), the biggest mistake people make in arm training is to sacrifice proper form for more weight. Because improper technique does not target the muscles properly, this error can slow progress and cause injury. Therefore, always stress proper technique in your arm training – and of course, it's a good idea to ask an exercise instructor to teach you the proper form of any exercise you've never performed before.

Improper technique in any bodybuilding exercise leads to snails-pace progress and eventually to injury. Many bodybuilders perform arm training in a position of rounded (protracted) shoulders – this problem can be exemplified by putting a bodybuilder in a

perfect posture and having them perform dumbbell curls with a weight they normally use for a 10-rep set. By the second rep you'll see that they will go back to the rounded shoulder posture or will fail to raise the dumbbells beyond the 30-degree mark – this is because their strength levels have adapted to poor posture. The result is arm development without associated stabilizer strengthening, a condition that predisposes the shoulder to a repetitive stress injury.

For optimal training of the arm and shoulder complex, you must exercise with good postural alignment. Postural training is an especially complex subject and is certainly beyond the scope of this chapter. In elbow flexor training, the trainee should concentrate on keeping the elbow as close as possible to the ground at all times.

**3. Concentrate.** One key to proper form is concentration, and enhanced concentration enables you to use safely heavier loads and maximize tension on the working muscles – factors that always lead to bigger gains. Here are some tips that will help you concentrate:

- **Always begin the set with the end in mind.** You should have a clear picture of the goal you want to achieve. If you have problems with goal setting and time management, consult these excellent books: *The Aladdin Factor* by Canfield and Hansen, *First Things First* by Covey, Merrill & Merrill, and *Life 101* by Peter McWilliams. Anthony Robbins may be a popular motivation guru, but after all the hoopla you may find that his material leaves you unsatisfied.

- **Always know how many reps you are going for.** Counting the reps backward (e.g., 6,5,4,3,2,1) is an effective trick staying focused on the task. When counting reps in the regular fashion, most people get anxious during the set about achieving the desired goal and forget about focusing on the set.

- **Focus on “feeling” the muscle, not just the weight.** This is a favorite from heavyweight bodybuilding champion Jusup Wilcosz, an ex-Mr. Universe and training buddy of Schwarzenegger. If you have problems feeling an exercise, slowing down your movements will allow you to perform the task better.

**4. Perform the most effective exercises first.** You should always perform exercises that recruit the maximum amount of muscle fibers early in your arm training workout. For example, exercises that work the long head of the triceps should be performed after exercises that work all three heads.

A practical way to determine which exercises activate the most muscle fibers is by how much weight is used. Triceps kickbacks, therefore, are obviously not as effective as triceps pushdowns or close-grip bench presses. You may also want to give pre-exhaustion a try, a training principle that was introduced to the bodybuilding world in 1968 by Robert Kennedy.

With pre-exhaustion, the agonist muscle is first pre-fatigued by a single-joint exercise; that muscle is then further exhausted by a two-joint exercise involving the same muscle group and additional muscle groups. For example, you could pre-exhaust the long head of the triceps with the lying triceps EZ bar extension, and immediately follow it with a two-joint



compound exercise that involves all heads of the triceps, such as the triceps and shoulder dip. For the brachialis, you could pre-exhaust by supersetting standing EZ bar reverse curls with incline hammer dumbbell curls.

Finally, consider that isolation exercises that recruit few motor units are not as effective as compound exercises for optimal development of muscle mass. For example, parallel bar dips and close-grip bench presses are more effective than dumbbell triceps kickbacks. This is not to say you should never perform these inferior isolation exercises, but they should not be emphasized as much as the compound movements.

**5. Work all three heads of the triceps.** When we design workouts, we tend to favor certain exercises over others. Because there are three heads of the triceps, it's easy to ignore one. From experience, the long head appears to suffer the most neglect. One reason is that, according to research in the fields of biomechanics and neurophysiology, the triceps respond only to high loads. Two of our favorite exercises for the long head of the triceps are the overhead dumbbell triceps extension, using a reverse grip, and the close-grip triceps pressdown with a straight bar.

To work all three heads of the triceps, we find that the triceps and shoulder dip is one of the most effective because you can use heavy loads. Also, it is a good idea to start your triceps training with an exercise that either targets all three heads or hits directly the long head of the triceps. Of course, if one of the other triceps heads is proportionally weak, you'd want to train that one first.

**6. Emphasize the brachialis.** The brachialis is the muscle shaped like a golf ball (or a grapefruit if you're built like former Mr. Olympia Dorian Yates) that lies between the triceps and the biceps. Although it is involved in any exercise that flexes the upper arm, the brachialis often becomes a weak link in arm development. In fact, many bodybuilders have found that adding specific brachialis exercises to their workouts can increase their arm size by as much as one inch in a month!

When the forearm is supinated (palms up), the biceps have an effective line of pull. When the forearm is pronated (palms down), the biceps is rather ineffective at flexing the elbow. This is why you normally handle 28-34 percent less in reverse curls than you do in conventional barbell curls. When your forearm is pronated, the brachialis is primarily responsible for generating force. As such, the basic exercise for the brachialis is the reverse curl, which can be performed with a straight bar, EZ curl bar or dumbbells. Also effective are hammer curls.

Pausing for a 2-second count at 30-90 degrees after initiating the reverse curl will further increase the involvement of the brachialis – but make certain to continue the upward movement in a controlled fashion. If you have to lean back or move the elbows out to complete the concentric range, the resistance is too heavy. In all brachialis exercises, make certain that your wrists stay in a neutral position. Bending them back towards you or curling with them into a gooseneck position decreases the recruitment of the brachialis muscle.

**7. Do more work for the long head of the biceps.** Primarily due to poor exercise

technique, the long head of the biceps is often underdeveloped in bodybuilders. It is most effectively worked when the elbows are aligned with the torso or are slightly behind it. Two of our favorite exercises for this area include dumbbell curls, performed on an incline bench, and standing barbell curls using an arm blaster. Table 7 lists other effective exercises for the long head of the biceps.

### EXERCISES THAT OVERLOAD SPECIFIC AREAS OF THE ELBOW FLEXORS FORCE CURVE

| LOW RANGE                    | MID-RANGE                         | UPPER RANGE             |
|------------------------------|-----------------------------------|-------------------------|
| Scott Curl, 45 Degrees       | Standing barbell or Dumbbell Curl | Nautilus Curl           |
| Atlantis Biceps Curl Machine | David Biceps Machine              | Spider Curl             |
| Corbin-Gentry Curl Machine   | Seated Dumbbell Curl              | Compound Curls, Various |
| Polaris Curl Machine         | Standing Cable Curl               | Concentration Curl      |
| Close-Grip Chin-Up           | Cybex Eagle Curl                  | Incline Dumbbell Curl   |

Table 7

## Top 7 Biceps Movements

There are scores of biceps movements. Furthermore, there are hundreds of ways to do those biceps movements. The trouble is, unless you're involved in this business full-time, you tend to adopt certain exercises and do them over and over again, to the exclusion of all others.

In no way does the following list even scratch the surface of the incredibly broad spectrum of biceps movements. It is simply a list of seven of our favorites, in no particular order. Obviously, many of them will be familiar to you. However, it's a good idea to read the descriptions anyway because you might discover a new way to do that particular movement, or you might find that you've been doing it incorrectly.

**1. Single-Arm Dumbbell Scott Curls.** The Scott curl is usually called the preacher curl in the US (the exercise resembles a preacher leaning over his pulpit to preach his sermon). However, in most other places around the world, it's called the Scott curl in honor of two-time Mr. Olympia Larry Scott, who helped popularize the bench by slaving on it for years to develop his massive arms.

Most biceps exercises require some assistance and stabilization work by other muscle groups, but the Scott bench was designed so that you could isolate the elbow flexors. By taking out the possibility of using body English, the assistance muscles are excluded from participating in the movement.

Regardless of the intent of the designer, we continue to see trainee after trainee using terrible form on the bench – so bad, in fact, that it reminds us of a penguin having an epileptic seizure. In fact, one Mr. Olympia finalist tore his biceps because he failed to use proper form on the bench.

The Scott bench is used to isolate the medial (short head) of the brachialis muscle. A lot of bodybuilding quasi-kinesiologists, however, will say that a 90-degree inclination on the

padded surface will work the lower biceps. Too bad there's no such thing as a "lower" biceps. If you feel soreness after a Scott bench workout, it's because you've worked the short head of the biceps brachii and the brachialis. Since the distal insertions of both of these muscles are in the crook of the elbow, people invented the term "lower" biceps.

Most gyms have a standing Scott curl and a seated Scott curl. We prefer the seated version because it minimizes cheating. Simply sit on the bench, holding a dumbbell in one hand, with your arm fully extended. Use your free hand to lock your triceps in position. As you curl the weight, keep your neck aligned by looking straight ahead. Here's the tricky part: Be sure to work only in the range where the tension is put on the elbow flexors. If you curl the weight up too high, you'll lose the tension on the elbow flexors, and you'll compromise your results. In other words, don't curl the weight up until your forearm touches your biceps.

Conversely, make sure you lower the weight all the way. Because the initial portion of the movement is a lot harder than it is in a standard barbell curl, many trainees make the mistake of not lowering the barbell all the way.

You might also want to try varying the angle of the support pad by turning it around (most Scott benches allow you to remove the pad and flip it around 180 degrees to use the alternate, steeper side of the support pad). This will vary motor unit recruitment.

**2. Incline Dumbbell Curl with Offset Grip.** You can use the Scott bench for this movement, too. However, you'll be holding the dumbbells with an offset grip – that is, an asymmetrical grip where the thumb side of your hand rests against the inside plate of the dumbbell. This will increase the involvement of the short head of the biceps.

Start with the dumbbells in a semi-supinated (hammer) grip and curl the weight to about 40 degrees. Then, turn your palm up (supinate) and complete the curl. Because you're holding the dumbbell in an asymmetrical fashion, you'll be forced to activate the short head of the biceps to complete the supination movement.

Do the movement at a very slow tempo to create high intramuscular tension.

**3. Incline Dumbbell Curl.** This is a very simple and common movement, yet many trainees fail to do it correctly. Too bad, because this is the most effective exercise for isolating the long head of the biceps. The incline position allows the elbows to be drawn back, away from the body, thus recruiting the long head. This exercise was first popularized by '50s bodybuilder Steve Reeves (of Hercules fame) to give his biceps a godly look.

Recline on a multi-angle bench with a dumbbell in each hand. The more flexible you are, the lower you can set the bench, but bringing it down to a flat position may be too hard on your rotator cuffs. As a rule of thumb, the lower the angle of the bench, the more recruitment of the long head of the biceps, especially if the angle of the bench is 30 degrees or lower. Conversely, the steeper the angle, the less the shoulders are extended, and the less the elbows are behind the midline of the body (and thus, less recruitment of the long head).

With your arms fully stretched out, curl the dumbbells up simultaneously while keeping the elbows directly in line with the ground for at least the first 90 degrees. (In other words, pretend your elbows are rifles and keep them pointed at the ground.) After the first 90 degrees, however, your elbows will begin to come slightly forward, especially if you're using gargantuan weights. Don't worry about it, though, as long as you kept them in line for the first 90 degrees of the movement. Keep the palms supinated at all times so that the elbow flexors are well stretched.

Here's a tip: If you have a forward head posture – meaning your head comes off the bench no matter how hard you try to keep it down – roll up a towel and place it between your neck and the bench. You'll find that it increases your strength.

We recommend that you keep the incline dumbbell curl as a staple of your arm workouts, especially if you want to do specialized work for the long head of the biceps. Just make sure you change the angle of the bench every six workouts so that you don't adapt.

**4. Concentration Dumbbell Curls.** This is one of the most basic of all exercises. In fact, a neophyte, if left alone, would no doubt “invent” this movement after a workout or two. It probably got its name from the undivided attention a trainee usually gives to the arm being worked. Furthermore, it's a physiological fact that you can increase muscle facilitation when you look at it.

The concentration curl can be performed in either a standing or a seated position, but we prefer the seated type. When you're standing, your nervous system is “distracted” because it's maintaining balance. If, however, you sit down during this movement, it will allow full attention to the movement at hand, and your neural drive will be enhanced.

Sit on a bench and lean over. Grab a dumbbell. Sit back and rest your triceps against your inner thigh. Keep a slight arch in your back while leaning over the dumbbell. Make sure to curl the dumbbell slowly and deliberately until full range is completed. By that time, the dumbbell should be near your pectoral muscle.

It's crucial that you lower the dumbbell until your arm is fully extended and that you make an effort to frequently vary the angle at which you curl the dumbbell towards you. (Go ahead and vary the angle on each rep if you like.) This will ensure that you recruit and knock off different motor units.

Concentration curls allow you the luxury of performing 1 to 2 forced reps on your own once you've achieved concentric muscle failure. We often employ a variation of this movement in which we back up against a wall, bend over, and place the glutes against it using a narrow grip on an EZ curl bar instead of working with a dumbbell. We then plant our elbows against the inner thighs and curl the weight up, being careful not to adopt a rounded back position.

You may prefer doing a freestanding version where you don't back up against a wall, but many people end up using too much upper body swing to complete the movement. If that's the case, we recommend lying facedown on an incline bench and extend your upper torso over the edge. This will allow superior isolation of the elbow flexors.

**5. Seated Zottmann Curls.** This is one of the best upper arm thickening exercises because it thoroughly stresses all the elbow flexors. It feels uncomfortable at first, so it may take a few workouts to get used to this movement.

To begin, sit at the edge of a flat bench while grasping two dumbbells. Fully extend your arms downward and keep your palms facing forward. Begin curling the weight, but keep your palms extended away from your body to prevent the forearm flexors from being recruited. The natural tendency is to curl the wrist upwards, but we're asking you to extend the hand backwards. Once you reach the top, pronate the forearms. In other words, rotate your hands so your palms are now facing downwards and straighten the wrists so that, in effect, you're ready to do the eccentric portion of a reverse dumbbell curl.

Keeping your wrists in a neutral position, slowly lower the dumbbells. Keep your elbows glued to your sides throughout the entire exercise. If your elbows tend to flare out, that means your brachialis muscles are weak in relation to your biceps brachii. If that's the case, you'll need to use slightly less weight so you can do the eccentric portion of the movement correctly.

**6. Swiss Ball Incline Dumbbell Curls.** Many trainees are resistant to the concept of the Swiss ball, but we have a few words of encouragement for them: Get over it! The Swiss ball is a useful bodybuilding tool (when used properly).

Squat down in front of a Swiss ball and rest your back and triceps against the surface of the ball (a 65-centimeter ball should suffice for most trainees, but if you're a pro basketball player you might need to use a 75-centimeter ball). Grab your working pair of dumbbells.

Perform the concentric range of a seated dumbbell curl, initiating the movement from the elbows in a smooth fashion. Make sure that the wrists are bent back again so that you'll isolate the elbow flexors instead of the forearm flexors.

Once you've completed the concentric portion of the movement, raise your hips so your thighs are parallel to the floor. Simply push down on the floor with your feet and roll your body and the ball back so that it raises your torso and hips.

Now, while remaining in this hips-elevated position, lower the dumbbells away from you. At this point, the brachialis anticus and the short head of the biceps are fully activated. Keep your wrists cocked back as you lower the weights.

After your arms are fully extended, lower your hips and start over again.

If you're excessively masochistic, or you simply want to trash your brachialis muscles, adopt the Zottmann style of curling to this exercise.

**7. Close-Grip Supinated Chin-Ups.** We've met a lot of people who've packed inches on their elbow flexors simply by doing chinning exercises. However, the main reason they did chinning movements was that they didn't have access to a wide variety of equipment. Necessity, as they say, is the mother of invention. These individuals, however, were determined to achieve international success, regardless of the limitations imposed on them. You can list Boyer Coe and Arnold Schwarzenegger as part of this group.

Grasp the chin-up bar with a close, supinated grip. The palms of the hands should be facing you, and your pinky fingers should be 4-6 inches apart. Hang below the bar and then pull yourself up until your chin clears the bar. This movement should be done very slowly, taking 15 seconds or so. Then, slowly lower yourself to the start position.

Don't shortchange yourself by not coming all the way down; range of motion is critical.

If your arms haven't grown for a while, consider adopting this movement. It's a surefire mass builder.

Regardless of which of these exercises you decide to adopt, make sure that they, too, don't become habit. Try mixing one or two into your biceps workout, and after six workouts or so, replace them with one or two other biceps exercises. Variety is not only the spice of life; it's the main ingredient of bodybuilding and strength training success.

## Top 7 Triceps Movements

Of all the essential exercises to develop the largest muscle of the upper arm, pressdowns are, by far, the most popular in gyms throughout the United States. They are easy to perform and are especially popular in magazine photo spreads because the triceps really pop out on the exercises. The lower body equivalent would be leg extensions, which showcase the separation of the major muscles of the upper leg. But as with leg extensions, pressdowns are not particularly effective for building either strength or mass.

Just take a look at the triceps of powerlifters and strongman competitors. They are plenty massive, but very few competitors will waste their time on pressdowns. Along the same line, look at your average gymnasts – most have massive triceps that were built largely by doing plenty of dips and pressing motions.

Because so many trainees are fond of pressdowns and are unsure about what might be better, we offer for your consideration the following “top 7 list” of triceps exercises, in order of good to better to best.

**1. Seated Half Press in Power Rack.** As a testimony to the effectiveness of this exercise, consider that Pat Casey is the first man to have bench pressed 600 pounds and that seated presses were one of his favorite exercises – he claims a personal best of 400 pounds. This variation of the seated press is one that powerlifting guru Louie Simmons has promoted extensively; it is excellent for packing meat on the lateral head of the triceps, which are often the most underdeveloped of the triceps muscles. You can tell when the lateral head is developed, though, as it will make the back of the triceps look like an X, in addition to making you appear to be considerably wider.

Place an adjustable incline bench inside a power rack, setting the inclination of the bench at 80-90 degrees (in relation to the floor). The seat portion should be angled also so that you won't slip off when executing the exercise. Adjust the pins in the power rack so the bar is at the hairline level for the starting position. Your grip on the bar should be about shoulder width. Your elbows should be pointing outward.

Simply press the weight up as if you were doing a conventional press. However, in the bottom position let the weight come to a complete stop against the pins. We've found that

using dead stops of 2-4 seconds in the bottom position is most effective with this exercise. They will help you build up your triceps, as each rep forces you to fight against inertia. A recommended tempo for this exercise is either 2211 (2 seconds to lower, a 2-second pause, followed by a 1-second lift and a 1-second pause) or 3211, depending on your arm length.

**2. Lying Triceps Extension.** There are several possible bar pathways for the lying triceps extension. You can bring the bar to the bridge of your nose, to your hairline or your forehead (aka skull crushers). These exercises also can be done by using a handle attached to a low pulley machine. Trying to figure out which is best is futile because you'll adapt to a particular movement in a matter of a few workouts.

It's important not to turn this movement into a lat exercise. It's all too easy to do, as the impulse is to employ a pullover motion while extending your forearms. Also, make certain to keep your wrists in a neutral position to minimize the stress on your elbows.

**3. Decline Dumbbell Triceps Extension.** MRI studies have shown that the decline dumbbell triceps extension is one of the most effective movements when it comes to recruiting the triceps. It provides a great stretch of the triceps.

Lie on a decline bench and hook your feet under the padded rollers while holding a pair of dumbbells. Press the dumbbells upward in a bench press fashion. You're now ready to start the exercise. Use a semi-supinated grip so your palms are facing each other. Keep your elbows stationary and lower the dumbbells until your forearms make contact with your biceps. At this point, the end of the dumbbell will probably be making contact with your shoulders. Lift the dumbbells back to the starting position by extending your elbows. Your elbows, of course, should be the only joint moving during this exercise.

For the sake of variety, you can add a pronating motion at the end of the elbow extension (turning your palms away from you), which will further recruit the small anconeus muscle.

**4. Seated EZ-Bar French Press.** Sit on a flat bench with an EZ bar racked on your clavicles. Hold the bar with a pronated (palms down) grip. The grip width should be slightly narrower than shoulder width. Press the weight overhead until your elbows are just short of reaching the lockout position – this is where you'll begin the exercise.

Start by lowering the bar behind your head until your forearms make contact with your biceps – at this point, you should feel a good stretch on the long head of the triceps. Now extend the elbows, using only your triceps strength, to push the bar back to the start position. To ensure triceps isolation, your forearms are the only body part that should be moving during this exercise.

**5. Decline Elbows-Under Bar Close-Grip Bench Press.** You'll perform this exercise in almost the same manner as the conventional close-grip bench press, except that it's done in a decline position and your elbows are pointing outward so they are aligned with the bar, especially during the eccentric portion of the lifts.

Perform this exercise on a decline bench that is set between 10 and 25 degrees of declination in relation to the floor. Lift the barbell off the rack and hold at arm's length. Bring the bar to a point about two inches above your nipples, and keep your elbows

extended just short of lockout during the pressing portion of the movement.

**6. Close-Grip Bench Press.** From a supine position (lying on a bench), lift the barbell off the rack and hold at arm's length. Bring the bar to the lower portion of your sternum, and extend your elbows just short of lockout during the pressing movement.

The name of the exercise itself is a misnomer because we advise most individuals to use a 14-inch grip. We don't like the very narrow grip (4-6 inches) that you see all around the country, as it creates enormous strain on the wrists and elbows.

As soon as the bar is 4-6 inches above your chest, concentrate on pushing the bar back toward the uprights and move your elbows under the bar for a greater biomechanical advantage. Locking out your elbows will take the precious muscle-building tension away from your triceps, so just go to 95 percent of lockout. Of course, we suggest having a partner help with unracking and racking the barbell not only for obvious safety reasons but also to ensure the longevity of your rotator cuff muscles.

And the number-one exercise for developing the triceps is...

**7. Convergent Bar Dips (aka V-Bar Dips).** This is the absolute king of triceps builders. Yet, like other ever-demanding movements such as squats and chins, it rarely makes the pages of general fitness magazines.

Dips were a key exercise for bodybuilders of the past, and as a result those muscle builders were as strong as they looked. One of the best dippers who made the cover of many muscle magazines is Marvin Eder. Eder could perform a single repetition with 434 pounds at a bodyweight of 198 pounds. Pat Casey, incidentally, at a bodyweight of 300 pounds, could perform a single rep with 380 pounds strapped to his waist.

To start the exercise, grasp the bars and boost yourself up until you've stabilized yourself at arm's length over the handles. If you have access to the better V-shaped dipping bar, use as narrow a grip as possible without compromising shoulder integrity. Begin the exercise by lowering your body as far as possible in between the bars, making sure to keep lowering until your biceps make contact with your forearms. In other words, your triceps must get fully stretched. Once you reach the bottom position, press yourself back up by extending your elbows. Try to stay as upright as possible throughout the range of motion. If you lean too far forward, you'll just be bringing your pecs into the movement.

If you can't lower yourself under control until the biceps make contact with the forearms, perform the decline close-grip bench press movement until your elbow extension strength is sufficient. Performing an incomplete range in the triceps dip is a complete waste of your time. Further, don't cheat yourself by performing chopped reps – that is, not going all the way down and coming up only three-fourths of the way. Keep in mind that your elbows should travel to only 98 percent of full elbow extension to maintain maximal tension on your triceps.

At first, your bodyweight will probably suffice as the means of resistance. As you get stronger, you can progressively increase the resistance by holding a dumbbell between your legs or by hooking a plate or dumbbell in the specialized chin/dip belt. There are a lot



of models on the market, but we prefer the ones that consist of standard leather lifting belts with hooks sewn into the belt. Belts that tree climbers use are the best, and can be bought inexpensively on eBay. Of course, adding chains to the belt will help match the resistance curve even better.

And please, don't resort to the dangerous version where you put your feet on a bench in front of you and your hands behind you. This exercise, along with Smith machine pressing exercises, is one of the major causes of shoulder impingement syndrome in the bodybuilding community.

Okay, so it's not realistic for you to use all these movements in any one workout. Don't sweat it. Think of this list as a menu of triceps movements, and use it to plan current and future workouts.

## Top 5 Ways to Grow Big Forearms

Biceps and triceps get the bulk of attention in arm training, but you should not forget to train the forearms. Yes, when Sergio Oliva and Casey Viator were at their peak condition their biceps and triceps development were among the best in their day, but their arm development was made even more impressive by massive forearms. To help you fulfill your potential in lower arm development, here are five guidelines to get you started.

**1. Work forearms frequently.** Your forearms can handle a lot of work. Forearm flexors and extensors can be done at least twice in a five-day cycle. The grip can be trained daily. Don't let anyone tell you that it will lead to overtraining.

**2. Make sure your pronated curling strength is structurally balanced with your supinated curling grip.** You should be able to reverse curl 82 percent of what you curl supinated. If not, your brachialis anticus and your brachioradialis muscles need some specialized work. If you are balanced, your neutral grip (hammer grip) should be 15 percent stronger than your supinated grip. In other words, if you can curl a pair of 50-pound dumbbells in a supinated grip for 6 reps, you should be able to curl a pair of 57.5-pound weights for the same number of reps with a neutral grip.

**3. Work on supinators and pronators every second workout.** Often, when a new client complains of elbow pain, the first thing we do is assess the strength of their supinators and pronators. It usually is pathetic. Once they work on these neglected muscles and bring them up to par, the elbow pain disappears by itself.

**4. Work on grip every forearm workout.** Always end your forearm workout with grip work. We have more than two dozen gripping devices at the Poliquin Strength Institute, as we believe in having a lot of options for our training – and to prevent boredom.

**5. Work with thick-handled equipment.** The key to thick-grip training is to vary the thickness of the handles the same way you vary other loading parameters, such as reps, sets, tempo, rest intervals and frequency. The key is to continually provide new methods to simulate growth, so try to change the grip diameter with each training cycle.

## Advanced Techniques for Breaking Arm Size Barriers

Next we'll share an extremely effective training method for the biceps and triceps to perform in the power rack. We developed this routine by combining ideas from articles by Anthony Ditillo and the late Don Ross. Most intermediate bodybuilders will increase their standing curling poundages by 5- 25 pounds and their close-grip bench press poundages by 30-45 pounds in just 3-4 weeks using this training system.

This routine makes use of what exercise physiologists call "functional isometric contractions." In the early '60s this method was known in the iron game as "isometronics," which is a term coined from the combination of isometrics and isotonic (or, more properly, auxotonic).

With isometronics you take advantage of the joint-angle specificity of strength gains caused by isometric training. Thus, during every set performed in the power rack, you will do a functional isometric contraction after pre-fatiguing the muscle with heavy partial repetitions.

For both the biceps and triceps workouts presented here, you will be working at three ranges – low range, midrange and top range. For each of these ranges you will select a weight you can move from the starting position to the pins placed at the end of range of motion. Here's how to do it:

Perform 4-6 partial reps in the normal fashion. When you come to the end of the last concentric repetition, press the bar against the top pins. Press as hard as possible for 6-8 seconds, trying to rip through the pins! Do not hold your breath during the isometric contraction; instead, use a very brief cycle of breathing, alternating rapidly between short inhaling and short exhaling. If you've performed this set properly, you should not be able to perform another repetition – if you can, the weight you used was too light.

Building strong muscular arms is a function of experimentation and variation. Winners always find solutions; losers find excuses.

## Chapter 17: Abdominals



*Muscle and Fitness* began publishing in 1980. Although not as hardcore as its sister publication *Flex*, much of its focus is on weight training for physical fitness and athletic performance.

A defined, hard midsection sends out a powerful signal about the shape you're in. Abs of steel are perhaps the most sought-after body part of the hardbody generation – even beer commercials use actors with washboard abs! In spite of such attention to what appears to be a relatively small muscle group, it's not uncommon to hear the complaint that “no matter how much I work them, I just can't get my abs in shape!” Frustrated, we turn to abdominal crunch machines or Roman chair sit-ups and seriously consider buying one of those plastic gut-busting gadgets at our local sporting goods store.

The fact is, most of what we hear about abdominal training is untrue, and there is so much

misinformation that it's difficult to separate fact from fiction – and from fraud. What expert do we believe – the professional bodybuilder, the physical therapist or the “Personal Trainer to the Stars”? What a mess! But before you grind out another crunch or devote any more time, effort and money in search of the perfect waistline, understand that a little training knowledge can go a long way towards getting you those sought-after six-pack abs. Let's start with the concept of “core” training.

**Training “the core.”** One popular theory in the area of rehabilitation and sports performance is the concept of training “the core.” From the attention it has received, not just within the strength training community but also the media, you would think that the core muscles should be the focus of your training. So-called core training is done primarily with Swiss balls, BOSU® balls, rocker boards and other such equipment designed to throw you off balance – and supposedly activate the abdominals in a way that no other exercises can duplicate. Not quite.

The problem with this functional training approach is that it is based on two hypotheses: (1) to train for stability you have to train on unstable equipment and (2) the primary muscles responsible for stability are the abdominals. The problem with these ideas is that from the get-go there has been little interest in testing them – coaches simply pulled out their credit cards and started buying a lot of colorful balls and rubber tubing. But one coach who decided to challenge this thinking is PICIP coach Michael Jonathan Wahl.

**Instability training.** Wahl decided to study the effectiveness of instability training to see if the techniques do offer greater benefits compared to traditional training. Functional trainers obviously believe that squatting on a BOSU ball has some advantage over regular squatting, so Wahl decided to try to figure out what that advantage might be – or if indeed there is any difference. He also decided he would use elite athletes in his study because he didn't assume you could apply the data from recreationally trained subjects to elite athletes. In fact, this is a common problem with many studies on strength training – just because one workout protocol is extremely effective for a group of untrained, unmotivated college students doesn't mean that same workout protocol will work for an intermediate or advanced athlete.

Rather than using unmotivated college students looking to fulfill requirements for a grade, Wahls recruited 16 athletes who played at the college level or higher. One of these subjects was a world-champion kickboxer, and all the subjects were in the top 10 percentile for upper body and lower body strength according to the American College of Sports Medicine guidelines. Testing was performed with an electromyogram, which records electrical activity in muscles.

Wahl found that the brain motor patterns the athletes exhibited when performing unstable exercises were identical to those exhibited when they used a stable surface. However, the training effect is reduced when exercising on unstable surfaces because a trainee is forced to use less resistance. Further, Wahl makes the point that free-weight training is unstable by nature: “Remember the first time you did a bench press and your arms went everywhere and you had trouble stabilizing your joints? Sure, a Swiss ball exercise can be taxing for someone who has never done any exercise before; but get a first-year physics

student to explain the disrupted torque on the body that occurs when someone squats 500 pounds and you'll see that the entire muscle system has to work tremendously hard to handle that type of weight. When an athlete turns their ankle, it's often because they are not strong enough to handle the disruptive force of the activity, so why not train to get used to that excessive force using the principle of progressive resistance?"

From this perspective, what does Wahl see as the functional value of these types of exercises? Very little. "If any movement deviates 2.5 percent or more from the original motor program, the skills are not going to transfer," says Wahl. "Baseball players and javelin throwers both throw implements, but EMGs show that these movements are not similar, and, therefore, the skills from performing one of these activities does not transfer to the other." As such, being able to squat and juggle while balancing on a BOSU is not necessarily going to improve your regular squat, but it will certainly improve your ability to squat and juggle while balancing on a BOSU ball!

While the jury may still be out about the value of unstable exercises, the scientific research suggests that this type of exercise has little practical value for an elite athlete, and it also has a high risk of injury by its very nature. And for a bodybuilder, it will do little to improve abdominal development.

With the issues of stability and core training out of the way, let's look at some basic anatomy concerning the abdominals.

## **Rectus Abdominis: The Six-Pack**

**Midsection anatomy.** Many personal trainers and strength coaches firmly emphasize that the rectus abdominis, the muscle responsible for shaping the envied six-pack, is just a single, long muscle that extends from the top of the sternum and rib cage to the pubic bone. While it's true the lower abdominals don't really exist from an anatomical standpoint, for training purposes the rectus abdominis can be divided into two sections: the supraumbilical, the area above the bellybutton; and the subumbilical, the area below the bellybutton.

Although the entire rectus abdominis is activated to some degree in virtually every exercise, it's possible to emphasize specific segments of the muscle, such as by positioning your body differently. This effect is similar to what happens when bodybuilders attempt to develop specific areas of the pectorals by performing bench presses on an incline or a decline.

## **Targeting Your Training**

**Subumbilical section: the lower abs.** This area plays an important function in maintaining proper posture, and in fact the excessive lumbar curvature displayed by some gymnasts may be due in part to weakness in the lower abdominals. Such a posture reduces the shock absorbing qualities of the spine, and as such may contribute to lower back pain. The problem is further compounded if there is a strength imbalance between the two sides of the subumbilical muscle, an imbalance that creates excessive rotation of the spine, which places harmful stress on the disks.

In terms of athletic performance, when the pelvis is rotated forward due to muscle imbalance, the lower abdominals are stretched and become difficult to contract – this affects overall performance. Thus, a volleyball player with weak lower abdominal muscles would not be able to generate as much power when they serve. Weak lower abs can also change running mechanics. In fact, before his gold medal win in the 1996 Olympics, 100-meter sprinter Donovan Bailey's primary focus in his training was the lower abdominals. So the underlying principle here is to train muscles first (with exercises that affect the lower abdominals), and then movements (with compound exercises).

How do you know if you have weak lower abdominals? One popular test is to lie on your back with your knees bent at 90 degrees. Place your hands just above the hipbone, and then lift your elbows off the floor and rest your head on the ground. Now try to lift your upper legs straight up. If you can't perform this test without moving your knees towards your head, or if you have to brace your elbows on the floor or raise your head to perform the movement, then you have weak lower abdominals. This test can also be used to train the abdominals.

When you first perform this pelvic tilt exercise, you may not be able to lift your hips at all. That's OK – as long as you are contracting the muscles, you will get a training effect. Soon you will be able to perform it easily. At this point, you can make the exercise more difficult by holding a weight, such as a medicine ball, between your knees. A few sets of 15-20 reps (because the range of motion is small) will get the job done.

If you want to take lower abdominal training a step further, you can perform a simple leg lowering exercise. This exercise, which is discussed in the physical therapy textbook *Muscles: Testing and Function* is considered a test of coordination between the upper and lower abdominals. The difference between this test and a conventional leg raise is that you need to keep your lower back pressed against the floor throughout the movement. To score 100 percent on the test, a male should be able to lower his legs all the way to the floor, and a female should be able to lower until her legs are about 15 degrees from the floor. If you cannot pass the test, simply perform it throughout a partial range of motion, starting from a vertical position and lowering until you start to feel your back arch. A few sets, with about 45-60 seconds of time under tension, will suffice. And to make the exercise more difficult, simply hold a weight, such as a medicine ball, between your feet.

Although lower abdominal exercises have value, don't go overboard with them. Use them for a few weeks to correct structural imbalances.

Now let's look at the second-most controversial abdominal muscle group – the obliques.

**The obliques and rotational strength.** Many strength coaches mistakenly believe that basic multijoint movements such as squats and power cleans will not improve rotational strength. After all, most exercises occur in the vertical and horizontal planes, but may leave out rotary movements that occur in sports. As such, rotational strength is lacking, and the best way to develop this is to use kettlebells, elastic tubing, or medicine balls with ropes. However, for a bodybuilder, it's best not to do any of these oblique exercises. Let's get some answers.

A bodybuilder only needs a minimal amount of strength to prevent injuries in heavy multijoint movements such as squats, so working the obliques is not a good idea for them. The basic idea in bodybuilding is to develop an “X” shape, and a thick waist would detract from that ideal. Of course, athletic performance is another matter.

First, it’s important to understand that trunk stability plays a major role in rotation. If an athlete can stabilize their trunk when they encounter impact during sports, whether it’s hitting a baseball or swinging a tennis racket, they will produce more force. This is where exercises such as the overhead squat and the farmer’s walk are especially valuable.

Next, coaches and athletes need to understand that there are two basic types of rotation: rotation coupled with extension, and rotation coupled with flexion. Swinging a tennis racket from down to up during a return is rotation coupled with extension; bringing the racket from up to down during a serve is rotation coupled with flexion. This is how they generate powerful rotational force, by acting as force transducers and not as force producers.

Regardless of the type of rotation being performed, there is no single muscle that causes rotation, which is why focusing on isolation exercises for muscles such as the obliques tends not to transfer well to most athletic movements. There are many machines that limit the spine to one type of rotation for the obliques. For example, there is one machine at which you sit down, grasp handles in front of you, and then twist to each side. Is this a valuable exercise to isolate the obliques? No.

What many coaches don’t understand is that although these muscles are justifiably called obliques because they have oblique fibers, the fact is that most of these oblique fibers are not transverse to the trunk – most oblique fibers are arranged in a diagonal alignment that are not suited to producing strictly horizontal movement. Consider the biceps, which has fibers arranged longitudinally. You would not work the biceps by pulling your arm across your body because it’s not a natural movement pattern for the biceps, right? Similarly, in the case of the obliques you want to perform movements that are natural to them. Rotating the spine on a single axis is not a natural movement pattern, especially when performed seated, and creates large shearing forces on the spine that can easily damage the disks. This movement pattern is even riskier when performed with resistance – although performing high reps with just a stick (in a misguided attempt to trim the waist) will also produce high shearing forces on the spine.

Even worse is a popular trunk-twist exercise performed with a rope attached to a medicine ball – the trainee stands with their back against a wall and slams the ball side to side at high speed. Stuart McGill, one of the foremost authorities on lower back pain, did research on this type of exercise and found that it’s a great way to blow out a disk. As for fat loss, the energy expenditure is so low in trunk twists that it will have little effect on “burning” off fat. But for anyone who wants to do a more specific exercise for rotation strength that strongly involves the obliques, we recommend many of the popular wood-chop exercises performed with cables.

**Supraumbilical section: the upper abs.** Whereas the lower abs are trained effectively with pelvic tilt exercises, the supraumbilical section of the abdominals is

trained dynamically by conventional exercises that flex the spine, such as crunches. As for Swiss ball crunches, they do train the rectus abdominus; but because the much greater range of motion puts the abdominals at risk for injury, you have to start these exercises with no resistance.

One popular exercise to work the rectus abdominus with minimal involvement of the hip flexors is the reverse sit-up. Position yourself on a sit-up board, facing away from the rollers and grasp the handle. Keep your arms slightly bent to minimize the stress on your shoulders. Bend your knees so that your upper thighs are perpendicular to the floor; your feet should be off the floor and should not touch the floor throughout the exercise. Now lift your hips up and towards you as far as comfortable, and then return to the start. To increase the difficulty of the exercise, perform it on an incline or from a hanging position. You can also attach a low pulley cable to an ankle attachment, thus giving you a precise increase in resistance.

Another variation of the reverse crunch is with the legs straight. Start in the same position as for the reverse crunch, but with your legs straight and perpendicular to the floor. Lift your hips straight up and then return to the start, but do not allow your legs to move towards your head. To increase the difficulty of the exercise, perform it on an incline bench or use ankle weights.

Regarding organizing the exercises in a workout, or for long-term planning, always focus on the weakest area first. This means lower abs first, then obliques, and then upper abdominals. Unless the individual is especially weak, training the abs once every five days is sufficient – again, we only recommend specific abdominal training for short periods (and for athletes, the best place to insert them in a yearlong periodization plan would be during preparation phases). But seriously, the idea of performing specific abdominal exercises may not be necessary for many individuals. Let's take a closer look.

**The best abdominal exercises.** Despite all the cool toys available to develop the abdominals, the fact is an athlete can develop tremendous abdominals without ever performing a sit-up, crunch or anything involving all those fancy circus balls and other gimmicks on the market. Core training, to use the popular buzzword, doesn't have to be complex training.

As evidenced by the muscular midsections of powerlifters and weightlifters, simply performing total-body lifts such as squats, power cleans, and deadlifts can develop impressive abdominals. In fact, a study published in *Physical Therapy in Sport* in 2011 found that competitive female weightlifters had significantly stronger internal and external oblique muscles than a recreationally active control group. Their internal obliques were the thickest, followed by external, and then by transverse abdominis – this represents a structurally balanced relationship.

It's no big surprise to anyone who has done heavy Olympic lifting that it builds the abdominals. Research shows that the strenuous overload of fast-twitch abdominal fibers required from the snatch and clean and jerk is the reason for greater size and strength in the subjects' lateral abdominals. Research also points to the role of the internal obliques as part of the muscular system that transfers the load between the pelvis and thorax, as well



as handling the stress of repeated rapid lifts required from the snatch and clean.

Transverse abdominis strength and size is further developed through the stabilization required in the catch portion of the snatch and clean, and because of intra-abdominal pressure that is commonly increased in weightlifters versus recreational trainees. Clearly, Olympic lifts are an excellent addition to your ab program if you are trying to get stronger and more powerful.

**The truth about belly fat.** The misconceptions about how to lose fat are extensive and are commonly spread by uninformed fitness professionals and the mainstream news media. For example, a recent research study from Duke University titled “The Effects of Aerobic Versus Resistance Training on Visceral and Liver Fat Stores, and Liver Enzymes,” reported that aerobic training is significantly more effective at burning fat than resistance training alone and equally as effective as resistance and aerobic training together. Not so fast – this conclusion would hold up only if you were comparing resistance training on Cybex machines with intense aerobic training for 40 minutes a session!

What many of the news reports didn’t clarify about this study is that the resistance program consisted of eight Cybex machine exercises used three times a week, whereas the aerobic training program was performed at 75 percent of maximal oxygen uptake for a total of 12 miles a week. The resistance program used Cybex machines with what appears to be a muscular endurance training program (but by using 8-12 reps for 3 sets, could this be for hypertrophy instead? – the weight or percentage of the 1RM isn’t mentioned in the study, so we don’t know for sure), whereas the aerobic training group exercised at a fairly vigorous intensity (75 percent of the max oxygen uptake is 80 percent of heart rate max). Once we take those facts into consideration, it’s not surprising that the aerobic exercise performed in this particular study was more effective than machine lifting at burning fat.

Another concern with how the study results were presented is that most of the news reports proclaimed that jogging or cardio was best for burning belly fat. This implies that cardio will help you lose *subcutaneous* fat (the “grabbable” fat covering the abdominals just under the skin). Actually, the study tested the effects of exercise on *visceral* fat – the type of fat that is deep inside the body and surrounds the organs or even gets into organs such as the liver. Although this fat can make your stomach stick out, it’s not what most people think of when they talk about losing abdominal fat. It’s too bad that the results of this study were misrepresented in the media, because the research provides valuable insight into strategies for losing fat to prevent disease.

In fact, there are a number of recent studies that can guide you in designing the best fat-burning programs for health and a lean physique. Let’s review them here.

**More about subcutaneous fat.** Subcutaneous fat is directly below the outermost layer of skin. This is fat that you can pinch with your fingers and can be tested with calipers. Subcutaneous fat in the stomach area covers the abdominal muscles, and if you have too much of it, you won’t be able to see your ab muscles. In comparison, visceral fat is located between organs, deep inside the body. You can’t grab it, although it will make a

stomach stick out if you have a lot of it. There is evidence that men tend to have more visceral fat, and women tend to have more subcutaneous fat. Once women reach menopause and lose estrogen, they begin to develop more visceral fat as well.

**More about visceral fat.** Visceral fat sits deep behind the abdominal wall and surrounds the organs within the peritoneal cavity. Visceral fat negatively affects health by increasing inflammation in the organs, in part because it releases substances called adipokines, which are cell-to-cell signaling proteins that increase blood pressure and interfere with insulin health. Visceral fat also decreases the amount of adiponectin in the body, an essential hormone for fat burning that helps speed up metabolism, which means there are more triglycerides getting into the bloodstream. The combination of decreased insulin sensitivity, greater hypertension, and elevated triglycerides often results in atherosclerosis and higher LDL cholesterol (the bad kind) and is an important factor in the development of diabetes.

The most effective way to get rid of visceral fat is to do high-intensity intervals and strength training. Of course, for best results, you should do what you enjoy most because there's more chance you'll stick with it. Fortunately, the evidence shows there are many effective options. Some individuals won't stick with a workout program that is extremely hard; and overweight or novice exercisers may not be ready for high-intensity intervals, meaning it is valuable to present alternatives that can help decrease visceral fat. Let's start with the most effective strategy.

**High-intensity training.** High-intensity training, or HIT, is effective because it increases fat burning both during and after exercise and may decrease appetite after exercise. During exercise and after HIT, fat burning increases to remove built-up lactate and hydrogen ions. Elevated growth hormone also supports fat burning and is a result of HIT programs.

The very best protocol for visceral fat loss and a lean physique is high-intensity interval sprints and a resistance training program. This will allow you to burn visceral fat and build muscle. Having more muscle elevates metabolism and supports a better hormonal and biochemical environment by lowering adipokines – those evil chemicals that create more fat and break down muscle.

A dual program of HIT, or at least strenuous aerobic training, combined with resistance training is clearly essential for health. You'll be getting rid of the unhealthy fat and building up an arsenal of muscle to protect against future fat attacks. You'll also be more anabolic due to bursts of growth hormone, and you'll have the benefit of acute elevations in testosterone if the volume and weight lifted in the training program is significant.

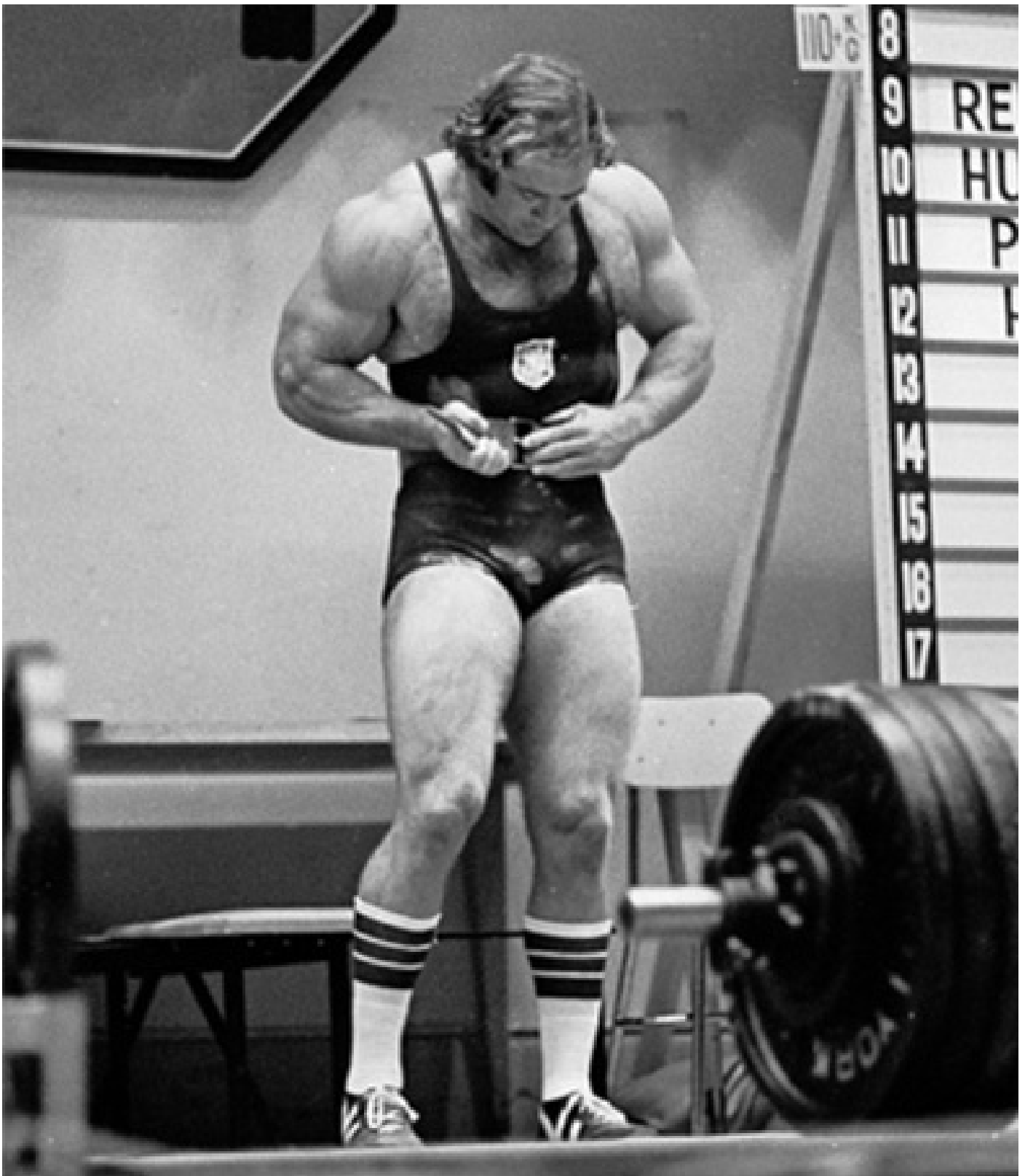
The Duke study shows that steady-state aerobic training at a vigorous intensity such as 75 percent of the maximal oxygen uptake does burn visceral fat and can improve metabolic biomarkers and that such a protocol is better than a training protocol consisting solely of machine resistance. But that doesn't mean that aerobic training is better than all resistance protocols.

Based on the clear evidence that high-intensity anaerobic-style exercise is best for burning

visceral and total body fat, it's reasonable to make the conclusion that high-intensity resistance training would be effective as well. For example, circuit training with heavy weights can be effective for hypertrophy, and it triggers a release of potent growth hormone, leading to more fat burning. And as mentioned above, it's clear that pairing both aerobic and anaerobic training with weight training will provide better long-term overall results, despite the fact that the Duke study is skewed toward aerobic training for visceral fat loss.

Achieving an impressive six-pack is not that complicated. If you follow the advice in this chapter, you can have great abs much faster than you might expect.

## Chapter 18: Nutrition



A three-time world powerlifting champion who bench pressed 612 pounds wearing only a T-shirt, Doug Young was one of the most physically impressive powerlifters in the 70s.

There is a preponderance of great information available on how to eat well, and there is also a lot of nonsense (you can't solve all your problems by simply drinking protein shakes and carrots all day). To get you started on eating well, here are 14 principles of good nutrition:

**Principle #1. Always eat breakfast – opt for a high-protein, low-glycemic meal.** When we're asked for the single best dietary tip for optimal leanness, energy, and sustained mental focus, we invariably recommend to try the rotating meat and nuts breakfast. Clients ranging from NHL and NFL stars to corporate executives rave about the increased mental acuity and focused energy they derive from this food combination. The meat allows for a slow and steady rise in blood sugar. The nuts provide a great source of healthy smart fats that allow the blood sugar to remain stable for an extended period.

Here is a sample five-day rotation of a meat/nuts breakfast. You do not add anything to it – no beverages or other foods.

### **Day 1**

1-2 buffalo meat patties

1 handful of macadamia nuts

### **Day 2**

1 large venison steak

1 handful of cashew nuts

### **Day 3**

1-2 lean turkey burgers

1 handful of almonds

### **Day 4**

2 lean ground beef patties

1 handful of Brazil nuts

### **Day 5**

2 chicken breasts

1 handful of hazelnuts

**Principle #2. Eliminate all processed foods from your diet – don't ever eat them.** Processed foods are one of the major causes of obesity. For more information on this subject check out the books by Gary Taubes, such as *Why We Get Fat* and *Good Calories, Bad Calories*.

**Principle #3. Don't avoid fat** – just be sure to eat smart fats such as those found in fish and wild meats, coconut oil, olive oil, avocados, and nuts. Despite what many of the celebrity fitness gurus would have you believe, saturated fats are essential to our health. In fact, foods high in saturated fat were a key part of the diets of our Paleolithic ancestors, and our genetic code has not changed significantly since then.

**Principle #4. Consume a high-quality, high-protein diet** to increase resting metabolic rate and the amount of energy required to digest food.

**Principle #5. Eat antioxidant-rich foods** such as berries, dark chocolate, leafy greens and olive oil to prevent inflammation.

**Principle #6. The darker the fruit, the better.** Dark fruits tend to have very thin skin, meaning they need to produce more antioxidants to protect themselves from the sun. In contrast, light-colored fruits with thick skins such as bananas and melons have lower antioxidant content. Dark red, blue and purple fruits are great anti-inflammatory foods because the extra antioxidants help get rid of free radicals that cause aging and inflammation.

Berries with high antioxidant content such as bilberries, blueberries, cranberries and raspberries decrease glucose response in healthy subjects, slowing digestion. When you compare berries and cherries with bananas and pineapple, the latter two fruits have a significantly higher glycemic index. Of course, this applies to fruits in their natural state; when grapes become raisins, their glycemic index goes up because of dehydration of the fruit.

The bioactive polyphenols that dark-colored fruits contain promote greater insulin sensitivity. Also, there is evidence that adding berries rich in polyphenols to high-glycemic foods that normally trigger a negatively high spike in glucose can moderate the body's response, producing a remarkably low insulin response. Take note that it is necessary to fully chew berries or fruit to release the polyphenols to work their magic on the glycemic index of carbs.

**Principle #7. Eliminate all sugar and all sweeteners** – cane sugar, agave, maple syrup – all of it. Wakefulness, energy expenditure, and the brain's reward center are all downregulated when we eat sugar. A network of transmitters in the brain responds to the food you eat, and if you eat carbs, especially sugary carbs, the network is inhibited, slowing energy use and making you less alert.

**Principle #8. Consider eliminating gluten, wheat, and other grains to support insulin health.** Humans have never had adequate stomach enzymes to break down gluten so that it can be properly digested, a problem that has been made much worse by the genetic engineering of wheat over the last 100 years.

Wheat raises the blood sugar levels quickly in the same way as plain table sugar. Foods based on white flour, such as white bread and many cereals, are a poor source of fiber, and they have a high glycemic content, meaning they cause a quick spike in insulin. The presence of insulin tells the liver that food intake is meeting energy requirements, so lipolysis, or the breakdown of fat for energy from body stores, becomes unnecessary. The insulin spike stops the body from burning fat for fuel. Any excess sugar or food intake is saved for future energy requirements and is stored as fat. Constantly high insulin levels will make the body resistant to insulin and will lead to diabetes. This is why it's best to eliminate grains, particularly white grains, and it's important to do resistance training – you'll improve insulin sensitivity.

An allergy to gluten is called celiac disease and means that the sufferer will have serious digestive damage from eating foods containing gluten, which causes a wide variety of

other health issues. Among these problems are weakness, anemia, malnutrition, osteoarthritis, bone disorders, stomach cancer, and abdominal bloating – all problems that will trip you up if you want to gain muscle and lose fat. You can be allergic to wheat or be sensitive to gluten without having celiac disease; and even if your body isn't intolerant to wheat and gluten, removing them from the diet is recommended for optimal body composition, digestion, and health.

Not only does gluten raise insulin levels in the body and provide a large carbohydrate and caloric punch, it also causes the body to release cortisol in response to the gluten allergy stressor. Research shows that cortisol partially inhibits the harmful effect of gluten in the body. The problem is that cortisol results in muscle degradation and elevated levels suppress the immune response and lead to hormonal imbalances, fatigue, depression, insomnia, and illness.

If you are transitioning to a whole-food-based diet at the same time you are eliminating gluten, it may be helpful to use gluten-free substitutes to help you make the transition. However, be cautious about eating a lot of high-carb substitutes because this may compromise body composition and insulin health.

**Principle #9. The main source of carbs should be fibrous.** Fibrous carbs, including many green vegetables, typically have very low carbohydrate content. Their inherent high fiber brings about a very moderate insulin response, thus making them an ideal fat loss food. Research shows that the higher fiber content of most vegetables will delay carbohydrate absorption, favorably modifying the glucose response. Dark green vegetables usually have a large antioxidant content as well (not as great as dark fruits, but still a sizeable amount). The best sources of fibrous carbs include these vegetables:

- Kale
- Broccoli
- Lettuce
- Cabbage
- Cauliflower
- Mushrooms
- Green beans
- Onions
- Asparagus
- Cucumber
- Spinach
- All forms of peppers
- Zucchini
- Cauliflower

**Principle #10. Limit fructose in the diet to only fruit sources.** Eliminate all fructose-based corn syrup – that means you have to be a label reader, as so many modern-day foods are designed to turn us into Corn People. One of the worst sources of glycated fructose is low quality protein bars that contain high fructose corn syrup.

Even though fruits are loaded with nutrients, they also contain fructose. Consuming too much fructose can slow down thyroid function, reducing metabolism and negatively affecting body composition. Research shows that excess fructose in rats results in decreased ATP in the liver, leading to less thyroid hormone uptake and a reduction in fat burning.

Too much fructose in the diet also increases glycation. Glycation in layman's terms is browning, like the browning that makes a crust on bread. Glycation is the cross linking of proteins (and DNA molecules) caused by sugar aldehydes reacting with the amino acids on the protein molecule to create Advanced Glycosylation End Products (AGEs). If you want to see protein cross-linking in action, cut an apple in half and watch it turn yellow!

Why is fructose the worst glycation agent? Because it does not raise insulin. In other words, the fructose is not getting into muscle cells, meaning it lingers in the body and wreaks metabolic havoc. As nutrition expert Robert Crayhon used to say, fructose is like the guest that won't go home once the party is over.

One study compared the effect of a diet high in fructose with one high in glucose. After ten weeks, the fructose group had significantly elevated levels of cholesterol and insulin, while insulin sensitivity and fat metabolism decreased. They also gained significantly more total fat and an even greater percentage of abdominal fat than the glucose group. Further research shows that this extra insulin causes dysfunction of cells, and in addition to the negative effect on body composition, it accelerates aging, vascular degeneration, and development of diabetes.

**Principle #11. Consume enough fiber** – shoot for at least 25 grams a day. Low fiber intake leads to poorer insulin health and more belly fat gain. First, you need to get enough fiber every day, because without adequate fiber, inflammatory markers rise, compromising health and body composition. The best solution is to eat a high-protein diet that is high in fiber from low-glycemic vegetables and fruit. You want to avoid the carbohydrate-rich cereal fibers because they can persistently elevate insulin levels that lead to fat gain and diabetes. You may want to take supplemental fiber because the body will adapt very quickly to certain fibers, meaning that it's useful to rotate the kind of fiber you take every week or so.

**Principle #12. Ensure you have a healthy gut** – compromised gastrointestinal health leads directly to elevated cortisol and belly fat gain. We recommend taking a probiotic to support gut health and ensure you have adequate stomach acid.

**Principle #13. Drink at least 3 liters of water a day** to stay hydrated and detoxify the body. Hydration is the greatest determinant of strength. A decline of 1.5 percent in water levels will produce a 10 percent drop in your maximal strength. The leaner you are, the worse the effect of dehydration. Make sure you weigh the same or



more at the end of your training session. High water levels equal more sets and reps, which equal greater changes. Here is a formula to determine how much you should drink, including metric measurements:

Drink 0.6-0.7 ounces of water per pound of bodyweight, or drink 39 milliliters per kilogram of bodyweight. Therefore,

- a 200-pound man should drink 120 to 140 ounces.
- a man weighing 91 kilograms should drink 3.55 to 4.14 liters.

**Principle #14. Eliminate alcohol, juice, soda and sports drinks.** Stick to water, tea or coffee. Nutritional status and hydration at the time of drinking will influence recovery, which is one reason that avoiding alcohol intake after competition or hard training is so important. After an all-out competition or training session, if hydration, protein intake or the body's internal antioxidant system is compromised, alcohol will halt recovery until it is fully eliminated from the body.

Now that we've looked at food, the next step is to look at supplements, which will be covered in the next chapter.

# Chapter 19: Supplements



One of the most common questions those in the nutritional supplement industry get asked is, “Why do I need to take supplements – can’t I get all the nutrients I need simply by eating well?” The short answer is “No.” And this is not just our opinion.

Although the fields of functional medicine and traditional medicine clash in many areas, they both agree that nutritional supplements have merit. Take vitamins, for example. In a study published in the June 19, 2002, issue of *The Journal of the American Medical Association*, the authors noted that vitamin deficiencies are associated with many chronic diseases such as coronary heart disease, cancer, and osteoporosis. They also found that “elderly people, vegans, alcohol-dependent individuals and patients with malabsorption are at high risk of inadequate intake or absorption of several vitamins.”

The authors concluded that “it appears prudent for all adults to take vitamin supplements.” It follows that those who eat well would not have to take as powerful a vitamin supplement as those with a poor diet, which begs the question “How many Americans eat well?”

Since 1979, the US government has sponsored a continuing research project called *Healthy People*, which provides goals for the US to improve the health of its population in 10-year increments. According to “Healthy People 2010,” which involved approximately 350 national organizations and 270 state agencies, only three percent of Americans eat at least three servings of vegetables daily and only 28 percent eat two servings of fruit.

Note that we don't take the position that only those with a poor diet need supplements, as this downplays the importance of eating well. Dr. Robert A. Rakowski, a clinical nutritionist and the clinic director of the Natural Medicine Center in Houston, Texas, says, "Taking supplements in the absence of a good diet is still a poor diet with supplements."

Our opinion is that the initial goals regarding nutrition should be to improve our diets and to use supplements to ensure we are receiving the essential nutrients. After that, we can start looking at all the performance and other health benefits of targeted supplementation. These benefits include improving workout recovery, countering the effects of environmental toxins, accelerating fat loss and lowering the risk of coronary heart disease. Going further, here are 10 specific reasons to take supplements.

**Reason #1: Insufficient nutrients in our food.** We can't get all the essential nutrients we need from food alone. Of course, nature intended our food supply to provide us with the nutrients we need – and those nutrients were sufficient in our food of 100 years ago. But our food today is highly processed, genetically modified and prepared in a way that often destroys much of the nutritional content. According to Dr. Rakowski, our farm industry's fertilizers often contain only nitrogen, phosphorus, and potassium: "It takes 17 elements to make a healthy plant, and we only put three back in. So what happens is this malnutrition in the plants becomes malnutrition in the animals and becomes malnutrition in humans."

**Reason #2: Poor digestion.** If our digestive systems functioned optimally, we wouldn't need as many high-quality nutrients in supplement form – but that is not the case. It is estimated that one-half of the US population produces insufficient stomach acid, which diminishes the ability to absorb nutrients from food and can increase inflammation, stomach bacteria and numerous other health issues such as bloating, stomach pain and even depression.

**Reason #3: Poor food preparation.** When you cook food improperly you risk reducing its nutritional value. Also, many foods that are used in fast-food restaurants are highly processed. For example, the processing that converts brown rice into white rice reduces the fiber content by about 75 percent and also reduces nutrients such as iron, niacin, thiamin, folacin, potassium and vitamins E and B6.

**Reason #4: Environmental toxins.** The US Environmental Protection Agency published a report in 2002 that said more than 7.1 billion pounds of 650 different chemicals had been released into the air or water – and 266 of these chemicals are associated with birth defects. For more than years Dr. Mark Schauss, MBA, DB, has extensively studied medical research concerning the effects of toxins on our health. Says Schauss, "In a study by an environmental group on people not working in industry, such as teachers and journalists, the researchers found that the blood of the subjects contained nearly 100 chemicals that did not exist 40 years ago." Fortunately, many of these pollutants can be detoxified by natural supplements such as glycine, vitamin C, selenium, and N-acetylcysteine.

**Reason #5: Obesity.** In a study published in the July 2004 *International Journal of*

*Obesity*, researchers found that when rats are exposed to toxins, their body temperature drops. Schauss says that such hypothermia may be a protective response to reduce the effects of toxins. As for human body temperature, there is a debate within the American Medical Association about redefining the average healthy body temperature, reducing it from 98.6 degrees Fahrenheit to 98.0 degrees. It's not because 98.0 degrees is healthier but because fewer patients coming in for doctor's visits have a temperature of 98.6.

In his book *Victory over a Toxic World*, Schauss says that the chemical load in a toxic person may impair their ability to burn calories by about seven percent. Using the example of someone who normally consumes 2,500 calories a day, the lower metabolic rate would create 47,815 extra calories in one year. "Typically, if you burn 3,500 calories you lose one pound," says Schauss. "Take those 47,815 calories and divide this by 3,500 and you get 13.66 pounds worth of weight gain a year. Do that for 10 years and you have increased your weight by 136.6 pounds, and you are now officially obese."

It's estimated that 50 percent of the population in the US is overweight or obese and at current rates that percentage will increase to 75 percent by 2015. Using supplements for detoxification is one way to combat the growing obesity problem.

**Reason #6: Insomnia and stress.** The National Center for Sleep Disorders Research reports that the symptoms of insomnia affect between 30 and 40 percent of adults, and that 10 to 15 percent of adults say they have chronic insomnia. Insomnia has many adverse effects on our health; for example, a survey of 1.1 million Americans by the American Cancer Society found that those who slept less than six hours per night had significantly higher mortality rates than those who slept approximately seven hours per night.

There are many supplements that can help ensure a good night's sleep. For those who have a hard time falling asleep due to anxiety, phosphatidylserine can lower cortisol, a hormone associated with stress. For those who have trouble staying asleep, magnesium sulfate and vitamin E supplements may help.

**Reason #7: Hormone imbalances.** Although both testosterone and estrogen are present in both males and females, estrogen is considered the female hormone and testosterone the male hormone. A decrease in testosterone makes it difficult for men to gain muscle mass, and an excess of estrogen makes it difficult for both men and women to lose fat once it is acquired. But there are many other hormone imbalances that can affect body fat storage.

BioSignature Modulation teaches that many individuals have stubborn problem areas due to imbalances in their body biochemistry, especially with hormones. During a BioSignature assessment, skinfold measurements are taken in 12 major body fat sites. If the triceps carry a relatively high percentage of fat, this would indicate a problem with androgens; if fat content in the upper-back skinfold is high, there may be a problem with insulin. By identifying which hormones are causing the fat imbalance, a precise supplement protocol can be prescribed to restore the hormone balance so the individual can lose the excess body fat.

**Reason #8: Weight loss programs.** When people cut calories to lose weight, they

also reduce the amount of nutrients they consume and they may become nutrient deficient. Also, as people lose weight, often their protein requirements increase, as the body will start relying on protein as an energy source. Using a protein supplement will enable the dieter to avoid muscle loss, prevent hunger and also stabilize blood glucose. Further, a supplement can provide the extra protein without adding additional calories from carbohydrates or fat.

**Reason #9: Quality of life.** There are many nutrients that can improve our quality of life. One such nutrient is resveratrol (discovered in 1939), which is a compound found in plants that ensure healthy plant development by protecting plants from fungi and bacteria. In humans, the properties of resveratrol include the following: raises metabolism, increases energy, suppresses appetite, stabilizes blood sugar, accelerates the breakdown of fat stores, improves insulin sensitivity and carbohydrate metabolism, reduces inflammation, increases muscle mass, suppresses estrogen and protects the stomach lining.

Among the most common sources of resveratrol are red grapes, peanuts, pistachios, blueberries, cranberries, huckleberries, raspberries, lingonberries and mulberries; it can also be found in dark chocolate. However, it is difficult to get the dosages of resveratrol you would need from food or wine – in fact, you would need to consume at least 1,000 bottles of red wine a day to duplicate the dosages given to mice in some resveratrol studies. A resveratrol supplement would be the only practical alternative.

**Reason #10: Athletic performance.** Supplements help athletes achieve physical superiority over their competitors. Particularly valuable are the amino acids leucine, isoleucine, and valine, which are collectively known as branched chained amino acids (BCAAs). Unlike other amino acids, BCAAs are used as a form of energy by muscle cells and can be used during training to increase the quality of the workout. BCAAs have numerous other benefits for athletes, including modifying hormone profiles to increase muscle mass and strength while reducing body fat. BCAAs also can help reduce post-workout muscle soreness.

There you have it: 10 good reasons we need to take supplements. Now on to the next discussion: peri-workout nutrition.

## **The Science of Peri-Workout Nutrition**

In the early days of muscle building, bodybuilders and others using weight training to build mass were primarily concerned with what supplements they took after a workout. Often many took none, believing that just a protein shake would suffice. That may have been better than nothing, but to achieve the best results from hard workouts, trainees should consider the concept of peri-workout nutrition, which is a term that describes what nutrients you consume before, during and after a workout.

### **Before Training**

A pre-workout supplement should contain specific nutrients to prepare your body's biochemistry for the demands of intense training. This formula will improve and sustain energy, decrease oxidative stress, improve focus, increase hydration and electrolyte

balance, maintain proper pH levels and provide essential micronutrients. Let's take a closer look at these nutrients.

**Electrolytes.** Electrolytes are salts that when dissolved in water split into molecules called ions. The most common electrolyte in your body is sodium chloride, or table salt. Ions allow electrical impulses to travel throughout the body. Among many other functions, these electrical impulses enable your muscles to contract; in fact, if your diet did not contain electrolytes, your heart would stop.

Sodium is an electrolyte that controls how much water is present outside the cells, whereas potassium is an electrolyte that controls how much water is present inside the cells. Of course, water is necessary for hydration to occur, but if the electrolyte concentrations are not balanced the water you consume may be quickly excreted out of the body.

There are many commercial sports drinks that contain electrolytes. Unfortunately, the most popular ones also contain a high amount of calories, often in the form of high fructose corn syrup, and chemical additives that leave the body dehydrated and metabolically imbalanced. Decreased gastric emptying associated with high-intensity exercise can be further reduced by the consumption of these hypertonic carbohydrate beverages, leading to a host of metabolic problems.

**Magnesium.** Magnesium is the fourth most abundant mineral found in the body and is involved in hundreds of biochemical reactions that dictate optimal metabolic function, including energy production, cardiovascular regulation, and exercise performance. Approximately 66 percent of magnesium is found in bone, with 33 percent in skeletal and cardiac muscle. Research reports that the content of magnesium in our foods has significantly decreased over the past few decades, and approximately 75 percent of Americans are deficient in this essential mineral. For these reasons, dietary supplementation with magnesium should positively influence athletic performance.

**Adenosine triphosphate and D-Ribose.** Adenosine triphosphate (ATP) is the primary source of energy for the cells. The amount of ATP stored in the muscle that is available for immediate use during exercise is extremely limited. However, D-Ribose is a simple sugar that helps replenish ATP stores and serves as the biochemical backbone for RNA (ribonucleic acid), which is essential for genetic transcription. The availability of ribose in the muscle is a limiting factor for the rate of ATP resynthesis. Studies have reported benefits to performance when using ribose supplementation.

**Tyrosine.** Increased brain dopamine availability appears to be a major factor in prolonged exercise tolerance in the heat. Tyrosine is an amino acid made from phenylalanine. Tyrosine supports catecholamine synthesis (dopamine, epinephrine, norepinephrine) and also helps regulate thyroid hormones that are essential for metabolic and thermal regulation. Oral L-tyrosine administration is also reported to be associated with increased constant-load, submaximal exercise capacity in the heat.

**Creatine.** Creatine is stored primarily in skeletal muscle and is converted to phosphocreatine, which is used to create ATP and thus energy for high-intensity muscle contraction. Chronic supplementation with creatine monohydrate has been shown to

promote increases in total intramuscular creatine, phosphocreatine, skeletal muscle mass, lean body mass and muscle fiber size.

Creatine can also act as an antioxidant, which was demonstrated by a decrease in oxidative stress markers in a study of creatine use in resistance exercise. Supplementation with a magnesium-creatine chelate has demonstrated improved performance, body mass, peak power, and intracellular water, with less muscle soreness, compared to creatine monohydrate and placebo.

**L-carnitine.** The amino acid L-carnitine has many functions, including supporting heart function, fat metabolism, energy production, neurotransmitter activity, and pH regulation/intracellular acidosis.

**Pantothenic acid.** Pantothenic acid (Vitamin B2) has been reported to reduce blood lactate concentration.

**Vitamin C.** Exercise leads to the production of reactive oxygen species (ROS) via several sources in the skeletal muscle. During exercise, the mitochondrial electron transport chain in the muscle cells produces ROS, along with an elevation in oxygen consumption, leading to increased oxidative stress on proteins and their functional ability. Vitamin C supplementation in athletes has been shown to reduce blood markers of oxidative stress and protect proteins from oxidative damage.

**Choline.** Choline plays a major role in many physiological and biochemical pathways, including neurotransmitter synthesis (acetylcholine), cell-membrane signaling (phospholipids), lipid transport (lipoproteins), and in improving methylation reactions (reduction of homocysteine). Strenuous and prolonged exercise can lead to stress on several of these metabolic pathways, increasing the need for choline.

## **During Training**

Before a workout or athletic event, you want to consume substances to increase your focus and energy level. As you train or compete, however, you want a product that will sustain your energy level and electrolyte balance. As such, the first ingredient in an intra workout drink should be electrolytes. Now let's look at energy.

**BCAAs.** Protein is broken down into organic compounds called amino acids. A protein is considered *complete* when it has the appropriate quantities of amino acids for optimal absorption.

Leucine, isoleucine and valine are essential amino acids that belong to what is known as branch chain amino acids (BCAAs). In contrast to other amino acids that are broken down by the liver, BCAAs can be broken down by the muscles and be used as an immediate energy source to help prevent fatigue. For athletes who are trying to build muscle, these amino acids are especially important because they compose about one-third of the body's skeletal muscle. Research shows that BCAAs can also help build muscle and strength.

In an Italian study involving natural bodybuilders, researchers found that taking 0.2 grams of BCAAs per 2.2 pounds (1 kilo) of bodyweight 30 minutes before workouts and 30

minutes after workouts resulted in greater increases in lean body mass and strength in the bench press and squat.

BCAAs have been shown to reduce muscle soreness in both trained and untrained individuals, prolong endurance performance in the heat, and help maintain mental functioning during training and competition. For football players, BCAAs would be especially valuable during two-a-days. Likewise, athletes who practice for exceptionally long periods, such as gymnasts whose workouts might last as long as five hours in a single day, could improve the overall quality of their training with BCAAs.

**Beta alanine.** Beta alanine is a nonessential amino that helps athletes gain strength, increase muscle mass, and lose bodyfat. Let's look at some research.

A study on beta alanine published in the July 2011 issue of the *Journal of Strength and Conditioning Research* involved 22 collegiate wrestlers and 15 collegiate football players. These sports require high levels of anaerobic power as they are characterized by having bouts of high-intensity (75-100 percent effort) with short (5-45 seconds) rest periods. The study lasted eight weeks, and the time period was the early season for the wrestlers and the in-season for the football players.

It's important to consider that this type of study is known as "double-blind, placebo-controlled." More specifically, approximately half of the wrestlers and half of the football players were given a beta alanine supplement while the others were given a placebo. The results were remarkable.

For the wrestlers, those taking beta alanine increased their lean mass by an average of 1.1 pounds whereas the control group *lost* lean mass. For the football players, the beta alanine group gained an average of 2.1 pounds of lean mass to an average of 1.1 pounds for the control. Further, the beta alanine group experienced no changes in the bodyfat levels whereas the control group gained an average of .8 percent bodyfat.

## **After Training**

Although protein powders may seem like a relatively new athletic performance product, its beginnings can be traced to the Mongols and their powerful leader Genghis Kahn. The Mongols would evaporate milk by allowing it to dry in the sun, and would reportedly take the chalklike substance with them on long journeys of conquest. This powder was a great idea because milk contains protein, and protein helps to build and maintain muscle. Protein powders have evolved considerably since then.

In 1802 Russian doctor Osip Krichevsky introduced an efficient process for producing dried milk. Today powdered milk is usually created by a process known as spray drying, which involves rapidly drying milk with hot gas. It is a process that is used for many other types of foods and also pharmaceuticals. With powdered milk there is little risk of bacterial contamination because of the lack of moisture, and as such the bacteria will not have an environment to grow. This means they can be stored without refrigeration.

A major advantage of protein powders is that they are convenient. In a world where everyone is overwhelmed with a busy life, it often becomes difficult to find the time to



prepare high-protein meals of fish, lean meats, and eggs. Just mix the powder with water, juice or milk, and you're good to go. Also, it gives precise control over your nutrition. If you just want protein and minimal amounts of fat or carbohydrates, a protein powder is the answer.

The biggest boost to protein powders came from bodybuilders seeking an effective way to increase their protein intake without consuming large amounts of food. The most popular type of protein today is whey, which is made from milk. Whey protein is water-soluble and as such is quickly digested in the body and less likely to cause digestive issues. Another type of protein powder made from milk is called casein, but it is much harder to digest and with many individuals can cause gas, bloating and even diarrhea. This is one reason the popular recommendation of drinking chocolate milk as a post-workout drink is not a good idea for many athletes.

How much protein does an athlete need? The Institute of Medicine recommends a minimum protein intake of 0.85 grams of protein per kilogram (2.2 pounds) of bodyweight for those who exercise. That's conservative, especially if an athlete is trying to lose fat while building muscle. A review published in 2011 in the *Journal of Sports Sciences* found that protein consumption as high as 2 grams per 2.2 pounds (1 kilo) of bodyweight may be necessary "...in preventing lean mass losses during periods of energy restriction to promote fat loss." A three-ounce steak has about 21 grams of protein and an egg about six grams. It can be difficult for many athletes to consume enough protein from food, which is why supplementing with a protein drink is a good idea.

Having a protein drink is a good first step to sound sports nutrition, but for optimal recovery, a post-workout drink needs more than just protein. It also needs carbs.

When you train, your muscles use a stored form of carbohydrates called glycogen for energy. The best type of carbohydrate post-workout is dextrose because it is rapidly digested, making it ideal for replenishing glycogen. Using fructose in a post-workout formula is not only less effective but also is often associated with digestive issues such as belching and flatulence.

Taking a post-workout recovery formula to the next level is to add specific vitamins and minerals, as these substances can be depleted during exercise. For example, a study published in January 1976 in *Annals of Nutrition and Metabolism* found that vitamin B2 is an antioxidant that may improve neuromuscular function and recovery.

Another important substance to look for in a post-workout recovery formula is glutamine, an amino acid that is depleted during exercise – in fact, 60 percent of the body's glutamine is stored in skeletal muscle. Glutamine is especially popular in post-workout formula because it helps protect GI integrity, among its many other functions.

Certainly many great athletes became great without ever consuming protein powders or post-workout formulas, but this is more of a case of achieving success despite mediocre nutritional practices rather than because of it. If you're looking for an edge, follow the lead of Genghis Kahn and take a closer look at sports nutrition.

# Glossary

**Abadjiev, Ivan:** former head coach of the Bulgarian National Weightlifting Team whose training methods revolutionized the sport

**Active release technique:** a soft-tissue treatment created by Dr. Michael Leahy

**Agonists and Antagonists:** the agonist is the muscle that causes the primary movement; the opposing muscle, the antagonist, is relaxed during this movement

**Alexeev, Vasily:** a Russian weightlifter who broke 80 world records and was the first man to clean and jerk 500 pounds

**Concentric Contraction:** the type of contraction in which a muscle shortens, such as when an individual curls a barbell to the shoulders; if X is used in the formula, it implies explosive action with full acceleration

**Cortisol:** a hormone produced by the adrenal glands

**Critical drop-off point:** the point at which an individual experiences a 5-7 percent drop in performance; at this time, the person should move to another exercise or body part

**Cross-sensitization:** the total effects of following a program that is more than an individual's combined systems can handle; effects include exhaustion and impaired recovery

**Cross-training:** the concept that because individual sports each focus on certain muscles more than on others, an athlete can achieve balanced muscle development and thereby help avoid injuries

**Circuit training:** a training system introduced in 1953 by physiologists at the University of Leeds in England to describe a system of integrating several components of fitness into a single workout

**Danney, Ian:** a 180-pound bobsledder who could front squat 418 pounds for 2 reps and who is now one of the most sought-after pro football strength coaches in the US

**Descending Sets:** a training method in which virtually no rest time is taken between weight changes

**Draper, Dave:** famous 1970s bodybuilder, known as the Blond Bomber, who appeared on television and in films

**Eccentric Contraction:** the type of contraction in which a muscle lengthens

**Eder, Marvin:** a bodybuilder with exceptional upper body strength who placed third in the 1951 AAU Mr. America

**Functional isometric Contraction:** a term coined from the combination of isometrics and isotonicity

**German Body Comp program:** a workout system characterized by short rest intervals and multijoint movements to generate maximum growth-hormone production

**German Volume Training:** a workout that produces results from prolonged muscle tension instead of high levels of muscle tension

**Giant Set:** three exercises for the same muscle group performed in sequence

**Gironda, Vince:** a bodybuilding trainer who was nicknamed “Trainer to the Stars” because his clientele included many Hollywood celebrities; Gironda also trained Mr. Olympia Larry Scott

**Hackenschmidt, Georg Karl Julius:** a Russian wrestler born in 1878 in Estonia known for his physical conditioning

**Insomnia:** a general term describing the inability to sleep well

**Isokinetic Equipment:** exercise equipment that allows an individual to train at a specific speed

**Isometric Pause:** the isometric pause that usually occurs between the eccentric (lowering) phase and the concentric (lifting) phase of a repetition, such as when a barbell makes contact with the chest during the bench press

**Kaizen Principle:** an approach that advocates “constant and never-ending improvement” (from the Japanese word Kaizen)

**Klein, Karl K.:** outspoken critic of the squat who suggested that squats decrease knee stability, thus increasing the risk of injury to the joint

**Magnesium:** the fourth-most abundant mineral in the body; approximately 66 percent of magnesium is found in bone and 33 percent in skeletal and cardiac muscle; it is involved in 300 essential biochemical reactions in the body

**Medial Hamstrings:** the semitendinosus and semimembranosus

**Milo of Croton:** a Greek wrestler who purportedly built his tremendous strength and physique by carrying a calf every day until it was a full-grown bull

**Neural-Metabolic Continuum:** a graph showing the influence of muscle tension on the nervous system

**Olympic-style weightlifting:** competition that consists of the snatch and the clean and jerk; also known simply as weightlifting

**Overload principle:** the concept that a muscle will get bigger or stronger only if overload is applied to it

**Park, Reg:** a former competitive bodybuilder who was the first bodybuilder to bench press 500 pounds

**Peri-Workout Nutrition:** supplements taken immediately before, during and after a

workout

**Platz, Tom:** former Mr. Olympia competitor known for his remarkable leg development

**Plukfelder, Michael Rudolf:** a Russian weightlifting coach who trained Olympic weightlifting champions Vasily Alexeev and David Rigert

**Post-Exhaustion Superset:** type of superset in which an individual first performs a compound exercise and then follows it with an isolation exercise that taps into the same motor pool of the muscle receiving the focus

**Pre-Exhaustion Superset:** a muscle is first fatigued by a single-joint exercise and then further exhausted by performing a multijoint exercise involving the same muscle group and additional muscle groups

**Principle of Individualization:** the concept that the number of sets in a workout should be individualized because each individual has a unique response to a given program

**Rambie, Bala:** Romanian exercise scientist who defected to West Germany and who discovered that the lactic acid pathway is better for fat loss than the commonly accepted aerobic pathway

**Reeves, Steve:** AAU Mr. America in 1947, 1950 Mr. Universe, film actor in Hercules films

**Rep:** a complete movement of an exercise, from start to finish

**Relative Strength:** ratio of strength to muscle mass

**Repetition Maximum:** the weight that can be lifted in an exercise for a single repetition; also known as 1Rm

**Rigert, David:** a Russian weightlifter who set his first world record in 1971 and went on to break 68 world records and win an olympic gold medal

**Set:** a single series of reps

**Sheiko, Boris Ivanovich:** an accomplished Russian powerlifting coach who promotes a high-volume training system

**Speed of Contraction:** rate of movement of the implement or limb involved in any given strength exercise; it is described or measured scientifically in terms of degrees per second

**Stabilizers and Fixators:** terms that describe the function of muscles when they are used to anchor a body part so that the prime movers have a stable base to pull or push from

**Strength Curve:** the natural strength curve is the amount of force a muscle can exert at specific angles

**Subcutaneous Fat:** a type of fat located just below the outermost layer of skin; subcutaneous fat levels are tested with calipers or by pinching between the fingers

**Supercompensation Effect:** the body's response to stress in which a decrease in an individual's fitness preparedness is followed by a resistance phase that results in the body adapting to a higher fitness state

**Superset:** a pairing of two different exercises for different muscle groups performed in sequence; pairing agonist and antagonist muscle groups is the most common form of superset

**Tempo:** total amount of time it takes to complete an entire repetition

**Tempo Prescription:** a four-digit abbreviation that describes the four types of muscular contractions during a repetition, such as 4210

**Time Under Tension (tut):** the time it takes for a contracted muscle or muscle group to complete a set

**Training Frequency:** the number of training sessions performed per week

**Training Volume:** the total number of repetitions completed in a given time frame

**2 Percent Rule:** a training approach in which an individual trains hard but comes back for another workout only when the load can be increased by at least 2 percent

**Viator, Casey:** a teenager who worked with Nautilus inventor Arthur Jones and in 1971 became the youngest person ever to win the prestigious amateur competition AAU Mr. America

**Visceral Fat:** a type of fat that sits deep behind the abdominal wall and surrounds the organs within the peritoneal cavity

**Wave Loading:** a training method in which an individual works up to a maximum weight for a specific number of reps, backs down in weight for one or more sets, and then works up to even heavier weights

**Weil, Rick:** former world record holder in the bench press who recommended one session per week per muscle group

**Yorton, Chet:** a bodybuilder who was known for his symmetrical physique and defeated Arnold Schwarzenegger in the 1966 NABBA Amateur Mr. Universe

# Free Workouts

## POLIQUIN<sup>®</sup> PRINCIPLES

### Isometric Holds

This workout adds isometric holds at the bottom and top contracted positions. Holds at the bottom reduce elastic energy, causing the muscles to work harder. A pause at the contracted position increases the time the muscles are under tension units.

This program uses Vitruviant™ workout software. It consists of a total of 12 training sessions, divided into four workout cycles (Upper, Arms, Lower) that repeat. Here are two ways to design your workouts:

- 1. Lower, 2, 2 Days off. Repeat.
- 2. Upper, 2, 2 Days Off. Repeat.

## POLIQUIN<sup>®</sup> PRINCIPLES

### Drop Sets

You can only hypertrophy the motor units you can recruit. By performing sets of 4-6 reps, you stimulate the central nervous system, increase motor unit recruitment, and improve intra/intra-muscular coordination, which you then fatigue with the drop sets. Drop sets are introduced with last exercises. If introduced with first exercise series, muscles would become too acidic, affect the rest of the workout. Drop sets produce greater micro trauma and increase the amount of time the muscles are under tension.

This program uses Vitruviant™ workout software. It consists of a total of 12 training sessions, divided into three workout cycles (Upper, Arms, Lower) that repeat. Here are two ways to design your workouts:

- 1. Arms, Lower, Off, Upper, 2 Days Off. Repeat.
- 2. Lower, Arms, Off, Upper, 2 Days Off. Repeat.

  
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The complete strength training system

## POLIQUIN<sup>®</sup> PRINCIPLES

### Post Fatigue

This workout continues exposing muscles to a greater volume of work. One way is by first stressing the muscles with a compound exercise and then continue working with an isolation exercise. Another is to make the second exercise one with a more favorable mechanical advantage positioning to continue fatiguing the muscles.

This program uses Vitruviant™ workout software. It consists of a total of 12 training sessions, divided into three workout cycles (Upper, Arms, Lower) that repeat. Here are two ways to design your workouts:

- 1. Arms, Lower, Off, Upper, 2 Days Off. Repeat.
- 2. Lower, Arms, Off, Upper, 2 Days Off. Repeat.

  
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