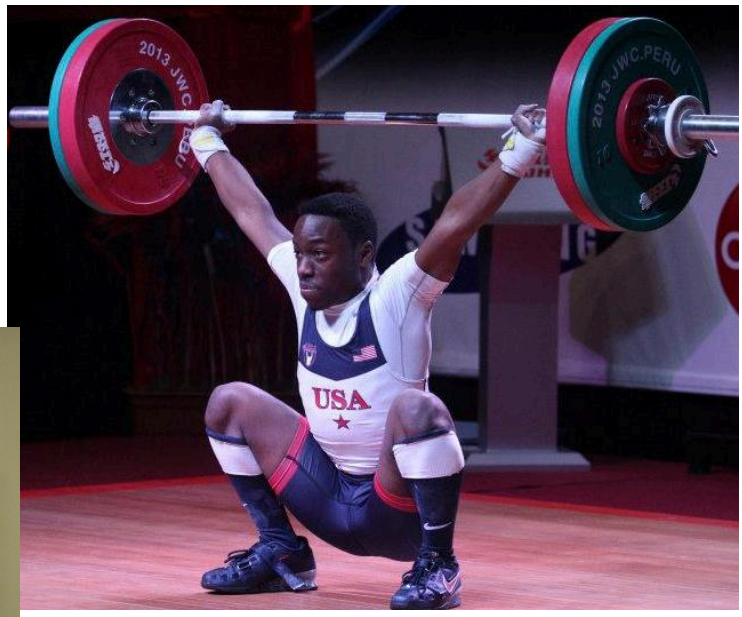
USA Weightlifting

Coaching Accreditation Course

Advanced Sports Performance Coach Manual

The National Governing Body for Weightlifting in the United States



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Photographs by: Tara Nott- Sydney 2000 Olympic Gold Medallist and Bruce Klemens unless otherwise noted

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Introduction

Welcome to the second formalized education course within USA Weightlifting's Coaching Education curriculum. The course accommodates the needs of coaches who have already qualified as Club Coaches. The facilitation of this course is over four days and may take place at USAW Headquarters, the Olympic Training Center in Colorado Springs or at a club location. Weightlifting clubs may have the option to facilitate the course over two weekends within a given period.

The objectives of the course are for coaches who would like to increase their knowledge base toward specific training for weightlifting athletes. The information will be more specific and geared toward training weightlifting athletes to higher levels of competition. More emphasis is on programming of training and preparing athletes to compete on the national platform. A more comprehensive biomechanics chapter is included and a number of new topics are introduced such as anatomy, physiology, kinesiology, nutrition, strength and power principles and general physical preparation.

USA Weightlifting sincerely appreciates your dedication to the sport of weightlifting and your desire to continue to advance your knowledge in our sport through our education system. We hope you find this experience refreshing and that it will compliment your current understanding of weightlifting and perhaps elicit your desires to seek current literature and research in this ever-growing field. We encourage you to be active throughout the course by asking questions and sharing your philosophies with the rest of your classmates. By doing this, we hope to provoke stimulating, and perhaps controversial conversations however, candidates can learn valuable information through these types of conversations. Once again, thank you for participating in this course and good luck!

Mike Gattone
Director of Coaching Education

USA Weightlifting Advanced Sports Performance Coach Course

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Acknowledgments

This manual is the result of a great deal of research and wonderful contributions from many individuals, all experts in their fields. Without their assistance, the contents of this manual would be average, at best. We would like to thank all those involved especially:

Dr. Mike Stone, Head of Physiology of the United States Olympic Committee, was extremely helpful in providing us with a plethora of information on the scientific basis for this type of training, much of which is the result of his own work.

Frank Eksten, Chair of the Coaching Committee, whose expertise and advice in the area of coaching proved to be invaluable.

We would also like to extend our thanks to the myriad of coaches who have taken this course in the past and used its contents to assist their lifters to become our future champions. Without the efforts of our volunteer coaches the mission of USA Weightlifting would be futile.

Chapter 1

Principles of Coaching

People who are attracted to, and find satisfaction from coaching weightlifting come from many areas. There are those who take the traditional pathway from competition. These individuals typically have a long background in the sport, and gravitate to coaching when their competitive careers have come to or are ending. In many cases, these coaches never achieved the levels as a competitor that they strived for, but find true fulfillment in helping others to maximize their talents. However, other pathways bring people to coaching weightlifting. Some just enjoy the sport and others involved in it. Still others are attracted to weightlifting because they may have applied the weightlifting movements to their own training to improve performance in another sport. These are just a few examples of the different personalities attracted to weightlifting.

Coaching Skills

Most successful coaches have developed a love and commitment to the sport that in weightlifting, almost borders on obsession. The deep commitment is evident in all of our successful coaches and is something easily recognized and appreciated by weightlifters. Individuals who become involved in coaching, no matter what the sport, find themselves in the "people business." In order to be effective, coaches must create the right conditions for learning to happen and to find ways of motivating the athletes. Most elite-level athletes are highly motivated and therefore the task is to maintain that motivation and generate excitement and enthusiasm. Therefore, coaches must develop or have available a plethora of skills to meet the needs of the athletes who they aspire to service. These include:

- Knowing how to effectively communicate with the athletes
- Understanding the learning process and training principles
- Understanding and implementing the appropriate training methods
- Understand the various coaching styles
- Advise athletes on safety
- Understand the causes and recognize the symptoms of over-reaching and over-training
- Understand how to reduce the chance of injury for your athletes
- Understand individual differences between athletes
- Assist athletes to develop new skills
- Use evaluation testing to monitor training progress and injury prevention
- Advise athletes on appropriate nutritional regimen
- Understand and know how to develop the appropriate energy system
- Effectively communicate competition performance

Coaching Roles

Not only do coaches have to develop skills, they also have to play many roles. These roles include being a:

- Leader
- Educator
- Facilitator
- Technician
- Organizer
- Manager
- Guide
- Philosopher
- Friend
- Arbitrator
- Critic
- Taskmaster

The myriad roles of a coach are demanding by the various circumstances in which coaches find themselves. The experience and age of the individual, both coach and lifter has a bearing on this rule. The goals of the coach and lifter can also dramatically alter the role the coach might take. Therefore, communication between the coach and lifter is paramount. The first thing the coach should determine is the goals of the lifter. What is he or she trying to accomplish? If the lifer's objective is to be a "social" lifter with enjoyment being the primary criteria, the coach will need to adopt a very different role than if the lifter's goal is to become and accomplished Olympic weightlifter. Likewise, if the lifter wants to use the weightlifting movements to become a better football player, the coach will need to implement yet another role.

Once the coach determines the goals and expectations of the lifter, he must ask himself "Are these expectations realistic?" If so, "Is the timeframe realistic?" From here, the coach develops a realistic plan to try to accomplish the goals and expectations. One other aspect the coach must realize is his own ability as a coach. An objective, self-evaluation of his abilities is vital. If the athlete expects to make it to the highest level as an athlete, the coach must reassure himself he is doing everything in his abilities to get the athlete there.

However, as crucial as role-playing is to the achievement of objectives with individuals; ultimately, the coach's own personality will have an enormous bearing, and maybe the ultimate bearing, on a lifter's success. The coach will find roles that he plays easily, others that he plays well for limited periods of time and some that turn out to be a total disaster. An example may be the coach who is incredibly effective with young lifters. This coach has a tremendous rapport with kids and can teach and develop skills and engender an excellent, secure and supportive club program. However, when some of his lifters progress, mature, and develop into perhaps national or international class lifters,

demanding a greater time commitment and individualized attention, the coach can find he is ineffective.

Coach/Athlete Training Roles

Over time, the roles of the athlete and coach will change dramatically. Athletes will mature physically, mentally, emotionally and psychologically in the years spent with the coach. Equally, coaches will develop and refine their roles and skills in the time spent with numerous athletes. Further, training requirements for the athlete will change over time as he progresses from the beginner to elite.

When the athlete first begins weightlifting, the coach's role is to direct the athlete in all aspects of training. The coach must guide and teach the athlete in numerous phases. These phases include not only training but in recovery, nutrition and injury prevention to name a few. Relaying these ideals to the athlete early in the training process is crucial to prevent unfavorable habits, which may limit performance in the future.

As the athlete develops and demonstrates a sound, technical understanding of the various weightlifting movements, then gradually, the coach's role changes. The change shifts from an autocratic role to a more democratic role where there is more communication between the coach and athlete. In some cases, the athlete will have more input on the workouts based on recovery, health, personal issues and various training methods.

Eventually, as the athlete matures, many will have a better understanding of training principles and methods. Different training methods will work better than others will and the athlete should communicate this to the coach. This communication process will enable the athlete and coach alike to reach their full potential.

Is Coaching an Art or a Science?

To support the coach, there is enormous scientific literature based on specific research conducted with athletes. This information is available to support the coach and athlete in all areas of training and development including nutrition, biomechanics, psychology, physiology and sports medicine. The coach however, must have access and the desire to use this information.

The art of coaching comes when the coach has to analyze the scientific data and convert it into coaching and training programs to help develop the athlete. Much of this analytical process depends on the coach's experience and knowledge of weightlifting and the athlete(s) he is working with. Scientific information is useless unless the coach understands and is willing to implement the data.

By understanding science, which is the foundation of training, the coach can develop a well-designed training program that will help an athlete reach his full potential. The art is to understand the research and then to apply it in a way that will help the athlete reach full potential.

The Four C's:

Concentration, confidence, control and commitment are generally considered the main mental qualities that are important for positive and successful performance in most sports.

- Concentration- the ability to maintain focus
- Confidence- the belief in one's abilities
- Control- the ability to maintain emotional control regardless of distraction
- Commitment- the ability to continue working toward agreed goals

Concentration

This can be defined as the ability to focus on the task at hand. A lack of concentration by the athlete will affect the athlete's ability to complete the lifting movements as efficiently as possible. In weightlifting, the athlete must possess the ability for intense concentration. Since most weightlifting movements, especially the competition lifts, are completed in a short period, the athlete must be able to have complete focus for that duration. However, the coach should be aware that distractions do exist, sometimes without his knowledge. Some common distractions are:

- Anxiety
- Fatigue
- Technique issues
- Family
- Opponent
- Negative thoughts

Strategies to improve concentration are individual but the coach can lend support on a majority of issues. One example is to set goals for each workout. The athlete should know and understand what the expectations of the coach are for that day. A second example is mental preparation. The athlete should begin to prepare for the workout prior to it not at the beginning of it. A final example is relaxation. The lifter should do as little as possible physically prior to the workout. This will give the athlete the best chance for achieving set goals in the workout. Hopefully, these examples will assist athletes in improving concentration.

Confidence

Confidence results from the comparison athletes make between their goals and their abilities. Typically, if athletes achieve their goals, the results are increased self-confidence and self-esteem. Usually, confident athletes tend to persevere even in extremely challenging situations. They have the ability to adapt, overcome, and still try to accomplish what they have set out to do. In addition, if athletes do not reach their goal they are willing to accept or share in the responsibility of failure.

Control
Athletics, especially at elite levels, can take an enormous toll on an athlete emotionally. An athlete's ability to maintain control of their emotions in the face of adversity and remain positive is essential for successful performance. The coach can have a massive influence on the athlete in certain stressful situations. If the coach can identify when an athlete feels a particular emotion and understand the reason for the feelings, he may be able to help the athlete gain composure and confidence. Two emotions, which are often associated with poor performance, are anxiety and anger.

Anxiety can be physical (butterflies, sweating, nausea) or mental (worry, negative thoughts, lack of concentration). Relaxation, mental imagery and input from the coach may help to alleviate these symptoms. When an athlete becomes angry, the source of anger often becomes the focus of attention. This then leads to lack of concentration, which may lead to poor performance. Many times if an athlete has a poor result in the snatch this has a direct correlation with how well the athlete will clean & jerk. Athletes will think about their poor performance and this causes a poor result in the jerk. The coach must do his best to calm the athlete down and to refocus his thoughts to the next lift.

Commitment
Athletes, as well as coaches, spend an enormous amount of time training and preparing to train. Much of what coaches do, especially in the sport of weightlifting, is on a volunteer basis. Because both coaches and athletes have other obligations, it is imperative the time spent training is efficient. It is the coach's responsibility to keep the athlete interested and to make continual progress. It is the athlete's responsibility to follow the training regime and to communicate with the coach regarding any important issues. Hopefully, when both make a deep commitment the fruits of their labor will be rewarded!

Legal Responsibilities of the Coach

A weightlifting coach is required to comply with USA Weightlifting's code of ethics and conduct. With increased issues of liability and inappropriate behavior by coaches who take advantage of their relationship with athletes, it is crucial all coaches follow the sport's legal requirements. The influence a coach has on his lifters can be enormous, especially when they are maturing and impressionable. The coach has to reflect on his philosophies not only in weightlifting but also on many other aspects of life, as his athletes will often use him as a role model. The coach is a standard setter, a point of reference by which young lifters meet on a regular basis. The coach should not take this responsibility lightly. In addition, coaches also have a legal responsibility to:

- Give appropriate advice and guidance
- Not offer advice beyond their level of qualification

Health and Safety
When athletes walk into the gym, they are now under the guidance and supervision of the coach. When athletes first begin training the coach should go over the rules and regulations of the weight room. USA Weightlifting also recommends that coaches review

chapter one of the Club Coach Manual periodically and know the first aid and emergency evacuation procedures of their facilities. Although the chances of serious injury are remote, one can never predict when a serious injury or event may occur.

Protection from Abuse
Coaches also have the responsibility to protect children from all forms of abuse. Four recognized forms of abuse are:

- Neglect
- Emotional abuse
- Sexual abuse
- Physical abuse

Coaches should be able to recognize indicators, which may signify abuse and take appropriate action if concerned. Coaches must also recognize these signs to prevent them from becoming abusive. All organizations (e.g. sports governing bodies, local authorities, clubs) should have a policy statement and guidelines regarding child abuse. Please contact the National Office for USA Weightlifting's Code of Conduct and Ethics forms.

Insurance
To be covered by USA Weightlifting's insurance and liability policy, all coaches must be current USAW members, certified and their club must be registered with the National Office. Due to frequent policy changes, coaches are encouraged to call the National Office for the most recent policy procedures.

Supplements
Coaches have an ethical and legal responsibility to advise, educate and provide general information to their athletes regarding supplement use and abuse and on general nutrition. USA Weightlifting encourages athletes and coaches to become familiar with the United States Anti Doping Agency's (USADA) policies, procedures and banned substance list. Failure to do so may lead to a positive test and athlete suspension. Chapter five of this manual will discuss in detail nutrition and daily regimen.

Coaching Styles

Since coaches are in a leadership role for the majority of the time, then the accepted research on leadership theory can be incorporated into considerations on coaching. Tutko and Richards (1971) have identified five coaching types and have outlined the advantages and disadvantages of each about handling a team, a squad of athletes or individuals. While it would be foolish to suggest that, all coaches will fit into one or the other of the categories, a review of the three predominant types will serve to illustrate the situation.

Authoritarian
This is the stereotype often associated with sports coaching by the public at large. It is probably the most common coaching "type" particularly among team sports like football, characterized by intense energy, emphasis on discipline and aggression. The coach often lacks composure in the "do or die" situation, but is able to win admiration and respect

from athletes for an almost fanatical devotion to his sport. This type of coach is well organized. He plans thoroughly and demands attention to detail by all athletes. The coach is stern with athletes and fellow coaches when his rules are broken or not followed.

Advantages:

- An atmosphere of discipline is conducive to success
- High level of dedication and purpose

Disadvantages:

- The team can be prone to dissension when they suffer a series of losses
- When firm convictions and confidence are shattered, it is difficult to rebound with the same degree of enthusiasm and desire
- Sensitive, introspective athletes are "turned off" by the critical authoritarian approach and usually seek and alternate coach

Personable or "Nice Guy" Approach

This coach is personable and well liked by all team members, flexible, creative in approach and deeply concerned about the welfare of all team members as individuals. Players feel at ease with this type of coach and appreciate his generous compliments when things go well or his tactful criticism when things go poorly.

Advantages:

- An atmosphere of respect and mutual good feeling encourages team cohesion and a positive training environment
- Competitions and training often produce above average results
- Athletes typically enjoy training
- Defeat never seems irreparable

Disadvantages:

- Sometimes the flexibility and openness to suggestion of the coach will appear to be a weakness, particularly if a team or individual is not training or competing well
- While this type of coach probably best handles difficult athletes, some will take advantage of his good nature
- Difficult for the athlete to justify a poor training cycle

Casual

This coach can be characterized as "easy going." This coach is relaxed, passive and detached about involvement. He gives an impression of no real commitment to the team or individuals. He is not well prepared or organized and usually coaches "off-the-cuff." Many view him as a consultant-type coach.

Advantages:

- Athletes develop a sense of independence in training
- There is a relaxed atmosphere with no real pressures on the group to perform
- Motivation and drive must come from the athlete

Disadvantages:

- Coaching is often inadequate for the serious participant
- There is often no overall development plan
- Fitness levels are below average
- Novice lifters are unsure of what to do and have difficulty with direction

In Summary

Management theory has used similar models and research to show that the styles can be effective in various circumstances. Many athletes dislike the authoritarian and can produce an aggressive reaction. The casual coach can be effective with creative and strong willed athletes who just need guidance and really want to train. The personable style appears to be the better over a long training cycle and is a well liked and tolerated style.

Obviously, there are advantages for each type of coach and again, quite obviously, some sports would seem to attract one type than another. Team sports with management problems attract the authoritarian coach who would argue that he does not have time in crises to use democratic methods of decision-making.

The individual sports usually attract the personable coach for they encourage one on one situations. The elite performer, regardless of age or sport, probably needs this type of coach to help him develop his talent within an organized, scientifically based training program.

However, it should be noted that coaching styles can be varied somewhat to accommodate the situation and individual athletes. Regardless of coaching style, the coach should remember that he is a service profession. Often, athletes determine the role they should take, and the coach should be sensitive to the individual needs of the athletes. In keeping with this point, it should be understood that while each coaching style will be more effective with certain athletes, all coaches can be effective with every athlete to the same degree though insight and thoughtful consideration. However, the most effective coaches are a combination of all types and can adapt to any situation that arises. Consequently, they will have a style that is reflective of their personality, not an image.

Characteristics of the Respected Coach

No matter which coaching style an individual leans toward, there are many characteristics or qualities that the majority of effective respected coaches exhibit. Respect from athletes and peers are not something any coach can expect as their right because of the appointment or position they hold. Coaches must earn respect and individuals use many qualities and tactics to gain this respect. It is difficult to perceive a coach being effective in just about any situation for any length of time if he has not gained the respect of the athletes he coaches. Attitudes, which contribute to gaining respect and coaching effectively, include:

Knowledge
Coaching has become a science as well as an art where knowledge of sporting performance demands more than simply the rules and skills of the sport. Successful coaches base training programs on the principles of kinesiology, physiology, psychology and biomechanics. Our sport is objective and measurable and we can constantly compare results with workload and other scientific criteria. In addition, the advancement in the nutritional needs of weightlifters and the care and treatment of injuries is constantly improving. To be effective, the coach must constantly update his knowledge and make adjustments and modifications to his methodology.

Organization
This is a classic feature of the successful coach. One can judge the success of a coaching program by the final outcome, competition. However, the efficiency of organization in the training sessions that build activity skills and the athlete who is either encouraged or deterred by such experiences readily recognizes progress. Linking together efficient, systematic practices with successful performance also builds confidence and respect for the coach.

Communication
This is a vital and necessary characteristic of successful coaches. All effective and successful coaches are good communicators. If they cannot communicate well, it is useless having the best possible knowledge and skills. In fact, the bulk of the coach's time spent with athletes is in communicating and transferring knowledge to them and ensuring this translation into action.

The methods used for effective communication will vary with individual coaches and individuals athletes and varies from sport to sport. The most effective communication occurs on a one on one basis, which in weightlifting is typically the norm. However, all communication should be a two-way street and not a dictatorship.

A good coach communicates with a positive approach. The coach will praise a job well done by the athlete in order to reinforce desirable behaviors and to promote self-confidence. Conversely, the negative approach uses punishment or negative comments which results in fear or failure and lower self-esteem. The positive approach should be consistent and fair but not over-exaggerated. Even if the athlete does not perform or behave satisfactorily, the coach should analyze the poor performance in a positive way.

A good coach communicates both verbally and nonverbally. Verbal communication is positive, brief and to the point. Too much talking can be a distraction and can make the athlete cautious and too concerned with evaluation by the coach rather than his performance. Nonverbal communication can include such simple things as body language, gestures and body movement. Touching behavior such as a pat on the back or using the hands to help position the athlete during a lift can be an effective communication device. Even various voice inflections can convey the real message implied by the coach: remember, it is not what you say, but how you say it.

Personality

Leadership, in its simplest terms, is the capacity of a person to direct and coordinate the activities of a group of people. It is essentially a position of power but in sport demands consent and compliance from talented but highly individualistic people. The individual personality of the coach will have an enormous bearing on how s/he handles his leadership and power base. What works for one will not necessarily work for another simply because of the individual's personality. Assuming technical expertise, the qualities found most desirable in a coach by athletes are a pleasing personality, the ability to show warmth and compassion, a sense of humor, enthusiasm, security and sense of fair play.

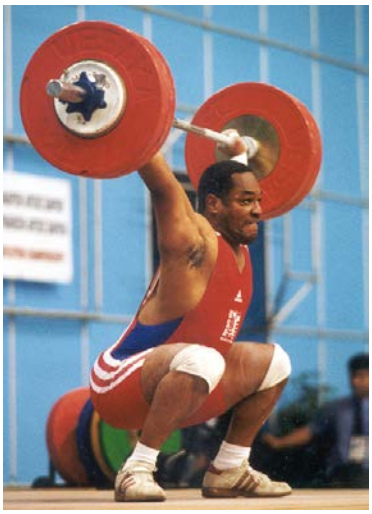
2000 Olympic bronze medalist Cheryl Haworth

Chapter 2

Skill Acquisition

Much of weightlifting coaching is devoted to the development of skilled performance. Skill has many definitions. One may define it as the "learned ability to bring about predetermined results with maximum certainty, often with the minimum amount of time or energy or both," (Knapp, 1963). This is true when coaching beginners in learning the techniques of the competition lifts. In fact, the teaching and coaching of technique, especially in the early years, tends to dominate the coaching scene. There is also constant refinement of the production of excellence with the elite performer.

However, the development of technique alone does not improve the skills of the weightlifter. Although we are primarily concerned with the physical development of motor skills in our sport, we cannot ignore the effects of psychological environment and situational preserves on this development. So perhaps another definition of skill comes closer to the mark. Welford (1969) defines skill as, "an organized, coordinated activity in relation to an object and/or a situation which involves a whole chain of sensory, central or motor mechanisms."



Two-time Olympian Tim McRae

Open and Closed Skills

In the coach's pursuit of the development of skilled performance with his athletes, he needs to deal with open and closed skill acquisition. In an open situation, such as basketball, white water canoeing or soccer, the athlete has to produce skilled movements in a multitude of differing situations. The athlete does not control the situation as in a closed skill but other players or changes in the physical environment contribute to the skill.

In closed skills, such as swimming, running or bowling, the athlete tries as efficiently as possible to perform the movement or technique in a standard environment. There may be some variables like weather, crowd noises, etc., but, largely, one 50-meter pool is the same as the next. In this example, the swimmer aims to produce the most refined and efficient stroke pattern possible to propel him to the end of the pool as fast as possible. Weightlifting utilizes both types of skills. Although we are endeavoring to reproduce efficient, stylized constant movement patterns, we are subject to a changing situation as the barbell becomes heavier.

Different coaching methods and approaches are required for the various types of skills. In coaching the performance of closed skills, the coach tries to encourage the performer to concentrate and shut out the external influences so that the skilled movement can be

produced as perfectly as possible. However, in the open skill situation, the coach has to make the performer constantly aware of the changes brought about by the heavier weights so that he may react in a positive way.

Stages of Skill Acquisition

The learning and development of skill (the translation from unskilled to skilled performance) is a continuous process. This manual covers three stages:

Cognitive Stage
Initially, the performer needs to understand the objective of the exercise. The beginner attempts to form a mental plan or scheme of performance that will govern his actions. During this stage, the performer is concerned with the organization of, which movements to make rather than how to make them. Errors, which are frequent, tend to be large. Once the beginner is able to reproduce the movement in considerable fashion, he may move to the associative stage of skill acquisition.

As an example, learning the power clean from mid-thigh, the beginner is initially unsure whether he should reverse curl the bar or swing it up. Gradually, he develops the feel of the movement and forms a mental picture of the whole sequence of movements. Eventually, the movement pattern develops and the athlete becomes familiar with the movement.

Associative Stage
This is a refinement stage; the athlete understands the core element of the skill and now the emphasis is on making the movement more efficient and smooth. The emphasis is on how to do the skill rather than what to do. The athlete now recognizes errors in performance without direction from the coach. The errors are no longer major. The performer slowly learns to utilize proprioceptive information (kinesthetic awareness) rather than visual and verbal information. The athlete is able to control longer sequences of response. The plan or scheme of movement formed in the earlier stage is now becoming more exact. The coach watches closely for the precise demands of the skill.

Using the power clean from mid-thigh as an example, the performer can now begin to feel the movement of the barbell and can refine movements like keeping the elbows rotated out, allowing the bar to brush the thigh, shrugging up at the finish of the pull, etc. The athlete may be in this stage for a longer period.

Autonomous Stage
This is the skill acquisition stage of the advanced performer. The movements that make up the motor responses have become more automatic. Now, athletes can concentrate on using them to accomplish the whole task.

As an example, athletes can work on the gradation of the effort of the power clean. They can focus on getting the barbell moving and overcoming its inertia, feeling the shoulders in front of the bar and forcing themselves to put all out effort into the explosion phase.

Marcin Dolega (POL), snatches a world record 198.0 kg at the 2002 Junior World Championships
Photo by John Bingham

In much the same way that the type of skill influences the method of coaching, so does the stage through which the performer is progressing. During the cognitive stage, it is useful for the coach to present the skill in such a way that the beginner may view correct patterns of movement. Repeated viewing of the skill helps the beginner to formulate the movement in the mind's eye. It shows the proper performance. Practice should concentrate on the basic aspects of the task and instruction should be verbal and visual. During this stage, the coach will direct attention to essential cues to ensure the athlete learns the core element of the skill. The coach will also give more verbal feedback and encouragement.

Again, using the power clean from mid-thigh as the example, the coach will either demonstrate the skill correctly or use a video, and show how the skill approximates a jumping action and that the movement stems from leg and hip extension rather than arm action. The coach's primary goal is to get the lifter to extend the body violently and receive the bar at the chest in the correct receiving position.

During the associative stage, the coach increasingly focuses attention upon the refinements that make up the basic form of the skill. Practice will develop a far more flowing movement with the lifter being able to make more and more minor adjustments as the skill becomes more autonomous. The coach is continually emphasizing and using reinforcing cues for more efficient performance.

In the autonomous stage, performance is increasingly independent of continual attention. However, the coach has to be observant of faults or deterioration of parts of the movement as the skill develops. A word of caution regarding this phase; lifters who have progressed to the autonomous stage using an incorrect movement pattern can cause future problems for the coach. At this point, major flaws in movement patterns are very difficult to correct. This is why it is important to spend time with beginners in the cognitive and associative stages to develop sound, efficient movement patterns.

Factors Affecting the Acquisition of Skill

Bearing in mind the skill learning process outlined above, we now consider the vital area of teaching and coaching skills. Experience and research has shown that proper teaching and coaching has a dramatically higher success rate in skill acquisition than merely providing basic instruction or leaving performers to learn by trial and error. In addition, there is no evidence to support the fact that performers given incorrect or poor teaching and coaching of new skills are any better off than the trial and error approach. Therefore, quality of teaching and coaching is of paramount importance. Many factors, which can ensure quality coaching include:

A) **Visual Guidance:** When introducing a new skill, it is essential to show the athlete a demonstration of the skill in good form. The coach, fellow athlete or a video can demonstrate the skill. The prospective performer can immediately apply this through imitative powers. Initially, it is important not to complicate this process with talking or instruction. Allow the beginner to see the movement and appreciate the function, speed and timing of the skill. Let them build an image in his mind of what he is going to do. Then, follow with simple instruction and commentary before allowing the performer to attempt the skill.

B) **Verbal Directions:** This aspect is crucial in all facets of coaching. Brevity is the key, especially when the coach is introducing a new skill. Research indicates that spending considerable time describing a movement before the individual has had the opportunity to experience it is counter productive. Give a few brief comments on what is happening in the demonstration, then talk the performer into the correct starting position, and let them perform the movement. After they have attempted to experience the movement, stop them and give more verbal direction, which now has far more relevance.

C) **Manual and Mechanical Guidance:** Some performers find difficulty in translating what they see or hear into appropriate movement. The coach can often get results by actively placing the performer's body into the movement pattern. For example, when setting the back to pull the bar, many athletes achieve the hollow back position only when the coach actually positions the body parts for them manually. However, this works well with static positions like the start, but is a little more difficult, and sometimes impossible, when fast movements are involved.

D) **Knowledge of Results:** It is often unclear to the performer if he is achieving success in learning the new skills. In weightlifting, the knowledge of results in the early stages of learning is quite simple; the athlete either lifts the weight or does not lift the weight. Throughout the learning process, feedback of the results from the coach to the athlete is vital for success. A coach can use several technological sources to give feedback to the lifter. Obviously video, but also companies such as Dartfish have qualitative analysis instruments and with the assistance of the Sports Science division of the United States

Olympic Committee develop software which can give the athlete immediate feedback on bar displacement, speed, velocity and power. However, the coach must learn to use these efficiently since it may prove time consuming. Conversely, the weight lifted in a skilled movement is also a very real indication of results.

Knowledge of results may not always produce the desired improvement. Individuals tend to be either “visules”or “motiles.” Visiles can see and do. Motiles have to feel and do. They recognize the problem but need more help and must experiment with attempting to “feel” an adjustment with immediate feedback from the coach.

E) **Motivation:** This is an extremely complicated area as motivational factors depend on the individual. This is paramount to success achievement not only in learning a skill but also in success in the sport overall. There are principles of motivation, which can help in setting up learning processes, training sessions and training cycles.

Success is one of the greatest motivators. Especially when beginning the sport, performers should be in a success-achieving environment. Initially, failure can eliminate enjoyment and enthusiasm and if the beginner is not experiencing enjoyable activities, soon the motivation to train will be lost. In time, the lifter may find limited failure as motivation and will afford more time and effort into training. However, prolonged failure, even for the elite performer, could result in negative results.

Praise can produce great motivation, although it can be overused and prove useless. Used judiciously and honestly, praise can produce excellent results. The lifter may find public praise, as in a weightlifting meet for example, very rewarding.

Most athletes, and even the lay population, enjoy doing activities in which they excel. This superiority may lead to increased motivation to improve. However, athletes must also continue to improve on aspects in which they are below average. If not, the athlete may experience false expectations at the next competition. Athletes must work on the aspects in which they do not excel. The coach must implement a balance so that the performer feels good about what he is doing overall. When a skill is improved or mastered after a great deal of effort, this proves gratifying and motivating.

Competition can be an enormous motivator but the coach must ensure the athlete has competent skills prior to entering a competition. Luckily, in our sport the individual can compete against himself and the weight on the barbell. As skills develop, athletes lift more and more, which has great motivational powers. Later, when the individual is ready for formal competition, he may use personal records as motivation. This can also work in

reverse, however, if the level of competition turns out to be overwhelming and detracts from the individual's potential to approach or increase their personal record. Also on the down side, competition can be detrimental to skill improvement if the individual perseveres with poor technique even though eventually more weight can be lifted using correct skills. Vivid examples of this occur in school age weightlifting when coaches allow performers to use poor clean or snatch technique. With inherent problems of weight transference, bar displacement and skill acquisition, the coach must initially spend time teaching proper, efficient technique. The reward of success and praise is usually enough to motivate the beginner, but with more advanced performer, material reward becomes an important motivator.

F) **Distribution of Practice**: Many coaches ask, "Should the training session be "massed' using long sessions, or should it be spread out with learning new skills?" Fatigue is always a limiting factor in our sport. Performers must practice with an "optimum" weight; doing every exercise with a broomstick will not produce the correct skill. The coach must be constantly aware of fatigue and once it sets in, the practice of that skill should cease.
When learning a new skill, research indicates massed practice does have a beneficial effect. We can illustrate massed practice by considering the split jerk. When a lifter is learning this lift, it is a sound idea to include it in every training session for a period of time, until a competent skill level is developed. Then, the coach can distribute it more evenly in the training program. The coach might include the split jerk in every one of the three weekly training sessions for a period of four weeks until the athlete learns the skill competently and then only include the jerk twice per week. This does not mean, of course, that the only exercise in the training session is the jerk; three or four other lifts or exercises using other movement patterns are also included.

G) **Speed and Accuracy**: These two qualities have a much greater relevance in weightlifting that previously thought. In fact, the snatch and the clean & jerk, are two of the fastest, most explosive movements in sport. Consequently, the speed of movement and accuracy of positioning the barbell are essential elements of weightlifting technique. Realize also, that weightlifting technique, in particular the explosion phase of the pull and the drive for the jerk, is ballistic in nature.

In addition, there is also a proportionate speed to make most of the skills in weightlifting possible. It is impossible to do a slow snatch with any kind of weight. All research indicates that when learning new weightlifting skills, the athlete must eventually learn them at the speed in which they will occur. In fact, there should be an emphasis on speed from the start. Initially, coaches would teach weightlifting skills at a slow speed and then increase the speed as the athlete becomes more proficient. This was based on the theory that it was

easier to speed up accurate movements than to correct fast, inaccurate movements.

H) **Whole and Part Learning**: In terms of skill acquisition, the whole method entails teaching the whole skill from the outset. The part method entails learned the skill in part and then fitting them together to form the whole. An offshoot of these methods is the whole-part-whole where the coach teaches the performer the whole skill, and then the coach chooses one phase or part to practice in isolation and then apply those parts to the whole skill.

To illustrate these principles, we can look at the clean. Coaches may attempt to teach it 1) as a whole or 2) choose to break it up into separate parts like the power clean, front squat or pull aspects and then practice the whole movement again. Coaches use one or all of these methodological aspects in weightlifting coaching. However, it is important to remember that we are teaching and coaching skill. The coach can also break the movement down into parts for strength and power training as part of the regular weightlifting training program.

There has been a good deal of research done on comparing the whole method to the part method approach. In many instances, the situation is still not exact. The whole method appears to produce the best and fastest results if the skill is not too complex. However, in our sport where coaches teach complicated, gross motor skill movements in the snatch and clean & jerk, the part method is sometimes appropriate. One of the advantages of the part method approach to these complex skills is the fact that each part is easily learned and the performer gains a sense of achievement by mastering it. However, it is essential to show the performer the whole skill initially so the athlete sees the movement in its entirety. The coach should have the performer practicing the full skill as soon as possible so the lift does not appear to be "segmented."

Another derivative of these methods, which we use a great deal in coaching weightlifting skills, is the **progressive stages** approach. Here, athletes begin with a part method and progress to another more advanced stage. For example, when teaching the power clean, the athlete begins with the power clean from mid-thigh. Once mastered, he progresses to the power clean from the knee then on to the power clean from below the knees until finally the power clean from the platform.

To summarize, the coach has numerous methods to draw and combine from, if necessary:

- Whole Method
- Part Method
- Whole-Part-Whole Method
- Progressive Stages

The coach must analyze each skill he is going to teach and decide which of these methods he will employ. The coach's decision will depend on the complexity of the skill and the ability and experience of the athlete.

Individual Factors

This is an intricate area and very frequently calls for value judgments by the coach. The coach should consider the following factors:

1) **Age and Maturation**: This has an enormous effect on the ability to learn skills. The actual chronological age is not as much a factor as the level of maturation. We all have seen cases where 12-year-old boys show enormous maturational differences. One is almost a man physically while the other is still very much a child.

   Coaches may begin to teach weightlifting at a much earlier age than previously thought. It was always felt that weightlifting should not begin before puberty but the Bulgarians experimented with 10 and 11 year olds with magnificent results. However, at this age, skill learning and general physical training are stressed and not the heavy loading, which produces results later.

   Children in this age range (10-12) learn skills quickly. In addition, there are no inhibitory problems from movement patterns, which are already established. This is in contrast when older people try to learn new skills. Earlier activities may have established autonomous movement patterns, which may inhibit new skill acquisition. Therefore, there really is a sound basis for saying, "You can't teach an old dog new tricks." This does not mean, however, that we should not be teaching weightlifting to anyone over twelve. The older the performer, the longer the skill learning process will likely be. Post-pubescence is the most result producing stage when considering weightlifting training. The trade-off is that youngsters may learn the skills of weightlifting easily, but they will not be as capable of developing the strength and power of the post-pubescent.

2) **Gender**: It was thought, at one time, that gender had an effect on an individual's capacity to learn skills but recent findings have shown this is not the case. Obviously, post-pubescence will show a marked difference between male and female in terms of power performance if all other things are equal. This is physiological in nature due to muscle mass in males. However, the actual skill levels will be approximately the same for males and females.

3) **Intelligence**: Although it would appear that intelligent people should learn skills quicker than less gifted people, this may not be true in actual practice. Although people that are more intelligent might understand verbal instructions more clearly, the transfer of learning to the physical may not occur. With proper coaching, there should be no difference in skill acquisition.

4) **Innate Ability**: A popular expression states, “In sport and in life, there is no substitute for ability.” This tends to be true. People appear to have innate abilities in various areas of learning new skills and this is certainly one of them. Some learn skills completely while others learn some but not all skills easily.

Some people are genetically and psychologically gifted for weightlifting. Coaches enjoy working with this population as they progress quickly and with equal work, achieve the highest results. Many times, we find these athletes through talent identification. Other times, an athlete just walks through the gym doors unexpectedly. Even in former Socialist block countries, coaches have “missed” some outstanding weightlifters. For example, coaches did not choose future World Champions Yanko Rusev or Ivan Ivanov in this screening process.

There is a school of thought, which believes that if coaches are to achieve results they should only work with people with innate ability. This is doubtless a very efficient, cost effective way to do business, but not all coaches are fortunate to get the “cream of the crop.” We all must work with the talent we get. Many National and World Champions had very humble beginnings but through hard work and dedication, and, of course, expert coaching, they have risen to the elite ranks.

Nikoli Peshalov wins gold at the
2000 Summer Olympic Games
Photo courtesy IWF website

Chapter 3

Anatomy, Physiology & Kinesiology

It is not the intention of this manual to develop our USAW Senior Coaches into physicians, chiropractors, physical therapists or the like. However, because coaches are dealing with the human body on a daily basis in the sport of weightlifting, a basic understanding of the structure and function of the human body is essential. Through this knowledge, coaches can better understand the training process, safety principles, mechanics of movement, recovery and rehabilitation, injury treatment, nutrition and many other issues directly or indirectly related to coaching. This manual is an introduction to these vital issues. USAW also encourages coaches to explore areas of concern on their own. Further, the USAW Regional Coaching Course will have more information on these issues. The following sections will concern itself with the "Where it is, what is it called and how it works." The "Why it works" will not always be addressed.

Basic Anatomy

Anatomy refers to the study of structure and the relationships among structures. Anatomy is a broad science and deals with many different aspects. We will not discuss the many sub-divisions of anatomy. The three main systems this manual will deal with are:

a. The Skeletal System
b. Articulations (Joints)
c. The Muscular System

The Skeletal System

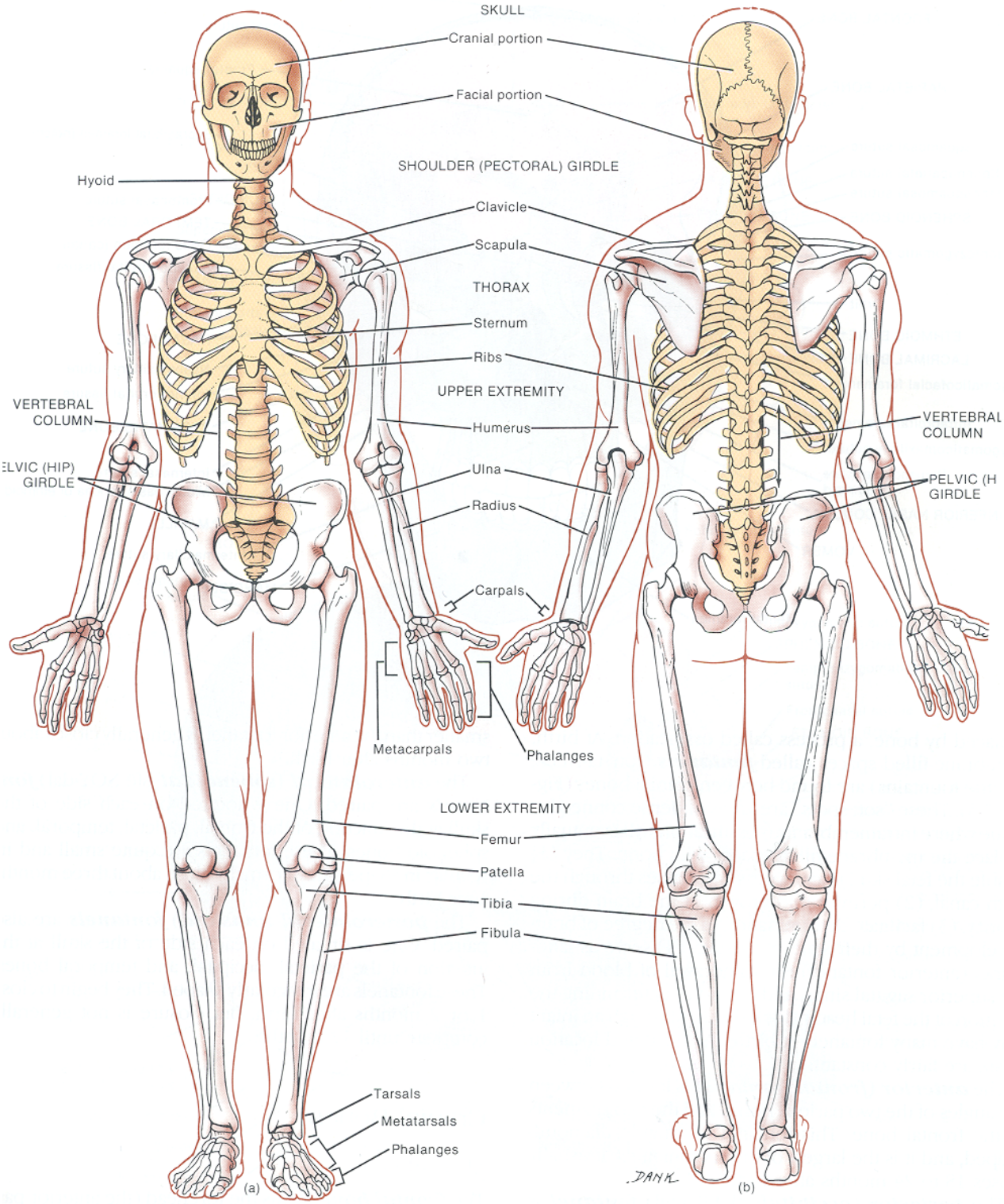
The human skeleton comprises a framework of a series of bones, which are often joined or articulated together to perform definite and combined functions. Some of these functions include the framework for muscular attachments, support and protection for organs, blood cell formation and a depot for Ca^{++} and PO_4. The axial and appendicular systems compromise the skeletal system. The **axial skeleton** consists of the skull, vertebral column, ribs and sternum. The **appendicular skeleton** consists of the shoulders, hips and extremities. For a closer look at these two skeletal systems, please see Figure 3.1.

Types of Bones

The skeleton is made up of a variety of bones, which are classified as follows:

- Long
- Short
- Flat
- Irregular

Long bones have greater length than width, consist of a shaft (diaphysis), and may have two or more ends (epiphyses). The bones of the hands and feet (metacarpals and metatarsals) are examples of bones with only one epiphysis. The femur is an example of a long bone with four epiphyses.
Figure 3.1 The axial skeleton is in gold and the appendicular skeleton is in light brown. Illustration by Leonard Dank



Long bones are also curved to better absorb stress and distribute it evenly to prevent fractures. In addition, long bones function fundamentally as levers.

Short Bones are somewhat cube-shaped and nearly equal in length and width. Short bones tend to have a spongy texture except at the surface, where there is a thin layer of compact bone. Examples of short bones are the wrist and anklebones.

Flat bones are typically thin and the basic requirement is to protect underlying structures or providing broad surfaces for muscular attachments. Examples of flat bones include cranial bones (protect the skull), sternum and ribs (protect organs in the thorax) and the scapulas (serve as muscular attachments).

Irregular bones have complex shapes and cannot be grouped into any of the three categories just described. Examples of irregular bones are the vertebrae, certain facial bones and the bones of the pelvic girdle.

Articulations

Bones are too firm to bend freely without causing some kind of acute damage. Fortunately, the skeletal system consists of many separate bones, most of which are held together at joints by flexible connective tissue. All movements that change the positions of the bony parts of the body occur at joints. An articulation (joint) is a point of contact between bones, between cartilage and bones or between teeth and bones. The joint's structure determines how it functions. Therefore, one may define articulations in one of three ways:

a. Immovable
b. Slightly Moveable
c. Freely Moveable

Immovable joints lack a synovial cavity (space between articulating bones) and fibrous connective tissue holds the bones very closely together. They have little or no movement. An example of an immovable joint is the sutures of the skull.

Slightly moveable joints consist of two bony surfaces united by ligaments alone or ligaments with a fibrous cartilage between them. An example of this type of joint would be the symphasis pubis; a joint connecting the pubic bones of the pelvis or the distal articulation of the tibia and fibula.

In a **freely moveable** joint, cartilage covers the epiphyses of the bone and a fibrous capsule connects the two. Within this fibrous capsule is the synovial membrane, which contains synovial fluid and this lubricates the joint. An example of a freely moveable joint would be the knee.

The movement permitted at synovial joints is limited by several factors. These include:

- Structure (shape) of the articulating bones
- Tension of the ligaments
- Muscle arrangement and tension
- Apposition of soft parts

Following is a description of the specific movements that occur at the synovial joints. Please see Figure 3.2 for illustrations.

Gliding
A gliding movement at a joint occurs when one surface moves back and forth and from side to side over another surface without angular or rotary motion. Joints that glide are those between the carpals and tarsals and the transverse processes of vertebrae.

Hinge
A hinge joint is one in which the convex surface of one bone fits into the concave surface of another bone. Movement is in a single plane and either flexes or extends. Examples of hinge joints are the elbow, ankle and interphalangeal (fingers and toes).

Pivot
The surface of one bone articulates within a ring formed partly by another bone and partly by a ligament. The primary movement permitted is rotation. An example of a pivot joint is movement between the proximal end of the radius and ulna.

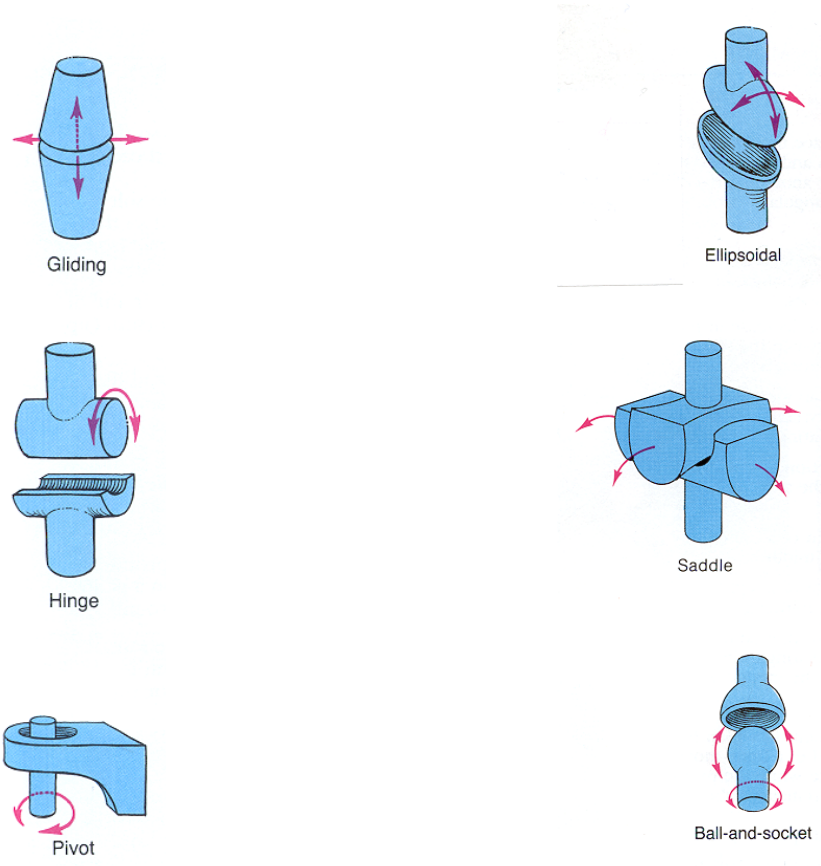
Ellipsoidal
An oval-shaped condyle of one bone fits into an elliptical cavity of another bone. The joint permits movement in two axes, from side to side and back and forth. An example of an ellipsoidal joint is at the wrist between the radius and carpals. Movement is flexion or extension, adduction or abduction and circumduction.

Saddle
The articular surface of one bone is saddle-shaped and the articular surface of another bone is shaped like a rider sitting in the saddle. Movement at a saddle joint is side to side and back and forth. An example of a saddle joint would be the trapezium of the carpus and the metacarpal of the thumb.

Ball and Socket
This joint consists of a ball like surface of one bone fitted into a cuplike depression of another bone. Similar to an ellipsoidal joint, movement is permitted in three planes of motion, flexion or extension, adduction or abduction and circumduction. An example of a ball and socket joint would be that of the acetabulum and the head of the femur (hip joint).

The Muscular System
There are three types of muscle tissue in the human body: skeletal, cardiac and smooth muscle. The muscular system, however, refers only to the skeletal muscle system. **Skeletal** muscle tissue attaches primarily to bones and moves parts of the skeleton, is voluntary and striated. **Cardiac** muscle tissue is located in the heart, is striated and involuntary. **Smooth** muscle tissue maintains the internal environment. It is located in blood vessels, stomach and intestines and is striated and involuntary.

Figure 3.2 Illustrations of the specific movements that occur at the synovial joints. Illustrations by Michael H. Ross



Qualities of Muscle Tissue

Muscle tissue has four characteristics:

1. **Excitability**- ability of muscle tissue to receive and respond to stimuli
2. **Contractility**- ability of the muscle tissue to actively generate force to shorten and thicken (hypertrophy) to do work (contract)
3. **Extensibility**- ability of the muscle tissue to be stretched
4. **Elasticity**- ability of the muscle tissue to return to its original shape after contraction or extension

Through contraction, muscle tissue performs three functions:

1. Motion- both reflex and voluntary
2. Maintenance of posture
3. Heat production

Muscle tissue consists of thousands of elongated cylindrical cells called muscle fibers. The sarcolemma, which is a plasma membrane, envelops each muscle fiber. The sarcolemma surrounds a quantity of cytoplasm called sarcoplasm. Within this sarcoplasm are many nuclei, myofibrils, mitochondria, enzymes and sarcoplasmic reticulum (Ca^{++} storage and release).

Connective tissue surrounds the sarcolemma connecting muscle fiber to muscle fiber. **Tendons** are cords of dense connective tissue that attaches a muscle to the periosteum of a bone. **Ligaments** are fibrous or cartilagenous tissue, which connects bone to bone. They reinforce and stabilize the joint and restrict movement in certain directions. Ligaments lack elasticity and if overstretched take considerable time to return to normal. In addition, ligaments have a low blood supply.

Skeletal muscles are well supplied with nerves and blood vessels. These innervations and vascularization is directly related to contraction, the chief characteristic of muscle. Arteries and veins enter the muscle via connective tissue. Both run parallel to the fibers and the numbers vary with muscle fiber type. Nerves also enter the muscle via connective tissue. Nerves supplying the muscle contain approximately 60% motor neurons and approximately 40% sensory neurons. When stimulated, motor neurons induce muscle contraction. In addition, connective tissue, blood vessels and nerves are all required to support the muscle in its primary function… *movement.*

Muscle Fiber Type

For the purposes of this manual, fibers within skeleton muscle fall into two categories, which have a direct impact on an individual's ability to produce force in differing circumstances. The fibers will be classified as red, or slow twitch (type I) fibers and white or fast twitch (type II) fibers. Type I fibers have a high oxidative capacity, are fatigue resistant, have a low glycolytic capacity and low motor unit strength and they are red due to the high myoglobin content. In contrast, type II fibers have a low oxidative capacity, fatigue easily, have a high glycolytic capacity and high motor strength capabilities and they are white due to the low myoglobin content. How then, does one determine muscle fiber type in individuals?

The primary determinant is genetics. However, muscle fibers become specialized according to the neuron, which stimulates them. For example, if a predominantly slow twitch fiber athlete only trains explosively, those slow twitch fibers will take on some fast twitch qualities. They will not however, change to fast twitch fibers. Training and muscular inactivity may result in changes in the percentage of different fiber types. Also, aging may result in changes in the percentage of fast twitch to slow twitch fibers.

Skeletal muscle contains both fast twitch to slow twitch fibers. ATPase (which is an enzyme) in type II fibers acts faster, thus providing energy for muscle action more quickly than ATPase in type I fibers. Motor units supplying type II fibers are larger than those supplying type I fibers thus, type II motor units can recruit more fibers. Type I fibers have high oxidative dependence qualities and are suited to low-intensity endurance activities while type II fibers are better quipped for anaerobic or explosive activities.

Determinants of Force Production

For a motor unit to be recruited into activity, the motor nerve impulse must meet or exceed the threshold. When this occurs, all muscle fibers in the motor unit act maximally. If the threshold is not met, no fibers in that motor unit act. This phenomenon is referred to as the all-or-none principle. The more motor units that are activated, the more force is produced.

Cross sectional area of the muscle fiber is also a determinant of force production. The larger the muscle fiber the more force it is able to produce. As mentioned earlier, fiber type is a factor. Type II fibers generate more force than type I fibers. In addition, biomechanical factors affect force. Bar displacement, velocity and technical flaws are all related to force production.

Major Skeletal Muscles in Action

In all weightlifting movements, muscles do not work in isolation and many muscle groups work in harmony to produce especially skilled movements. In weightlifting, the snatch and clean & jerk produce tremendous forces. We can identify these muscles and the actions they produce. Among the most important muscle groups are the muscles that stabilize the spine for proper back management. The major muscles include the erector spinae group of the back and the oblique and rectus abdominus muscles of the abdomen.

Using a diagram of the human skeletal muscle, one can identify the major muscles used in the various parts of the competition lifts. Beginning with the lower extremity, the calf muscles, gastrocnemius and soleus, plantar flex the ankle so the athlete can rise on the toes when finishing the pull and for the drive for the jerk. The quadriceps extends the knee when pulling, recovering from the squat and in the drive for the jerk. In contrast, the hamstrings extend the hip in the second part of the pull while simultaneously flexing the knee. The gluteals assist in pulling, squatting and driving for the jerk.

Continuing with the upper extremity, the muscles of the shoulder girdle include the trapezius, levator scapulae and the rhomboids, which contribute at the finish of the pull. The trapezius and serratus anterior also contribute in stabilizing the barbell when overhead. In addition, other muscles, which assist in overhead stabilization, include the deltoid, supraspinatus, infraspinatus teres major and minor. The biceps brachialis, which flex the elbow, assist in pulling the lifter under the bar after maximal extension of the pull. The triceps, which extend the elbow, assist in overhead stabilization.

Although this may be an oversimplification of the action of these muscles in weightlifting, and may also ignore many others, it may help the coach understand how they apply in a practical setting. The muscular system will go into further detail in the Regional Coach Course.

Basic Physiology

This is the study of how the body works or the function of the body parts. As with anatomy, physiology covers an enormous field of knowledge. The science of physiology and how it relates to the human body in regard to athletics is continually changing. New research is constantly adding to the knowledge of this complex and diverse area. Because of the enormity of this area, this manual will only concentrate on the section of physiology called bioenergetics. The Regional manual discusses this topic further in addition to the physiology of muscle contraction.

Energy for Contraction and Relaxation

In order for a muscle to contract, it requires energy. Adenosine Triphosphate (ATP) is the immediate energy source. When a muscle action potential stimulates a muscle fiber, ATP, in the presence of the enzyme ATPase, breaks down into Adenosine Diphosphate (ADP) + Phosphate (P) and energy is released. Muscle fibers synthesize ATP as follows:

ADP + P + Energy ⇨ ATP

The Phosphagen System

The amount of ATP present in skeletal muscle fibers (muscle glycogen) is minimal, enough for approximately five to six seconds of work. If exercise continues, additional ATP must be generated. Skeletal muscle contains a high-energy molecule called phosphocreatine that is used to generate ATP rapidly. This amount of phosphocreatine is about two to three times greater than ATP. Upon decomposition, phosphocreatine breaks down into creatine and phosphate and large amounts of energy are released. It can be described in this way:

Phosphocreatine ⇨ Creatine + Phosphate + Energy

Together phosphocreatine and ATP constitute the phosphagen system and provide enough energy for roughly 15-20 seconds of work. However, the energy is quickly restored; within 20 seconds half is replenished and within three minutes the energy is fully replenished. Therefore, the phosphagen system is the primary energy system in the sport of weightlifting.

Glycogen-Lactic Acid System

When muscle activity is continued, then the source of energy is glucose, which is derived from the breakdown of glycogen and also picked up from the blood. Glycogen, which is stored glucose, is always present in skeletal muscles and the liver. Once stored glycogen is broken down into glucose, each molecule of glucose is split into two molecules of pyruvic acid, in a process called glycolysis. This process is shown below:

1 Glucose ⇨ 2 Pyruvic Acid + Energy (ATP)

When there is not sufficient oxygen for the compete catabolism of pyruvic acid, it is converted to lactic acid, some of which diffuses out of the muscle fiber into the blood. The production of lactic acid in this way releases energy from glucose that can be used to produce ATP, and it occurs without oxygen or is oxygen independent. This is sometimes referred to as anaerobic. The system just described can provide sufficient energy for about 50 seconds of maximal muscle activity. An example of a sport where the Glycogen-Lactic Acid system is the primary energy system would be a 100 or 200 meter swim.

Aerobic System

Contrary to the Glycogen-Lactic Acid System, when there is sufficient oxygen for the complete catabolism of pyruvic acid it enters the mitochondria (the “powerhouse” where energy is transferred from carbon compounds, such as glucose, to ATP) of muscle fibers where it is completely catabolized to carbon dioxide and water in a process called cellular respiration. The process of cellular respiration is seen here:

Pyruvic Acid + Oxygen (O_2) ⇨ CO_2 + H_2O + Energy (ATP)

The energy produced by this process provides sufficient ATP for prolonged activity as long as sufficient oxygen and nutrients are available. An example of a sport where the Aerobic system is the primary energy system is a 10,000-meter race.

Although one energy source may be predominant source for a particular activity, there is an interaction between the three systems. All three systems supply a portion of the ATP needed by the body at all times. An example would be muscle actions, which simultaneously stabilize and move the limbs, so that the body may rely on cardiovascular processes for its overall movement in a particular event, while the postural muscles are fueled by oxygen independent processes.

Basic Kinesiology

This is the study of human movement and includes anatomy, physiology, biomechanics and psychology. Understanding kinesiology can give the coach an invaluable tool into the inter workings of his athletes and more importantly, weightlifting performance. This section of the manual is intended to be introductory, and will delve into fundamental movements, muscle classification and action and force generation. For this course, these areas are quite appropriate.

Fundamental Movements
The contraction or relaxation of a muscle or group of muscles causes movements in different ways. These movements are classified as follows:

- Flexion- decrease in angle between two bones
- Extension- increase in angle between two bones; restoring a body part to anatomical position after flexion
- Adduction- movement toward the axis or midline of the body
- Abduction- movement away from the axis or midline of the body
- Elevation- upward movement
- Depression- downward movement
- Rotation- moving a bone around its own axis with no other movement
- Circumduction- movement at a synovial joint in which the distal end of the bone moves in a circle while the proximal end remains relatively stable

In addition, the following terms refer to anatomic positions:

- Anterior- near to or at the front of a body
- Posterior- near to or at the back of a body
- Lateral- to the outside away from the midline
- Medial- to the inside toward the midline
- Superior- toward the head or upper part of a structure
- Inferior- away from the head or toward the lower part of a structure

Functional Classification of Muscles
Prime movers or agonists are the muscle or muscle groups principally responsible for the movement taking place. **Antagonists** oppose the agonist. In other words, they yield to the movement of the prime mover. As a practical example, during a bicep curl the biceps would be the agonist and the triceps would be the antagonist. In addition to the agonist and antagonist, a **synergist** assists a desired action

or counteracts and undesired action. **Stabilizers**, or **fixators**, assist in stabilizing or fixing a joint in position, while other movement is happening.

Types of Muscle Action

A muscle is capable of three different types of contractions. They are:

- Concentric- shortening of a muscle. Using the bicep curl as an example, the muscles in the upper arm contract causing flexion at the elbow.
- Eccentric- lengthening of the muscle. This is controlled relaxation under load. During eccentric contraction, it is possible to use considerably higher loads, up to 40% in some instances, than can be lifted concentrically with the same muscle groups. Again, using the bicep curl as an example, the athlete curls the weight to full flexion, which is the concentric movement; the athlete then begins to extend the arm to normal, anatomical position, which is the eccentric motion.
- Isometric- no change in the length of the muscle. In weightlifting, isometric strength is invaluable. In order to stabilize the spine during a snatch or clean & jerk, it is imperative the athlete have ample core strength. The abdominals and erector spinae of the back have the biggest influence in spine stabilization. If an athlete has difficulty flexing the abdominals during lift-off, the athlete will surely have difficulty generating enough force to compete the lift successfully, and without injury.
- Plyometric- rapid stretching or loading of the muscles involved followed immediately by a maximal voluntary contraction of the same muscles. The quintessential example of this would be any jumping movement.

Factors Influencing Force Generation

It is obvious; the sport of weightlifting requires strength. Besides strength, speed is a huge component. The result of these two elements, strength and speed, is **power**. However, for higher-level athletes, the potential for speed can be increased by first increasing strength. In addition, increasing strength allows the athlete to produce more force. If an athlete can produce more force, the ability to overcome increased external resistance is the result. Therefore, weightlifting athletes must emphasize the strength component. Increasing strength, and its by-product force, depends on the following factors:

1. Muscle fiber diameter- increasing the cross-sectional area of the muscle fibers. Larger muscle fibers produce more force than smaller ones.
2. Recruitment- increasing the amount of motor units, an individual motor nerve and the muscle fibers it innervates, involved. Ideally, the ability to recruit fast twitch muscle fibers due to the fact these muscle fibers produce more force than slow twitch.
3. Synchronization- increasing the coordination between muscle groups. Typically between agonist and antagonist muscle groups. Higher skill, multiple joint movements enable muscle fiber groups to alternate so when one group of muscle fibers exhaust, another group will begin to contract.
4. Joint angle- all joints have an optimal angle at which the muscles crossing the joint produce maximal force. The angle of maximal force depends on the relative position of the muscle's insertion on the bone and the load placed on the muscle. Initial muscle length is also a factor. Lastly, speed of action affects the amount of force produced. This is realized in the definition of force: F=ma, or Force equals mass times acceleration.

Research has shown high power-type training will produce adaptations in rate of force development, peak power and speed. Studies by Stone and others have shown that when power training with traditional high force/low velocity exercise, the result is more positive than when utilizing only one of the training methods.

Chapter 4

Biomechanics

This brief introduction to the study of biomechanics – the application of engineering principles to human body movement – will give and insight into the importance of this field of research to weightlifting coaches. The understanding, utilization and development of efficient weightlifting technique depends very much on biomechanical appreciation. However, biomechanical explanations should be used with discretion, for lifters differ widely in intelligence, education and interest. While some will be intellectually stimulated and show improved performance, others will be confused. Coaches conversely, if they are to truly understand why they teach certain techniques, cannot avoid using and understanding this field. It is an ongoing and developing area, which will always play a major role in the coach's pursuit of excellence and weightlifting efficiency.

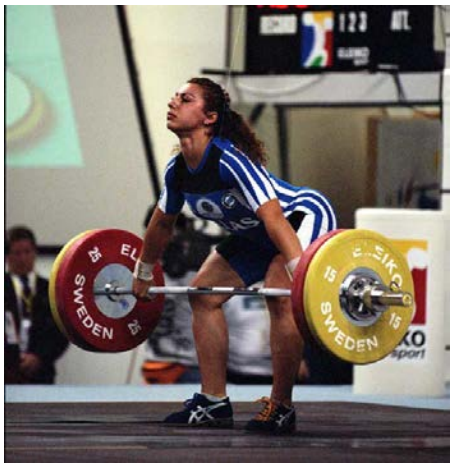
In the Club Coach Manual, the importance of the center of gravity (COG) of the human body and of the barbell has been discussed as well as the combined center of gravity of the body and barbell. The location of this COG position will lie somewhere on a line joining the COG's of the two bodies and be closer to the heavier object, hopefully the barbell. The line of action of the COG and combined COG is always vertically downward. We also discussed the importance and bearing on stability, keeping the line of action of this combined COG within the base of the lifter, the feet. However, the base of the lifter, due to the techniques used in the snatch and clean & jerk, is constantly changing. An understanding of this is important to maintaining stability and efficiently exerting maximum force in a balanced position.

Area of Base and Stability During the Lifts

The Pull

Some of these principles and facts were mentioned in the Club Coach Manual, but are worth exploring further. For the snatch and clean pull, the principles are essentially the same.

Start Position- The athlete's feet should be under the barbell, with the barbell approximately over the balls of the feet. This allows the COG to be in the middle of the area of base. The area around the athlete's feet is considered the area of base and remains constant throughout the pull. This position allows the athlete to control the barbell off the floor and bring the bar back immediately.



The Barbell at Knee Height- The barbell is still over the lifter's area of base, which allows the lifter maximal efficiency in preparation for the first pull. The barbell, and the COG, has moved back toward the lifter from the floor and the shoulders remain over the bar. This will also assist in maximizing the pull.

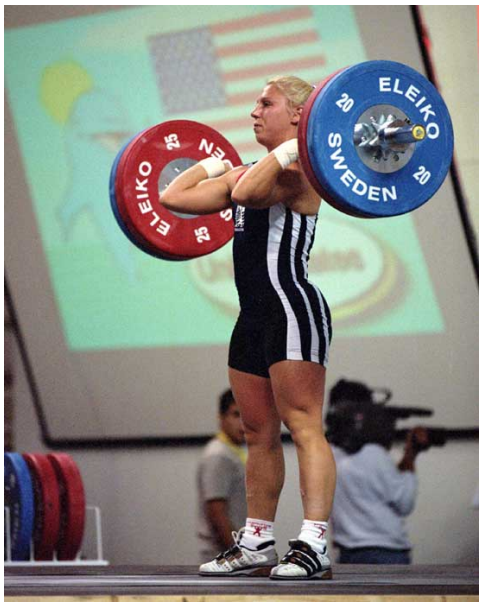
The Finish of the Pull- Upon maximal extension, the lifter plantar flexes onto the balls of the feet. This allows the lifter to produce maximal force and to get the feet prepared to jump into the receiving position. However, the area of base decreases in size causing a more unstable position. Yet, if the COG remains over the feet, the lifter will remain in a stable position.

The Receiving Position- As the lifter jumps his feet into the receiving position, the area of base increases. This allows the athlete more stability in the bottom position. The COG is within the area of base allowing the lifter the best opportunity for a successful attempt.

The pictures show that the lifter's area of base changes. Keeping the line of action of the combined COG within the area of base is essential for efficient force production. Lifters who "lean back" or “throw back” the head and shoulders at the top of the pull move the line of action of the combined COG outside the area of the base. To maintain stability, the lifter must jump back to re-establish a new base that the combined COG can fall within. Similarly, for lifters who swing the bar away at the top of the pull, a jump forward is needed to re-establish the base.

The Jerk

This presents new stability problems for the lifter. In the pull, problems stem from lateral instability of the base since it is wider than it is long. The opposite occurs in the jerk since the feet are split forwards and backwards.



Start Position- This position is crucial. If the lifter has a poor beginning position it will likely affect the outcome of the lift. The weight distribution will be toward the heels and resting solidly across the shoulders and clavicles. The COG will be directly in between the lifter's feet and the area of base is the area directly around the feet. The lifter will have a slack grip on the barbell and the eyes are focusing straight ahead.

The Dip- During the dip, the COG is still between the lifter's feet. The area of base also remains the same. As the lifter drives the weight up and plantar flexes to split the feet fore and aft, the area of base decreases, as with the finish of the pull. The COG however, does not change.

The Receiving Position- The feet have now split fore and aft into the receiving position. The COG remains equidistant between the feet. The area of base however, has expanded. This large increase in area of base increases stability and decreases the chance for error. It is also noted that the feet shift slightly to the side. If the feet do not shift slightly to the side, it will cause "tight roping", which reduces the area of base and increases the odds of missing the lift.

Levers

Levers are rigid bars that rotate around an axis or fulcrum. In the human body, muscles connect to bones and they act as levers. The bone acts as the rigid bar; the joint is the axis or fulcrum and the muscle(s) apply the force. All levers have a fulcrum or turning point (F), a point of application of muscle force (P) and a point where the weight or resistance acts (W). In any system of levers, the distance of weight or resistance from the fulcrum (F) will have an enormous bearing on the amount of force (P) necessary to produce movement. There are three types of levers in the human body, and can be classified as follows:

Class I
A first class lever is when the applied force and resistance are located on opposite sides of the axis. Examples of a first class lever would be a seesaw, scissors or pliers. Within the human body, the simultaneous action of the agonist and antagonist on opposite sides of the joint supplies the resistance force. The applied force and resistance may be at equal distances from the joint or further away. An example of a first class lever in the human body would be the joint between the Atlas and the Occipital bone, which is the fulcrum. The contraction of the muscles of the back is the effort while the head supplies the resistance.

Class II
With a second-class lever the applied force and resistance are on the same side of the axis, with the resistance closer to the axis. Examples of a second-class lever are a wheelbarrow, a lug nut wrench or a nutcracker. In the human body, there are two examples of second-class levers. During eccentric muscle contractions the muscle supplies the resistance against the applied external force. A second example would be during plantar flexion. The body is the resistance, the ball of the foot is the fulcrum and the contraction of the calf muscles to pull the heel upward is the effort.

Class III
With a third-class lever the applied force and the resistance are on the same side of the axis, but the applied force is closer to the axis. An example of a third-class lever would be a canoe paddle or a shovel. Most levers in the human body are third-class levers. One example is adduction of the thigh. The weight of the thigh is the resistance, the hip joint is the fulcrum and the contraction of the adductor muscles is the effort.

Linear and Angular Motion

In the sport of weightlifting, motion is a combination of both linear (movement in a straight line) and angular (movement about an axis of rotation) movement. There is often an interrelation of angular and linear motion during weightlifting performance. Prior to discussing Newton's laws of motion, a review of definitions is required. The following definitions will assist in better understanding the laws of motion. They are:

Velocity: A change in position with respect to time. This deals with uniform speed and, in mechanical terms, direction. It can be measured in feet per second, meters per second or miles per hour in a certain direction.

Acceleration: This is defined as the rate of change of velocity or increase in speed. It is measured in two units of time. An example would be the barbell was accelerating at two feet per second.

Momentum: The measure of the quantity of motion possessed by a body. It possesses magnitude and direction and is the product of mass and velocity. Thus, a lifter weighing 63kg and moving at a speed of 30 feet/second has a momentum of 4,200 units, as does a barbell weighing 30 kg moving at 140 feet/second.

Power: In mechanical terms, this means the rate of doing work or supplying energy. Work is calculated as Force x Distance moved. Power is thus:

$$\frac{\text{Force x Distance moved}}{\text{Time}} \quad \text{OR} \quad \frac{FxD}{T} \quad \text{OR} \quad \frac{\text{Work}}{T}$$

It is normally measured in watts, though many of us still think in horse power (HP) where 746 watts=1 HP.

Motion is produced by the application of force. As a result of force, magnitude and direction, three parameters are related to all types of exercise. They are:

- Duration
- Resistance
- Speed

The main sources of force in weightlifting are:

a) Internal, the muscular contractions of the lifter
b) External, the downward pull of gravity and the friction and up thrust of the platform. In advanced lifting, the elasticity of the barbell can also be a factor.

Now, by having a better understanding of these definitions related to motion, let us look at Newton's three laws.

Newton's Laws of Motion

Fundamental to the whole science of force are Newton's Laws of Motions. They state:

1. "Everybody continues in a state of rest or in uniform motion in a straight line unless compelled to alter it by some force". This is sometimes called the Law of Inertia. Inertia can be thought of as being a body's resistance to change." In weightlifting, this is particularly import as barbells have great inertia; they want to remain on the platform. Weightlifters have to exert enormous force to overcome this inertia.

2. "The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object." This second law tells us that when we consider a definite period of time, any change in velocity (positive or negative) will be directly proportional to the amount of force used. It will also be inversely proportional to the objects mass. In terms of an equation, the net force is equated to the product of the mass times the acceleration (F=ma).

3. "To every action there is an equal and opposite reaction." This has already been discussed in the Club Coach Manual and is a phenomenon regularly demonstrated in weightlifting.

Chapter 5

Nutrition and Daily Regimen

What weightlifters eat is very important for providing the necessary energy for top athletic performance and for maintaining the desired body composition and function. The quality of food is just as important as the quantity of food. In addition, what an athlete eats is equally important as when an athlete eats. Many athletes have found success with eating five to six smaller meals per day instead of the traditional three large meals. This not only keeps energy levels consistent but also keeps blood sugar constant. What are the elements of an optimal diet?

Adequacy- an adequate diet provides enough nutrients and calories to support health. The dietary needs of an athlete will vary from a non-athlete.

Balance- A balanced diet consists of eating enough foods from various groups, in the right amounts, to assure adequate intake of all the nutrients required by the human body.

Calorie Control- Eating the appropriate amount of food required for optimal performance.

Moderation- Understanding all foods can be enjoyed but balancing them in a healthy diet.

Nutrient Density- How many nutrients a food has in relation to the amount of calories it contains. For example, a cup of whole milk and a cup of skim milk may contain similar amounts of calcium, but whole milk will contribute more calories, especially fat calories, to the diet.

Variety- A diverse, healthy diet may eliminate deficiencies of nutrients or excesses of food components.

Table 5.1- Average amount of energy expenditure and replacement needed for different sports

Sport	Expenditure (kcals/kg/day)	Replacement (kcals/kg/day)
Untrained	<40	2,000-3,000
Basketball	50-80	5,000-6,000
Sprinting	55-70	4,300-6,000
Middle Distance	55-70	3,000-5,000
Marathon	50-80	2,500-6,000
Judo	55-65	3,000-6,200
Throwing	60-65	6,000-8,000
Weightlifting	55-75	3,000-10,000

These elements provide a good starting point for an optimal diet however; different sports have different expenditure rates. This brings up another question which many athletes struggle with. How many calories per day do I need? This not only depends on the sport the athlete competes in but also gender. Males, on average, need about 42-50 kilocalories per kilogram of bodyweight per day. Females, on average, need about 30-35 kilocalories per kilogram of bodyweight per day. In Table 5.1, Stone shows the average amount of energy expenditure and replacement needed for different sports.

From this table then, one can determine that the higher intensity shorter duration sports appear to expend more energy and therefore, replacement values are greater. This data also suggests that the primary energy system plus mass of the athlete has the most effect on expenditure. The degree to which carbohydrates (versus fat) is used is dependent on the duration and intensity of the exercise. Weightlifting depends primarily upon phosphogens and carbohydrates. To better understand this, please refer to Table 5.2, which illustrates a case study by Stone that breaks down macronutrients by grams per day and converts these to kilocalories.

Table 5.2- Energy needed per day for a 100 kg athlete during heavy training

	BWT	Recommended g/kg of bodyweight	Total grams	Calories/ gram	Total kcals	Percent of nutrients
Carbohydrates	100 kg	8.5	850g	4	3,400 kcals	61%
Protein	100 kg	2.0	200g	4	800 kcals	14%
Fat	100 kg	1.5	150g	9	1,350 kcals	24%
Total kcals					5,550 kcals	

Six Basic Nutrients

These refer to the six basic nutrients the body requires to function. Carbohydrates, proteins and fats are energy nutrients while vitamins, minerals and water are non-energy nutrients. Further, carbohydrates, proteins, fats and water are considered macronutrients. These are vital because they supply the body with energy and serve as the building blocks for growth and repair. Macronutrients are present in all foods but in different proportions. To understand how these nutrients affect the body, a closer look at them individually is needed.

Carbohydrates

Carbohydrates should form the major part of the diet. Fifty to sixty percent of one's dietary needs should come from carbohydrates. In addition, they affect performance according to when they are eaten and what kind they are. The two kinds of carbohydrates are complex, or starches, and simple, or sugars. Complex carbohydrates provide the body with a slow, steady supply of glucose because it is composed of chains of glucose that must first be broken down during digestion. Glucose does not need to be broken down and therefore enters the bloodstream immediately, providing a quick supply of energy.

Suggested carbohydrate intake should be between five and twelve grams per kilogram of bodyweight. Carbohydrates are the body's immediate energy source. The body converts carbohydrates into glucose, which it then converts into energy via ATP. For athletes who depend heavily on glycogen stores, ample carbohydrate intake is critical for optimal sports performance. Conversely, the body also uses

fat and protein as energy but the process of conversion to usable forms of energy is not as efficient. Good sources of carbohydrates include:

- Raw fibrous vegetables
- Grains like oats, bran cereal and rice
- Starchy vegetable like potatoes, corn and peas
- Fruits
- Breads and pasta

Glycogen and Athletic Performance

Glycogen is a form of carbohydrate stored in the muscle and in the liver. The body uses glycogen when it cannot get enough oxygen to burn fat for energy. The body's use of glycogen is determined in a number of ways including a person's diet, fitness level and exercise being performed.

- Higher intensity, short term exercise depends the most on glycogen stores
- Medium intensity, intermittent burst exercise also depends heavily on glycogen stores
- Moderate intensity exercise depends on glycogen stores for about 50% of its energy
- Low intensity, long duration exercise depends mostly on fat oxidation for its energy

Following exercise, carbohydrates can replace depleted glycogen stores. The type of carbohydrate consumed in the first 24 hours after exercise has been found to affect the degree of glycogen replacement. Carbohydrates that are quickly broken down to glucose are "high glycemic index" foods; while carbohydrates that are broken down more slowly are, "low glycemic index" foods. The glycemic index does not refer to whether or not a carbohydrate is simple or complex, but rather to how quickly it is broken down to glucose. Table sugar, for example, is broken down to glucose more slowly than mashed potatoes are, and therefore has a lower glycemic index. Recent research indicates consuming high glycemic index foods during the first 24 hours following exercise results in the greatest amount of muscle glycogen resynthesis.

Fiber

Fiber is a type of carbohydrate that is not digested by the body and has no nutritional value. However, it does play an important role for gastrointestinal and overall health. There are two types of fiber in our diet, soluble and insoluble, with each playing a distinctive role.

Soluble fiber is in fruit, legumes, vegetables and oat bran. It is an absorbent, gel like substance, which helps slow down the movement of food through the upper intestine. This helps in the absorption of nutrients from the food, which passes through the upper intestine. Soluble fibers also assist with the regulation of blood glucose levels and help to lower blood cholesterol levels by removing fat-digesting bile acids from the intestine.

Insoluble fiber, found mostly in unrefined grains and cereals, adds bulk to the food matter passing through the lower intestine thus speeding up the food's passage through the gastrointestinal tract. Conversely, to soluble fiber, insoluble fibers speed up the movement of food through the lower intestine. This effect reduces the amount of time the lower intestine is exposed to certain toxins that might be present in the digested food. This reduces the risk for developing colon cancer and helps prevent constipation.

Insufficient intake of dietary fiber has long-term negative effects, such as increasing one's risk for colon cancer and heart disease and it has immediate negative effects such as constipation. The daily recommendation for fiber is 1.25 grams per 100 calories consumed. The exception to this RDA would be prior to an athletic event to prevent gas or cramping during competition.

Protein

Protein, in the human body, is responsible for tissue repair and growth, functioning of the immune system; it is used to make hormones, enzymes and hemoglobin and is an energy source in prolonged exercise. However, there are many misconceptions and unfounded claims regarding protein. Many athletes believe they need large amounts of protein when, in fact, a normal diet will meet the recommended daily amount. However, the body does not store excess protein as protein. The body either uses it as fuel or converts it to fat. This is one reason excess protein does not benefit the body.

Athletes, especially weightlifters, do need higher protein requirements than sedentary people; they still do not need to load up on it excessively. Just as not enough protein can lead to deficiencies, excess protein can be detrimental as well. Some examples are dehydration, calcium deficiencies due to greater calcium release into the bloodstream to buffer the acid created by protein metabolism and higher fat intake as many foods higher in protein content unfortunately have higher fat content as well.

Compared to carbohydrates, proteins make up approximately fifteen percent of daily dietary needs. Athletes should limit protein intake to ~1.0-2.2 grams per kilogram. The average weightlifter should consume about 2 grams per kilogram of bodyweight. Good sources of protein include egg whites, lean beef and chicken, turkey, tuna and whitefish. Plant proteins contain some, but not all of the nutrients the body needs and therefore, are incomplete proteins. However, they are still good sources of protein when combined with a normal diet. Good examples of a plant protein are beans.

Fats

Fat is a necessary part of the human diet. Fat is not only responsible for fuel but also for the absorption of fat-soluble vitamins A, D, E and K and essential fatty acids can only be obtained from dietary fat –linked to immune system function, gastrointestinal health and overall well being. In addition, fat adds taste and satiety to food. Twenty to thirty percent of total calories should come from fat. However, most of the population of the United States consumes considerably more. This excess fat intake has become a major health issue since diets high in fat are linked to cancer, heart disease, obesity and diabetes. Conversely, other countries in the world that have lower percentages of fat intakes in their diets have lower rates of these same diseases.

How does the human body use fat as fuel? The longer the duration of the sports activity, the more the body depends on fat for its fuel source. This does not mean however, these athletes should increase the daily amount of fat intake. The best way to maximize the availability of fat during exercise is through training and conditioning.

The Three Types of Dietary Fat

Monounsaturated and polyunsaturated are the most beneficial types of fat for lowering blood cholesterol levels and risk of heart disease and hypertension. Monounsaturated and polyunsaturated oils are generally liquid at room temperature, while saturated fats, like butter, are solid at room temperature. When cooking, try to use olive or canola oils, which are monounsaturated or safflower or sunflower oils, which are polyunsaturated.

Saturated fat is the third type of fat. High intake of saturated fats can lead to health issues such as increases in blood cholesterol levels, heart disease, hypertension and cancer. Saturated fat intake should be limited to ten percent of the daily caloric intake. Examples of saturated fats include coconut oil (microwave popcorn and processed cookies), meat and poultry fat (burgers, dark meat chicken and bacon) and dairy fat (cheese, cream and regular fat yogurt).

High cholesterol foods are not linked to high blood cholesterol levels as saturated fats are. Since the human body makes cholesterol, it can adapt and make less cholesterol to maintain the appropriate blood cholesterol levels. Cholesterol should be limited to less than 300mg per day. Foods high in cholesterol include egg yolks, shellfish and fatty meats.

Hydrogenated fats are unsaturated fats that are artificially saturated by heating them them. Hydrogenated fats have two major disadvantages: 1) healthy unsaturated fats are converted into unhealthy saturated fats and 2) they contain trans-fatty acids, which are linked to heart disease. Examples of hydrogenated fats are margarine, vegetable oils such as Crisco and processed foods.

Water

The body's need for water depends on several factors: weather, diet, activity and overall health status. The body needs water because it is 98% water and much of its activity takes place in a watery environment. The body uses water for digestion, lubrication, elimination, recovery from strenuous exercise, transport and thermoregulation and as a medium for cellular activity and pH balance. When the body becomes dehydrated, these processes are compromised and the body can become fatigued, cramped or overheated.

Table 5.3- Daily Hydration Guidelines

Daily Energy Expenditure	Minimum Daily Water Intake
2,000 calories	64-80 ounces
3,000 calories	102-118 ounces
4,000 calories	138-154 ounces
5,000 calories	170-186 ounces
6,000 calories	204-220 ounces

Athletes must be aware of water loss during strenuous activity especially during hot or humid weather and if training at altitude. Thirst is not a good indicator of water needs. The body is already in dehydration at this time. It is best to drink water routinely especially during strenuous activities. Table 5.3 indicates daily hydration guidelines.

Vitamins and Minerals

Vitamins are a group of naturally occurring nutrients found in foods that are required in the diet for the maintenance of health, metabolic functioning growth, recovery and athletic performance. Vitamins are necessary for health and essential in the diet because the body either does not produce them or does not produce them in adequate amounts. If one or more are lacking in the diet, metabolism is affected and symptoms may arise. They are also essential parts of the enzyme system. This means they are not nutrients in themselves but aid and facilitate other body functions. They are involved in the formation of red blood cells, the building of bones and protein metabolism. Some vitamins act as co-enzymes in the energy-releasing chemical reactions in metabolizing carbohydrates and fats. Vitamins however, are not direct sources of energy themselves. Vitamins are divisible in two groups: fat-soluble and water-soluble.

Fat-soluble vitamins are A, D, E, and K. They are soluble in lipid and organic solvents. This lipid solubility allows these vitamins to be stored in large amounts in the liver along with fat. Water-soluble vitamins include the B and C vitamins. The B vitamins act as co-enzymes and are involved in the metabolism of fat, protein and carbohydrates. C vitamins act as antioxidants and are best known for their ability to combat a cold.

Minerals are inorganic substances that are required by the body to function. While minerals are found throughout the body, they make up only four to six percent of it. Minerals are major components of body structures such as bone, muscle and skin. From an athletic point, minerals are just as important as vitamins however, athletes will not benefit from taking mega doses of minerals.

Supplements

Many athletes ask the question “Which supplement is right for me?” The answer to this question applies to each individual and depends on many other factors such as diet, volume and intensity of training, sleep, school or work schedule and family obligations, to name a few. There are however, general guidelines for supplement usage.

There is little, definitive scientific evidence from human studies that supplemental intakes of vitamins and minerals provide significant ergogenic actions above the Recommended Daily Allowance (RDA). However, inadequate intake of many essential nutrients can lead to impaired performance. Optimal intake of nutrients will not overcome deficits in training and consumption of excessive quantities of dietary supplements can be toxic and impair performance. If appropriate, athletes may seek a dietary evaluation from a health professional and food intake patterns can be adjusted if necessary to promote optimal health.

Supplements should only *supplement* a healthy diet. They should not compensate for nor take the place of a nutrition regimen. Supplements may prove helpful for athletes who may need more calories and nutrients, especially during a high volume or intensity phases. However, athletes should remember to be realistic and that there is no “miracle” supplement. Supplements can never take the place of a good nutrition regimen or will not make the athlete better physically.

Meal Plan

As with training, dietary needs and nutrition must be part of the plan. Athletes must try to incorporate all aspects of the food pyramid with the appropriate servings. Due to their rigorous training schedule, many athletes do not have the time to prepare wholesome meals. One suggestion is to make a list of eight to ten breakfasts, lunches, dinners and snacks. This will help to answer the question "what should I make for dinner?" Another suggestion is to batch cook when there is extra time and freeze the contents. This will ensure appropriate meals for a few days.

Often times hunger pains occur at inopportune times. Keep food in strategic places such as in the car, desk, locker room or book bag. Also, eat at appropriate times. After a high intensity workout, try to eat within 45-60 minutes for optimal glycogen store. Other meals should be two to three hours apart. Finally, drink plenty of water. Some research has indicated that dehydration can cause hunger pains.

Before going food shopping it may help to have a "core food" grocery list with items that do not change. This may include fresh and stock items. Having a grocery list will expedite the shopping process and hopefully, make the experience more tolerable.

Pre/Post Exercise

Prior to a workout or competition, athletes should eat foods that they are comfortable digesting. These foods should optimize hydration and not upset the stomach. Typically, foods higher in carbohydrate content and lower in fiber, to avoid any gastrointestinal discomfort, should be emphasized. This may include foods such as toast with jam, fruit, an energy bar or cereal with skim milk. Athletes should avoid large amounts of simple sugars. Due to the fact simple sugars are quickly absorbed into the blood stream through the intestinal wall; they will dramatically alter blood sugar. In addition, insulin is affected. When the body releases insulin, it cannot burn fat. Therefore, simple sugars allow more fat storage and less stamina.

How much food should an athlete, eat? This is an individual decision that the athlete will make based upon his or her own experiences. However, some guidelines indicate 30-40 grams of carbohydrates and 5-10 grams of protein may be appropriate. Under no circumstances should an athlete eat "new foods". The athlete may have a negative reaction to it and this may interfere with performance. New foods should be "tested" only in training.

Following a workout or competition, athletes must restore glycogen levels and re-hydrate to enhance recovery. One does this by eating foods higher in carbohydrate content, especially simple sugars, within 45-60 minutes of the completion of the activity. Research indicates eating foods higher in protein and fat will inhibit the process of recovery and may cause gastric distention in some individuals. Examples of foods higher in simple sugars are high carbohydrate energy drinks, low fat smoothie, fresh fruit or pancakes with syrup.

Recovery

As stated previously, a good diet and hydration will aid in the recovery of training. However, other factors are involved for the best possible recovery. Athletes should try to get at least eight hours of

sleep per night. In addition, athletes may find an afternoon nap may help in recovery during hard training. Coaches may also find active recovery aids in recuperation. This may consist of low volume/low intensity non-specific work in transition periods or on days when athletes are sluggish or mentally unprepared for a rigorous day of training. This may consist of medicine ball work, a flexibility routine, swimming or hydrotherapy or team activities such as volleyball, tennis or hiking.

External aids have also proven to be very helpful in recovery. Historically, massage for weightlifters has shown positive results, not only from a physical aspect but also psychologically. However, the appropriate sports massage and a skilled masseur/masseuse is needed for optimum recovery. The average Swedish massage will do no more than put the elite athlete to sleep with minimal recovery.

Saunas may improve recovery and aid in tolerance for weight loss. In addition, modalities such as electrostimulation and ultrasound have shown positive results. Contrast hydrotherapy, in the form of hot tub to cold dip for various amounts of time, have proven helpful, and although it may take the athlete some time to learn to tolerate this sort of recovery method. Finally, ice and ice massages after workouts and on off days have proven effective.

Travel

When traveling, especially abroad, athletes must be aware of potential problems. One is dehydration. Spending several hours on a plane and traveling across time zones can affect the body negatively. If the athlete is trying to keep his bodyweight up, ample food and drink must be consumed to achieve this. Conversely, if the athlete is trying to lose or monitor bodyweight, he must be cautious not to lose too much. It is not uncommon to lose two kilograms of bodyweight on a transatlantic flight.

Another precaution one may take is for jetlag. Although one cannot prevent jetlag from occurring, there are steps one can take to minimize it. Upon arriving, athletes should try to acclimatize their bodies by adjusting to the current time of day. Athletes should try to eat at normal times. Taking a nap upon arrival should also be discouraged. This will only exacerbate jetlag. The athletes should try to stay awake until their normal bedtime and sleep until their normal wake times. Some athletes may want to have a light training session to awaken the nervous system or to get rid of the stiffness from a long flight or day of travel. It may take two or three days to adjust to the new environment. Some research indicates the body may need the number of days to adjust as the number of time zones crossed. In any event, athletes should try to regulate their lifestyle to the new time zones to expedite recovery for optimal performance for competition.

In summary, caloric consumptions should meet the individual needs of the athlete. Athletes have different caloric needs based upon energy demands, weight gain/loss and the sport that they are competing in. During hard training, extra vitamins, minerals and supplements may help the athletes get through the training session and aid in recovery. Adjusting to the new environment will speed up recovery from jetlag. Nutrition and daily regimen is a very individual component of the athlete. However, all athletes must take responsibility in finding the nutritional plan and recovery methods that will benefit them the most for optimal performance.

Chapter 6

General Physical Preparation

In today's society, increasing pressure on youth to perform and compete at the highest levels at earlier ages forces these young athletes to endure stresses their unprepared bodies cannot manage. Consequently, conditioning and general physical training play a crucial role for the ultimate success in not only the sport of weightlifting but all sports. The main objective of general physical training in a lifter's regime is to increase the athlete's ability to do work and to prepare the athlete for more work and loading in future years (Bompa, 1994). This includes a solid, yet balanced foundation of physical conditioning in endurance, strength, speed, flexibility and other basic factors of fitness (Siff, 1998). In addition, Siff states the athlete should not focus on one sport but compete in a variety of sports that emphasize low volumes of running, jumping, throwing, flexibility and all around conditioning. This requires a great deal of patience from both the coach and athlete. A long-term, well-prepared plan in general physical preparation (GPP) will help to ensure the success of high performance training in later years. However, for the beginning athlete, the focus of training should be on acquiring basic and tactical skills in a fun and supportive environment while downplaying the competitive aspects of sport (Balyi, 2000).

Because the goal of youngsters is basic skill acquisition and overall preparation, athletes are encouraged to participate in a variety of sports including gymnastics and track and field. These two sports are considered the basic sports for all other sports because they develop general movement skills for other sports including agility, balance, coordination and speed (the abc's of athleticism) as well as the basic skills of running, jumping and throwing (Balyi, 2000).

According to Drabik (1996), Dvorkin (1992) and Nadori (1989), GPP with junior weightlifting athletes usually begins between the ages of 11 and 14 with 70-80% of the time spent on GPP and the remaining 20-30% on the technical aspects of the sport. Dvorkin (1992) continues to say athletes between the ages of 14 and 17 should devote 45-50% to GPP; athletes between the ages of 17 and 20 should devote 30-35% to GPP and athletes older than twenty should devote 20-25% to GPP. As athletes get older, GPP exercises should become more specific to weightlifting training i.e. jumping, bounding, sprinting, medicine ball and shot/kettle bell throwing.

Physical Development in the Early Years

Too often, children's sports programs mirror those of adults. In addition to gross physical differences, there are neuromuscular, psychological and emotional differences. According to Bompa (1995), the best way for youngsters to develop basic and perceptual motor skills and fitness are to practice them in a fun, non-stressful, non-threatening environment. Some children today participate in sports for ten months throughout the year. This competitive environment does not allow children to practice the skills needed

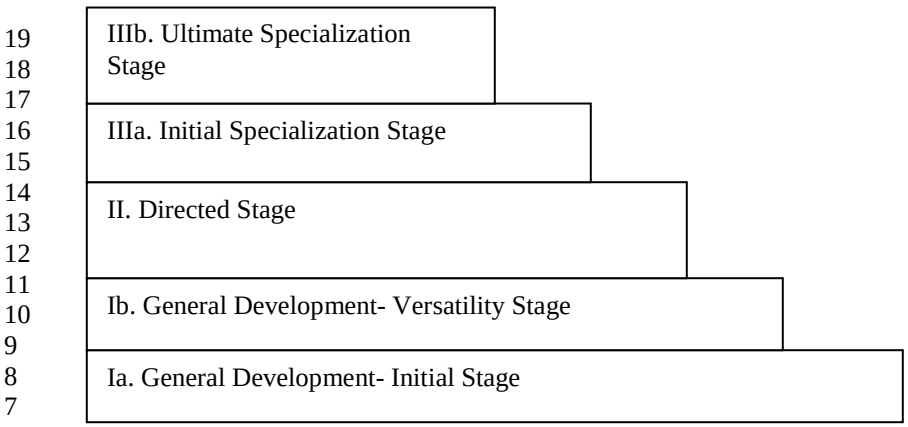
to become a better athlete. During competitive games, children are applying, not developing, their skills in order to win (Bompa, 1995).

In the human organism, there likely are sensitive periods of individual development when morphological, psychological, emotional and neuromuscular qualities develop optimally (Nadori, 1989). In weightlifting, these sensitive periods of development include the physical abilities of strength (maximum, speed-strength, endurance) and coordination (equilibrium, rhythm, kinesthetic awareness) (Nadori, 1989). Drabik (1996) adds coaches should take advantage of these sensitive periods, as the development of the particular ability will accelerate. For example, motor skill development is at its highest between the ages of 9-12 for males and 8-11 for females (Balyi, 2000). Nadori (1989) also states, that one of the preconditions of successful strength performance is the balanced development of the skeletal muscles, especially those of the trunk.

In the early years of training, wall bars, medicine balls, dumbbells and throws with both hands accentuate the development of the erector spinae and the abdominal muscles (Nadori, 1989). These activities strengthen the core, protect the vertebral column and assist in coordination. Furthermore, the gradual development of the gluteals, iliopsoas and the rectus abdominus by including rope climbing, hanging leg raises, plyometrics and bodyweight exercises is significant. Nadori (1989), states including bodyweight exercises are vital because the body must be prepared for bearing great loads before applying great resistances.

Although GPP makes up most of the work in a beginning athletes curriculum, some technical work should be included. Resistance should be lower, repetitions should be higher and the focus should be on learning and perfecting the technical aspect of the movements. This will help the athlete with specific strength, speed and coordination. In addition, the feedback between the nervous system and physical training plays a vital role in a person's adaptation to loads, which in turn, create new coordinations (Drabik, 1996).

Figure 6.1



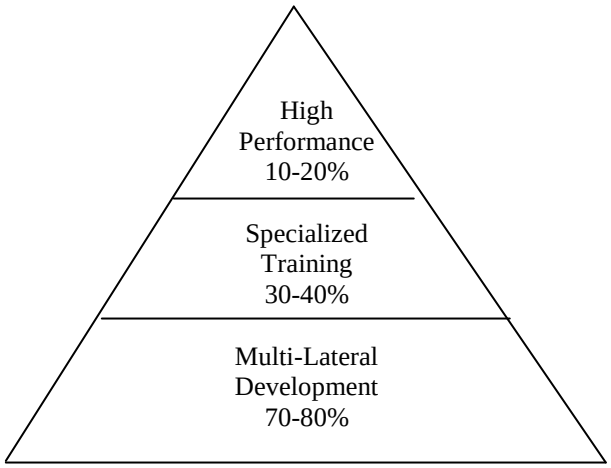
System of youth sports training in Poland and its division into stages (Drabik, 1996).

Because the movements in weightlifting have a high neural component, efficient weightlifting technique requires an above average sense of equilibrium and rhythm (Nadori, 1989). Lifters with excellent technique have a very smooth and graceful technique and energy expenditure is optimal. In other words, the lifter is not wasting any energy. Beginning the weightlifting movements at a young age with correct technique, helps to ensure a biomechanically efficient movement throughout the lifter's career. Furthermore, neural adaptation not hypertrophy seems to be the contributing factor with strength gains, especially with beginning athletes.

Stressing a Multi-Lateral Approach to Development

As the young athlete is growing and developing, the program will eventually taper towards sport specificity in post puberty. The general physical training curriculum helps to ensure these young athletes contain the basic and fundamental skills needed for high performance. Several authors, Balyi (2000), Bompa (1994) and Vermeil (1998) agree a sequential approach to training is desirable. Figure 6.2 below shows this approach to training.

Figure 6.2 The main phases of athletic training

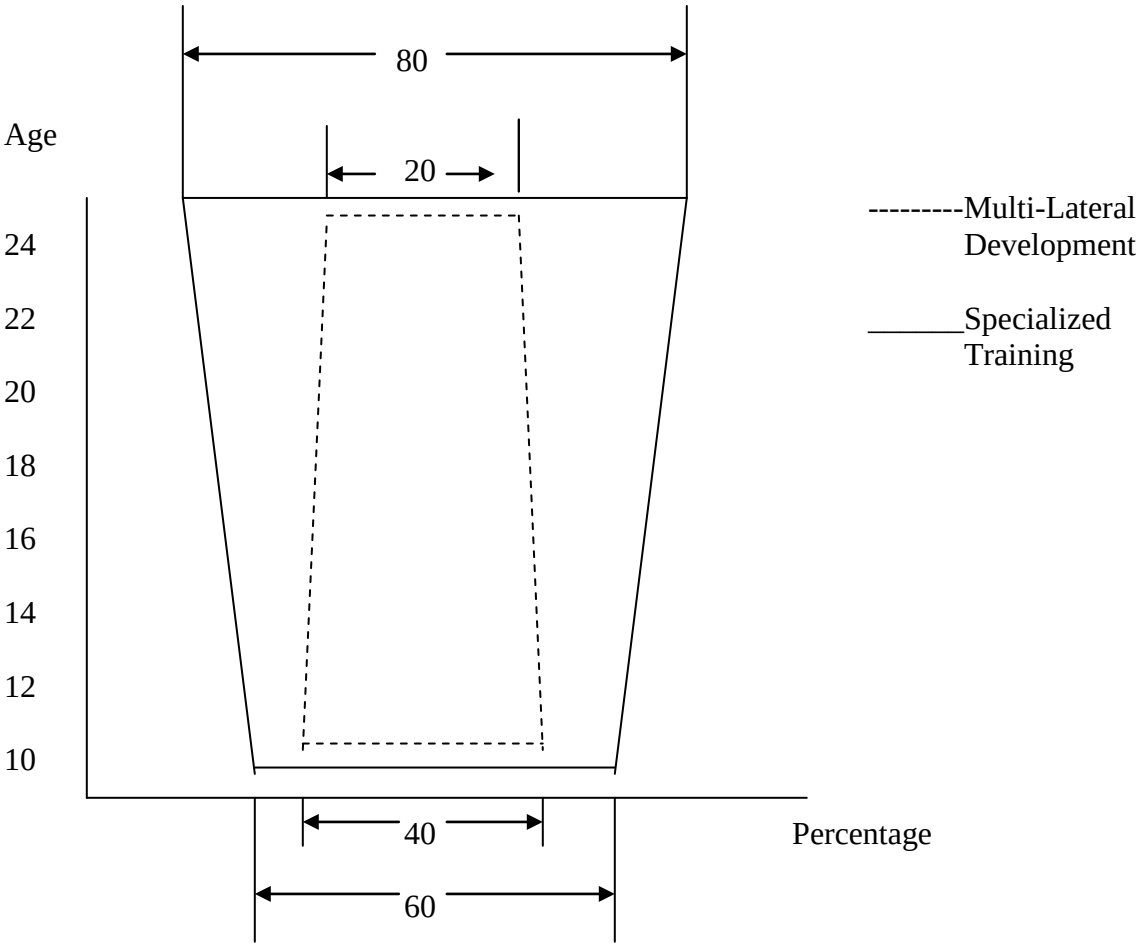


The base of the pyramid emphasizes GPP through multi-lateral development. When the athlete then reaches an acceptable level, especially with physical maturation and development, the athlete enters the second level, specialized training. After several years in the second stage, the athlete eventually graduates to the final stage, high performance (Bompa, 1994).

The myriad changes that take place during and following training are interdependent. Regardless of the nature and motor requirements of an exercise, there is always input from several systems, biomotor abilities and psychological traits (Bompa, 1994). Therefore, in the early stages of training, the coach should consider an approach directed towards proper functional development of the body (Bompa, 1994). The structural and functional abilities must be at a high level in order to perform the higher-level technical and tactical skills of sport. The road to specialization and athletic mastery is functionally based on multi-lateral development (Bompa, 1994). How much specialization and at what

age depends on the individual athlete. Figure 6.3 is a theoretical graph depicting age and percentage of specialization (Bompa, 1994). It essentially reiterates the triangle from the previous page only in more detail. There is a high percentage of GPP at an early age and as the athlete gets older, the training becomes more specialized.

Figure 6.3 The ratio between multi-lateral development and specialized training for different ages



Early specialization and multi-lateral development has been the subject of several studies. In a longitudinal study of 14 years in the former East Germany (Harre, 1982), a large group of 9-12 year old children was divided into two groups. One group's training program was very specialized to a given sport. The second group's program was a generalized program, where in addition to specific skills and physical training, children were exposed to a high variety of other sports skills and overall physical training. Table 6.1 shows the results of the study, indicating that a strong foundation leads to athletic success.

Table 6.1 Comparison between Early Specialization and Multi-Lateral Development

Training Philosophy	
Early Specialization	**Multi-Lateral Program**
• Quick performance improvement	• Slower performance improvement
• Best performances at 15-16 years	• Best performances at 18 and older
• Inconsistent competition performance	• Consistent and positive performances at competitions
• At 18 years, many athletes burnt out and quit the sport	• Much longer athletic life
• Injury prone	• Fewer injuries

An example of a lifter who had multi-lateral development in his early years before specializing in weightlifting was World and Olympic Champion, Yurik Vardanian. According to Dvorkin, Vardanian played volleyball, soccer and engaged in track and field, where he achieved high results, before he began weightlifting. Dvorkin (1992), goes on to express that a proportional development of physical qualities is realized when the educational training process is structured in such a way that one avoids premature "narrow specialization" in the junior athletes training. How then does one develop these general physical qualities?

GPP- The Process

General physical preparation can be divided into three areas of development:

- Developmental- development of general physical qualities
- "Pre-hab"/Rehab- addressing specific physical issues
- Sport Specificity- increasing the advancing lifter's capacity for work through weightlifting specific training

Development of General Physical Qualities

Following are five general physical qualities, which help in the development of all athletes. Understanding and applying these qualities are vital in the growth of a weightlifter.

1. *Speed-Strength*: In weightlifting, speed-strength is a basic physical quality. According to Dvorkin (1992), the development of speed-strength is extremely important, from the very beginning in weightlifting training. Because the qualities of weightlifting deal with maximum power output against heavy loads, it is associated with high power or a high rate of doing work (Siff, 1998). The resulting quantity is what distinguishes speed-strength activities from all other types of sport: a very high power output compared with other activities, which are longer in duration and have lower intensities (Siff, 1998). Finally, Verkhoshansky (1988) writes that a systematic sports training regimen contributes to the

formation of a high correlation between strength and the rate of muscle contraction and absolute strength is the primary factor in determining the speed of movement.

Young athletes can begin training these qualities as early as the ages of seven and nine. Because the neuromuscular system is most malleable between these ages, working it will reflect success in later years (Balyi, 2000). Activities high in speed-strength qualities are sprinting, vertical and horizontal jumps, especially triple jump, sports games emphasizing spring, jumping, throwing and change of direction, and basic barbell exercises, using 30-60% of a 1 repetition maximum, like squatting, snatching and clean & jerks. All weightlifters can benefit from this type of initial training.

2. *Flexibility and Mobility*: Outside of physical limitations, factors such as age, gender, body type, laterality and training all influence flexibility. Flexibility and a regimented stretching program are grossly overlooked in the development of the athlete. According to Adler (1996), small children are quite supple during the school years then flexibility decreases until about puberty, and then will increase throughout adolescence. After adolescence, flexibility tends to level off and then begins to decrease. However, for athletes who maintain a regimented flexibility routine throughout their training, it appears decreases in flexibility are minimized (Adler, 1996). Superior flexibility in weightlifting will be advantageous to the lifter due to the positions of the competition lifts. It will assist with dexterity, coordination and confidence in the low receiving positions. Exercises that will help with flexibility are dynamic range of motion exercises, yoga, gymnastics or tumbling type movements and mandatory warm up and cool down periods.

Michael Butler cleans 177.5 kilograms

3. *Kinesthetic Awareness and Agility Qualities*: The ability to understand where one's body is in space depends largely on proprioceptors in the muscles, connective tissues and joints to integrate this information from these areas with the senses of balance and touch (Siff, 1998). Agility or dexterity is the ease with which an athlete performs a given task (Drabik, 1996). The relationship of both these qualities are extremely important in sports such as gymnastics, diving, tumbling and weightlifting. The athlete's ability to quickly assimilate motor habits, perfect them, and quickly apply them is a quality all elite athletes seem to possess. Many of these superior athletes begin to perfect these qualities at a very young age when the nervous system is impressionable and adaptable. Team games, obstacle courses, movement drills such as carioca, side shuffling and

bounding, twisting, turning and tumbling movements and balance activities will assist the young athlete in perfecting kinesthetic awareness and agility.

4. *General Strength*: Categorizations of three different, specific types of strength training are maximal strength, power and strength-endurance. Some authors have further divided power into reactive ability, explosive strength, strength-speed and speed-strength. Although several of these have their place in weightlifting training and have even been discussed previously in this manual, this section will concentrate on the three main types of strength training methods below.

   - *Relative Strength*: One definition of relative strength is the amount of strength per unit of body mass. Relative strength is important in sports where there are weight categories like wrestling, judo and weightlifting. It pits athletes of approximately the same bodyweight against each other. Relative strength is also important in sports such as gymnastics or sports, which use similar apparatus. Athletes who excel in bodyweight to mass ratios, or who are good at bodyweight exercises, have good relative strength. They have a good base of strength development and are very efficient in their movements. On the other hand, these exercises may rely on strength per kilogram but they are not special in improving it. An example of how to increase relative strength are with bodyweight exercises such as single leg squats or lunges, dips, kips, pull-ups, push-ups, handstands and rope climbing. These exercises lay the foundation for future success.

   - *Hypertrophy/Work Capacity*: The sub-maximal resistance method, or hypertrophy, focuses on increasing muscle fiber diameter. This type of training uses intensities in the range of 60-80% of 1RM. Because the focus of weightlifters is performance, hypertrophy is merely a by-product of training, and not the main focus. Hypertrophy training however, should not be totally disregarded, as this type of training may be appropriate at certain times during the training cycle. Dvorkin (1992) states that increases in muscle fiber diameter lead to higher results in the total. In addition, higher percentages of muscle mass lead to positive metabolic changes.

     Work capacity training is also valuable in a developing athlete's program. Circuit training methods provide an excellent starting point for many beginning athletes as well as those returning from injury or layoff. Circuit

training, with an emphasis on strength development and utilizing different means of resistance, can provide a solid base program. One may include medicine balls, dumbbells, barbells, bodyweight exercises and a special emphasis on the core of the body.

- *Core Strength and Stability*: Core strength and stability is integral in all sports. Both must increase simultaneously with general strength development. Emphasis should be on performing a full range of motion to promote joint mobility and muscular flexibility. Weightlifting movements, such as the snatch and clean, develop core strength while other exercises may enhance core strength.

  It is also a necessity to focus on the stability of the stomach and back versus over emphasizing abdominal flexion. Failure to give attention to core stability gives way to limited force production and an increased chance of injury. When increasing loads with athletes, muscular strength increases faster than passive tissue and vertebral discs take even longer to adapt to increasing loads (Grieves, 1986).

2000 Olympic Gold Medalist Hossein Rezazadeh

  Before progressing young athletes, they should achieve certain core strength and stability levels before loading to assist in the prevention of injuries. Coaches can test athletes with general core strength tests, which have established norms. Athletes can increase strength and stability with gross, dynamic body movements with medicine balls, on the floor and from wall bars. Static holding exercises in the prone, supine and lateral positions in addition to addressing all aspects of the system; anterior, posterior and transverse (Gattone, 2002).

5. *Body Composition and Fitness*: From the beginning, it is essential coaches teach their athletes the importance of nutrition and fitness. Weightlifting is a demanding sport and neglecting either of these issues may lead to poor training, performance or injury. Regardless of weight category, fat does not contract! Below are five suggested training parameters for anaerobic endurance (Bompa, 1994).

   - *Intensity*: Typically measured as a percentage of the athlete's one repetition maximum. May range from sub-maximal to maximal. Typically, though, a

training program employs a variation of intensities with the emphasis towards higher percentages.

- *Duration*: In weightlifting training, work time is usually between 5-60 seconds.

- *Rest Interval*: Following an activity, which was very high intensity, the rest interval must be long enough to replenish the oxygen debt. Because the interval of recuperation is a function of the intensity and duration of work, it may be within the limits of 2-10 minutes.

- *Activity During Rest*: Activity must be minimal and relaxing. Athletes should focus on preparing themselves for the next set.

- *Number of Repetitions*: Throughout most of the training program, the majority of repetitions will be in the 2-6 range. However, during preparation periods, the repetitions may be between 5-10.

School age athlete Michael Martin

Activities that will aid in fitness levels include medicine ball circuits, tempo runs or sprinting, bodyweight circuits and sports games. Also, exercises that use large muscle groups emphasizing higher repetitions with controlled rest periods. Training within these parameters will help ensure body composition and fitness levels.

Pre-hab/Rehab: Addressing Specific Physical Issues

Before beginning any type of physical activity or regimented program, the athlete should acquire a pre-participation screen or a physical from a physician. Then, after sharing these results with the coach, the coach can administer an assessment. The assessment should include the needs or characteristics of the sport. Following the assessment, the coach can then determine an appropriate program. Newton (2002) suggest steps to include in program design are:

- Determine key performance characteristics (needs analysis)
- Conduct testing
- Design a training program
- Implement the program
- Follow-up assessments, which will lead to a re-design of the program

This will give the coach an opportunity to identify potential problems through evaluation and history *before* problems occur. This is especially true with joints, structures and soft tissue in critical areas like the wrists, shoulders, back/core and knees.

In addition to a needs analysis, the program should also consider the individual athlete. Individualization refers to the fact that each athlete, based on several factors, will respond differently to any given training program. The coach must consider each athlete at the individual level and make appropriate adjustments. When designing training programs the coach must consider several factors that will affect one's individual capacity for training. These factors include:

- Age (chronological and biological), body composition and bodyweight
- Training history: How long has this individual been training, in terms of weeks, months or years of training? The previous experience should dictate the amount of work.
- Individual differences in work capacity: Individuals capable of similar performance will have differences in ability to perform work
- The ability to recover from training: Many factors outside of training affect the rate of recovery such as stresses from work, school or social environment

Medvedyev (1965) adds a unified, rational (generic) distribution of training is recommended only for novices. The means for qualified athletes should only be planned *individually*. What are some of the tools necessary to construct an individualized, comprehensive training program?

1. Postural/Structural: General spinal observation, Adams Test and a press-up test.
2. Flexibility/Mobility: Hamstring, quadriceps, low back, shoulders, wrists, Achilles and gastrocnemius. Functional mobility tests include squatting, lunging, overhead squatting and pressing and a comfortable "rack" position.
3. Stability: A support (eyes closed) or bridge, side support, prone support and a static back extension.
4. Muscular imbalances: One and two leg vertical and horizontal jumps and single leg squats
5. Weightlifting ratios off one repetition maximums:
   - Snatch approximately 65% +/- 2% of squat and
   - Clean & jerk approximately 80% +/- 2% of squat
   - Decide on the percent of strength work vs. percent of technique work
   - Decide on the percent of snatch work vs. percent of clean & jerk work
6. Technical analysis: Identify and work on poor or technically incorrect or inefficient portions of the lifts.

Danica Rue snatches 87.5 kilos

Once the coach addresses these issues, a comprehensive and effective program is implemented. The program, however, should not end there. There should be constant revisions and changes to accommodate new issues. After an injury, an aggressive rehabilitation regime must be

incorporated. Following rehab, the coach should make sure the athlete continues to address the injury. Although the pain is gone, the dysfunction may persist. Consequently, by being proactive, the chance of recurrence will Danica Rue snatches 87.5 kilos decrease.

Sport Specificity Training

Increasing the advancing lifter's capacity for work through weightlifting specific training is integral but only after the proper foundation is in place. This foundation is created by general physical preparation. The main objective of sport specific training (SST) is to further the athlete's physical development in regards to the physiological and methodical characteristics of the sport (Bompa, 1994). When athletes reach these higher levels of training, a higher level of physiological specialization is also predominant (Bompa, 1994). Yakovlev (1967) claims that an organism, which was previously fortified and strengthened would develop to high physiological levels more readily. Consequently, the improvement of specific endurance may be enhanced if training programs to achieve such capacity are preceded by the development of general endurance (Bompa, 1994).

Dr. Mike Stone, Head of Physiology of the United States Olympic Committee and coach of several world-class athletes, observes that "...Weightlifters typically reflect measures of cardio respiratory (heart and lungs) fitness, which are superior to average values and suggest beneficial adaptations have taken place." He goes on, "...Evidence does exist suggesting that training to improve aerobic power/endurance using typical methods such as jogging will compromise maximum strength and power thus reducing weightlifting performance. Training to enhance endurance and recovery capabilities (as well as strength and speed) for weightlifting should be performed in as specific manner. A program of interval training or high volume weightlifting can increase endurance capabilities with little or no compromise in strength and power, compared to a typical aerobic endurance program."

During SST, the amount of GPP is approximately 30-40%, according to the performance triangle in figure 6.2. This means that most of the training will be on the classical lifts and their derivatives, squatting, pulling and specific overhead work. If the lifter has made the commitment to the sport, the coach can introduce two a day training sessions. This type of training entails higher volumes of training and lower intensities. If the coach does not make these adjustments, the lifter risks the chance of over reaching or over training leading to poor training and competitions performance.

Oscar Chaplin III snatches 162.5

In conclusion, a comprehensive, well-planned training program has many influences. However, it is apparent, that a solid foundation of strength, general development and coordination are the cornerstones to future success. The coach must have patience and nurture his athletes from novice to elite levels. With this regimen in place, the chance of a long and prosperous weightlifting career is apparent.

Chapter 7

Strength and Power Training Principles

In order to make good decisions regarding training methods and philosophies it is crucial that one should have a sound working knowledge of several key principles that form the basis for strength and power production in the human body. It is not our intention here to provide a comprehensive text on exercise physiology. The information here provides a reference point and introduces some basic concepts and principles of exercises science.

Definitions

Strength is the capacity to utilize muscular activity initiated by the nervous system to generate force against an external force or load. Strength is an essential component in all aspects of human performance. Strength is demonstrated in performance in three distinct but related qualities; maximal strength, power and muscular endurance.

Siff and Verkhoshansky define **Maximal strength** as the ability of a particular group of muscles to produce a maximal voluntary contraction against an external load. In training, this refers to a 1RM or one-repetition max. In competition, the maximal strength demonstrated is often more than the maximal strength demonstrated in training. **Relative strength** is the strength per unit of body mass. It becomes very important in sports where athletes must overcome their own body weight, such as running and jumping events in track and field and in gymnastics or in sports that have body weight classes such as weightlifting and wrestling. **Isometric strength** or static strength is strength demonstrated while there is no change in the length of the involved muscles. This is very important in joint stabilization. **Eccentric strength** is strength demonstrated during a lengthening of the involved muscle or muscle group. This becomes very important in one's ability to decelerate and make a rapid change of direction. One area where eccentric strength is important is in the body's ability to absorb force, which is crucial in avoiding many injuries.

Shane Hamman doing clean pulls

Power, which Verkhoshansky has further described as strength-speed or speed-strength, is the ability to overcome external resistance at a high rate of speed in a given unit of time (Force x Velocity). It is the product of speed and strength and is demonstrated in sport by quick accelerations of the body or body part; or velocity applied by the body to an object (such as a barbell, ball, javelin or racquet) or to an opponent. The ability to generate high levels of

power is of paramount importance for the proper performance of most sport techniques in both team and individual sports. Even sports, traditionally classified as endurance type sports such as soccer, have certain aspects where power plays a critical role. MacDougall and others have shown there is a high correlation between peak power and athletic performance.

Hartmann has further described two special forms of power as explosive power and starting power. The ability to develop power is an important factor in speed of execution in track and field, combat sports and other sprint type events such as speed skating and cycling.

Explosive power, which is also termed **explosive strength**, refers to the rate of force development or the ability to generate maximal muscle tension in a very short time (less than 250 milliseconds). This quality is vital in many sports.

Starting power, also referred to as **starting strength,** is the ability to develop the greatest possible force at the initial moment of force application. Schmidtbleicher has stated that starting power is a component of explosive power and has a significant influence on the overall force-time curve.

Work capacity, also referred to as **strength endurance,** is the capacity to maintain an efficient level of muscular performance over a relatively long duration. According to Bompa, strength endurance is either static or dynamic in nature and the amount of muscular force required can be either large or moderate.

Muscular Factors Relating to Strength and Power

Hypertrophy
Muscle hypertrophy, or an increase in the cross-sectional diameter of the individual muscle fiber, represents the mechanical basis for increased strength. Simply put, a thicker fiber can create more tension that a thinner fiber. With resistance training, there is an increase in muscle fiber cross section if the load is sufficient. An increase in maximal strength typically accompanies this. There is evidence in studies by Hakinnen that the use of explosive power training movements promotes hypertrophy primarily in the Type II or fast twitch fibers.

Fiber Type
Human muscle consists of a mixture of slow-twitch fibers and fast twitch fibers. The slow–twitch (ST) or Type I fibers are best suited for low force, longer duration situations such as postural control and endurance activities. The fast twitch (FT) or Type II fibers contract much faster and generate greater peak force. Fast twitch fibers subdivide into a fatigue resistant type and a fatigable type.

Central Nervous System Factors Relating to Strength and Power

Motor nerves, which control physical movement, stimulate muscle fibers. Each motor nerve cell controls many muscle fibers. This nerve and fiber group is a motor unit. All

motor units are comprised of the same fiber type (either entirely FT or ST fibers). Many motor units make up a muscle. All muscle fibers in a motor unit will contract and relax at about the same time. This is referred to as the all-or-none principle. This neural stimulation is related to two basic adaptive effects in the body:

- Functional muscular action (functional effect)
- Muscle hypertrophy (structural effect)

In the sport of weightlifting, coaches are mainly concerned with the functional effect. The structural effect will increase over time however, it is not the primary goal of training; the primary focus is on performance.

When performing different athletic movements a wide range of forces are required depending on the movement and the situation. The athlete's ability to grade or vary the force application is an important factor in proper movement. Concerning these factors, we will limit the scope of our discussion to the following areas, which result in neuromuscular adaptation: intramuscular and intermuscular coordination.

Intramuscular Coordination

The amount of force produced during a muscle contraction can be varied or graded by:

1. Varying the number of motor units involved in the movement
2. By changing the frequency at which the motor nerves fire. This is motor unit recruitment and frequency coding, respectively.

These two factors are most important in the gradation of force. The grading of force during most types of human movement follows Henneman's size principle. The smaller, slower motor units deal with low force demands, and as the force-required increases, the larger, faster motor units (FT) come into play.

Highly trained power athletes, such as weightlifters, wrestlers and shot putters are able to activate or recruit a high level of their available motor pool in a short period, thus generating great force.

Intermuscular Coordination

Most athletic movement requires complex coordination and efficiency of numerous muscle groups. There must be coordination between the muscles responsible for movement through contraction, the agonists or prime movers, and the muscles responsible for opposing movement, the antagonists. As we consider complex movement, it becomes obvious that we must have precisely timed contraction and relaxation of opposing muscle groups to provide smooth, fluid movement. This becomes even more important during powerful, high-speed movement.

With this in mind, it becomes most important that the training of athletes involve strength training and power movements that require complex coordination in muscle activation and movement patterns similar to what is required in their particular sport. This is a dilemma with many selectorized machines in that they train muscles and not movements.

Adaptation to Strength and Power Training

In all types of training, the objective is to create positive adaptations in the body that will allow for increased performance. These adaptations are the result of a specific stress placed upon the body through training. The type of adaptation necessary to result in improved performance should dictate the type of training.

Based on the above discussion, determination of performance potential in strength and power has several adaptations. These include:

- Increased fiber diameter (hypertrophy)
- Improved intramuscular coordination (recruitment and frequency coding)
- Improved intermuscular coordination (synchronization)

Training adaptation will depend upon several factors such as the current trained state of the athlete, the type of training employed and the movement pattern similarity of the training exercise to the actual event or task performed.

Garhammer has shown that the power output produced during explosive lifts such as the clean, snatch and jerk are up to ten times greater that the power output of traditional high force/ low velocity movements such as the bench, back squat and dead lift.

Research has shown that high power-type training will produce adaptations in rate of force development, peak power and speed. Studies by Stone have shown that when power training with traditional high force/low velocity exercise, the result is more positive than when utilizing only one of the training methods.

Methods for Training Power

The concept of power has to do with developing large forces at high rates of speed. This can be very specific but generally, one can divide power into two areas of movement. The first is speed-strength where the importance is on speed of movement against a relatively small resistance. The second case is strength-speed where there is a quick application of force against a large resistance. The two cases will dictate different combinations of the various power-training methods.

Power training with free weights represents one of the classical methods used for improving power, and specifically strength-speed. Here the emphasis is on moving the weights as fast as possible with as much force as possible. Technique is of the utmost importance so these movements are safe and effective. Generally, this type of training characterizes intensities in the range of 50-85% of 1RM. Athletes who encounter greater

resistance situations in their sport would train near the higher end of the intensity range. Depending on overall workload, 4 to 6 sets are suitable. At the lower intensity range, 6 to 10 repetitions are appropriate where as at the upper intensity range 4 to 6 repetitions are fitting. Higher repetitions and sets will be more metabolic in nature while lower reps and sets have a more neural effect.

Ballistic Training represents a training situation where the athlete is overcoming a small resistance at a high speed of movement. The emphasis is on dynamic movement with continuous acceleration throughout the range of motion. This training improves the coordination between agonists and antagonists. Common examples of this type of training involve the use of medicine balls, heavy shots or kettle bells. Here, the work is in the range of 3 to 5 sets of 10 to 20 repetitions with emphasis on fast and explosive speed of movement. The exercises can either emphasize strength (lower reps) or power endurance (higher reps).

Plyometric training is a method of training used to improve explosive strength and reactive ability. It utilizes a rapid stretching or loading of the muscles followed immediately by a maximal voluntary contraction of the same muscles. The most common applications of this method are in the use of depth jumps and medicine balls. These training methods have become very popular in recent years and seem to be the center of much controversy. This method is often misapplied or misused. This type of training has a large effect on the neuromuscular system, and can be very fatiguing to the nervous system. Proper loading is important to avoid overuse and excess fatigue.

Proper technique is crucial in realizing the benefits of plyometric training. It is vital the athlete receives the force of landing or catching in a pre-stretched position. In other words, the legs or arms are slightly bent and the athlete should endeavor to overcome the load as quickly as possible. For example, in landing from a depth jump, the athlete should minimize ground contact time and should start the jump even before touching the ground. The inability of the athlete to absorb the forces can result in injury. Proper preparation of the athlete is most important in avoiding these types of injuries. A preparation period utilizing general physical development training such as low impact jumps, ankle jumps, jump rope, and core, leg and hip strengthening is important in avoiding injury with this type of training.

Division of plyometrics into low impact and high impact exercises is common. Movements such as skipping, jumping rope, low hops, bounds, and certain medicine ball training movements are low impact exercises. Movements such as standing long and triple jumps, jumps over and off higher boxes (greater than 20”), heavy medicine ball

throws, drop jumps and reactive jumps are high impact exercises and may cause more stress on the body.

Generally, number of foot contacts signifies volume and intensity represents the degree of force on impact. Number of repetitions can vary from three sets of five jumps for high impact depth from a moderate height to a ceiling of 300 contacts for low impact jumps or light medicine ball work. The rest interval can vary from two to ten minutes, with the most intense jumps requiring the most rest.

It is important to note that although the use of this type of training with younger athletes (12-13 year olds) is appropriate, only the lower intensity jumps and throws are useful for the first 2-3 months.

Factors Limiting Strength Production

Trainability refers to the potential an athlete has to develop strength through weightlifting. A large part of this potential depends upon genetics and the amount of prior training. Genetic factors determine the distribution of fast twitch muscle fibers, potential for hypertrophy, lever system and metabolic efficiency. Prior training refers to the amount of specialized weightlifting training an athlete possesses.

Neuromuscular efficiency relates to how well an athlete uses his body. Intramuscular and intermuscular coordination play a large role in this process. The more coordinated an athlete is the more efficient the movement will be.

Biomechanical efficiency refers to how competently an athlete can complete a movement or series of movements. Biomechanical efficiency is closely related to neuromuscular efficiency.

Success in weightlifting depends greatly on **psychological factors** such as motivation, concentration, aggression, focus, attitude and the ability to deal with anxiety. Being physically prepared will not make up for psychological deficiencies during competition. If an athlete has psychological deficits, the coach or athlete may want to solicit outside resources.

Pain, or the **fear of pain**, may influence training performance. A serious injury may influence force production, which is critical in weightlifting. The coach however, must differentiate between injury, fatigue or motivation to train. Fatigue will affect the athlete psychologically and attitude affects motivation. Conversely, training on an injury may exacerbate the injury or increase the chance of another related injury.

Fatigue determines one's ability to sustain a specific type of effort. Rapid fatigue is induced by the maximal and near-maximal efforts associated with sports such as weightlifting. **Recovery** is the body's ability to return to homeostasis. The two terms have a close correlation:

- The more fatigue which is present the more time is needed for recovery

- The athlete must sometimes overcome fatigue and perform at a maximal level
- Recovery therefore, is of utmost importance for all athletes

Principles for Sport Preparation

In all sports, factors other than training affect performance. Further, the success of a training program is directly linked to the philosophy of the author. Meaning, the coach has the largest influence on the outcome of an athlete's performance. Below are several principles, which may assist in the construction of a training program.

All-around development or **general physical preparation** can be described as building a foundation for future performance. This was discussed in detail in chapter six.

In the Club Coach Course, Matveyev's principle of **progressive overload** was introduced. This principle entails the systematic increase of training load over time in accordance with the individual's capacity. In all aspects, including strength, skill and strategy the athlete moves from easy to difficult. This type of base prepares the athlete for positive results in the future.

In chapter two, the three stages of **skill acquisition** were discussed. These include the cognitive, associative and autonomic stages. Please refer to this chapter for a review.

Early in the training process, the coach should emphasize **visualization**. Athletes may find mental imagery, or visualizing the lift beforehand, helpful. In addition, watching fellow lifters, video and understanding the kinesiology involved, may also assist the lifter.

Once at a certain level of performance, the athlete must begin specialized training for that particular sport. This is commonly referred to as **specialization**. This type of training should not be at the beginning of the athlete's career but when the athlete has made a commitment to the sport and is ready for a higher level of training. Further, the athlete will need a foundation for this training spurred by general physical preparation. Specialized training includes exercises that perfect the motor skills involved, tactics used and understanding the arena in which one competes. In addition, training in similar conditions in which the competition is to take place will assist in performance. When however, should specialized training begin? Please see chart 7.1.

Chart 7.1

Sport	Begin Sport	Specialization Age	High Performance
Basketball	7-8	10-12	20-25
Diving	5-6	8-10	18-22
Figure Skating	5-6	8-10	16-20

Gymnastics (F)	4-5	10-11	14-18
Gymnastics (M)	5-6	12-14	18-24
Skiing	6-7	10-11	20-24
Swimming	3-7	10-12	14-18
Tennis	6-8	12-14	22-25
Wrestling	10-11	15-16	24-28
Weightlifting	10-12	17-18	21-28

In addition to specialization, the coach must incorporate **individualized** training. All athletes are different. Their training programs must reflect these individual differences for optimal performance. Individual programs are essential from the beginning of training to the elite level.

The above stated principles are all part of **structured training**. A common industry saying in weightlifting states: "Failing to plan means planning to fail"! From day one, athletes must have a structured, well-prepared plan. Structure, more commonly referred to as periodization, should include the short-term as well as the long-term. For a daily plan this includes an introduction, where the coach and athlete discuss the training goals for that day, a general and specific warm up, the specific training period and finishing with stretching, mobility and recovery. A long-term plan includes laying out several weeks of training including intensities, volumes, training days, competitions and any other vial information. This type of a structured plan breeds success from the beginning.

Chapter 8

Technique of the Olympic Lifts

The description and discussion of standardized technique for the snatch and clean & jerk is written in chapters five and six of the Club Coach Manual. Further support for this philosophy is in the general physical preparation chapter and in the more advanced biomechanical principle's chapter governing technique outlined in this manual. Of enormous benefit to all coaching is to observe elite lifters in action. This can be either in a “live” situation or by using video. The video gives the coach the opportunity to slow down the movement to observe key positions and actions in more detail. In many instances, the movements are so fast and explosive the coach will require the aid of external devices. This chapter will address some of the finer points or subtler techniques, which may enable our athletes to apply force more efficiently.

The Dynamic Start

In our coaching philosophy, it is sound practice to employ a **static**, well-balanced starting position, which many coaches refer to as the “get set” position. Here, the lifter pauses for a few seconds before lifting the barbell from the platform. This static start has its advantages, especially early in a lifter's career. These advantages include:

a) It is easy to ensure that the lifter is in a sound mechanical position.
b) It is safe, and ensures a good start.
c) It is not complicated.
d) It is easy to learn.
e) It works.

However, for many years the very best weightlifters in the world have not employed this static starting position. They have preceded the lifting of the barbell from the platform by preliminary movements. Coaches refer to this start with a preliminary movement the **dynamic start**. The lifter using the dynamic start accelerates the body or various segments of the body before actually lifting the barbell. The lifter is able to take advantage of the stretch reflex mechanism within the muscles to exert force. The lifter overcomes the inertia of his body. By pushing the feet against the platform, the lifter creates reactive forces. In the dynamic start, this “support reaction” increases, influencing the development of momentum. Because the impulsive force (force x) between the lifter’s hands and the barbell will tend to reduce upward body momentum, there will be some transfer of momentum to the barbell. In using the dynamic start, advantageous conditions are available for the remainder of the lifting sequence.

Observation and analysis suggest that there are at least three types of dynamic starts including sub-types. The first example, the dive start, is somewhat unorthodox yet some world-class lifters use this start with excellent results.

1. Dive Start

This type of start was once very popular in the sport and in the 1920s, the 1930s, and even the 1940s it was almost "standard practice." More contemporary lifters that have experimented with this technique are Soviet superstar David Rigert and Armenian Champions Vardanian and Militosian. In addition, American World silver medallist and American record holder Wes Barnett had positive results.

To use this technique the lifter places his feet under the barbell in the pulling position, stands erect, aims his open hands at the barbell using either the snatch or clean grip, sets his back and "dives" down to grasp the bar. The lifter almost "pounces" on it. In moving down, the lifter lowers the hips into the normal starting position, grasps the barbell and immediately begins pulling the bar. It is actually a plyometric action. There are also many good physiological and mechanical reasons why this technique should result in greater initial force on the barbell. However, the disadvantage of gripping the bar incorrectly and more frequently ending up with an uneven grip are reasons that outweigh the advantages. Only very talented lifters, in modern times, have been able to use this technique successfully. This technique relies mainly on linear momentum and muscular force together with the "plyometric" action.

2. Hip Lowering

There are two basic variations to this technique:

a) With the feet placed under the barbell in the pulling position, the athlete grasps the barbell with the correct width grip (snatch or clean). The lifter raises the hips to a much higher position than the normal "get set" position. He then lowers them to a position, which is lower than the "get set." From here, he quickly and dynamically drives back up, lifting the barbell from the platform as he passes through the "get set" position. Many international lifters use this technique.

b) The second variation is to take up the normal "get set" starting position and then sink down to a position where the legs are almost in full flexion and the arms are relaxed. The hips sink to below knee height and the back angle almost approaches vertical with some lifters. The lifter then drives up from the low position, the shoulder rocking back over the bar again so that when it actually parts company with the platform, the lifter is briefly in the "get set" position. The lifter aims to be moving fast before the barbell comes off the platform. The Bulgarian lifters have adapted this start and have been very successful.

Both of these variants rely on angular and linear momentum together with muscular force. However, lifters must have a considerable amount of back strength and the ability to isometrically contract the erector spinae of the back, as the lifter hoists the barbell from the platform. The forces involved as the bar breaks contact with the platform increase greatly over the normal "lift off" and lifters must be prepared for this change in situation. The back can round, the hips can come up quicker than the shoulders and balance is challenging to preserve. These and many other points have to be taken into consideration

before deciding to coach these advanced techniques and a value judgment as to whether the “trade off” is worth it.

3. Oscillation

Another variation of the dynamic start and one seen increasingly at world level is to use a prior oscillation of the body before lift off from the platform. There are two or more variations.

a) The first and basic oscillation method is the athlete takes up the starting position, then raises and lowers the hips in a rhythmic, oscillating movement prior to lift off. We have seen many lifters use this technique to good effect over the years, Rigert (URS) being a notable advocate.

b) The second variation is to use two or several oscillations before lifting the bar. Suleymanoglu (TUR) would be the most famous exponent of this technique. As he also was the most efficient – pound per pound – lifter in the world, it is difficult to accept he uses the technique for any reason other than the production of maximum force. However, coaches must not be lulled into thinking that this or any of the other dynamic starts are a very modern and new technique. In fact, Tommy Kono can be seen using this oscillation method in his lifting on occasion. However, in the quest for even higher results we now see the majority of world level lifters utilizing one of the dynamic start techniques.

Research conducted by Glyardkovski and Rodionov in the Soviet Union investigated the effects of using dynamic starts with high caliber weightlifters. Their aim was to determine the most productive variation of the dynamic start. They used force platforms, height gauges, bar displacement graphs etc., in their research. Their conclusions showed that lifters would pull the bar higher when using the two or more oscillation technique. The next best results were with the one oscillation technique. Less satisfactory results were with the hip lowing technique. Finally, the static start showed the least satisfactory result.

A second hypothesis in this research was the observation that most world-class lifters use a dynamic start. Why then, is it policy to coach the static start for beginners? All dynamic starters pass through the "get set" position and in the early days of the sport it was wise to develop and reinforce a stable and balanced starting position. However, once the athlete learns this and it becomes an autonomic skill the dynamic start has real potential for increasing results. Many lifters have developed a dynamic start individually and through no coaching just because it “feels right.” However, lifters should avoid this “trial and error” approach.

The Explosion Phase

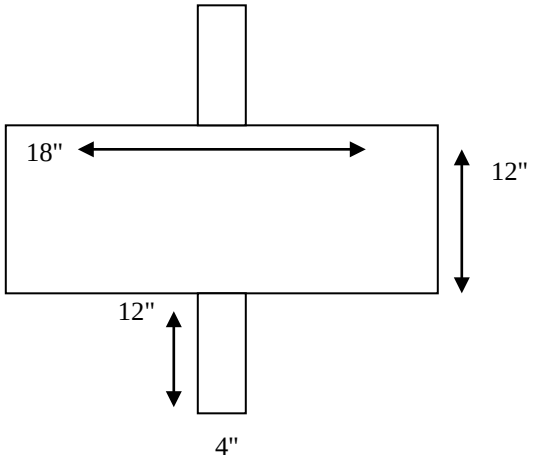
The Club Coach Manual emphasizes this important phase of the pull in weightlifting and we would like to elaborate more in the Senior Coach Manual. It occurs in both the snatch and clean and reinforcement must not only be in the lifts, but in pull assistance exercises.

The explosion phase of the pull is crucial, as it enables the lifter to give maximum momentum to the barbell so that it continues its upward path for as long as possible while the lifter is moving swiftly into the receiving position. Essential to success of this phase is the lifter remaining on flat feet for as long as possible during the second pull. The lifter should try to stay “flat footed” until the double knee bend naturally occurs. From here, athletes should emphasize the combined explosive extension of the legs and driving onto the balls of the feet while violently shrugging the shoulders. This “jumping action” must be impulsive by nature and reinforced using assistance exercises. Lifters must spend a great deal of time working on their coordinated force production of this vital movement.

Murray Cross

When coaching technique, coaches now have the availability to sophisticated apparatus, which they can use, to analyze technique. Video analysis is available to all coaches and even force platforms, V-Scopes and other devices, which measure power and speed are becoming more accessible. Many of these devices have immediate feedback for the coach and lifter to optimize training sessions. However, the Murray Cross, a training aid, which is relatively cheap, has been available for many years. It is named after is inventor, former British Olympic and National Coach, Al Murray. This simple device is drawn or painted on the training platform and once understood by the lifter, is used to give immediate feedback on foot and hip positions in both lifts. Very often, to the naked eye, small incorrect floor movement will go unnoticed, but with the introduction of the cross, the coach can see this immediately. For a basic diagram of the cross, please refer to Figure 8.1. The exact dimensions are unimportant; it is the configuration and interpretation of results from this that are paramount.

Figure 8.1



Once the coach chalks, tapes or paints the Murray Cross on the platform, the lifter places the feet within the cross so that the toes are in line with the forward edge of the horizontal axis as shown in Figure 8.2.

Figure 8.2

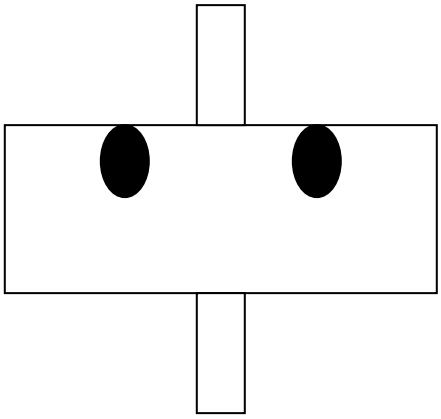


Figure 8.3

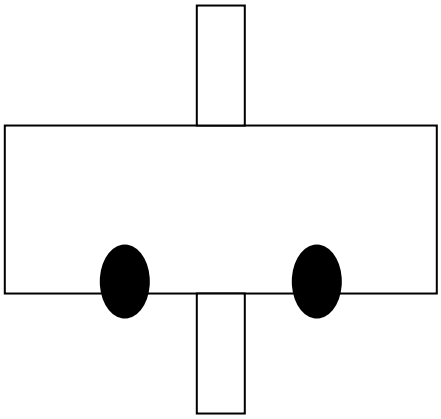


Figure 8.4

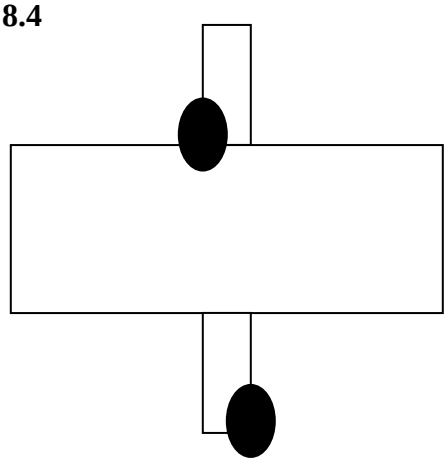


Figure 8.2 Coaches can implement this starting position for all lifts and most assistance exercises. For the classical lifts or lift related exercises, it ensures the lifter starts with feet and barbell in the same plane and once the athlete completes the lift, it is easy to see the foot position in the receiving or final position.

Figure 8.3 This either shows the receiving position of the feet in a snatch or clean. In this particular example, the lifter has jumped back significantly.

Figure 8.4 This foot position in the jerk shows the lifter has stepped away and has “tight roped”, i.e., he has brought his feet in toward the centerline creating a stability issue.

These examples serve to show how coaches can implement the Murray Cross and to take advantage of immediate feedback. The Murray Cross not only gives immediate feedback to the coach, but also the lifter. This coaching tool is invaluable if a coach is working with a large group of lifters on several platforms or to observe technical errors if all lifters are training with it.

Chapter 9

Assistance Exercises

In the early days of weightlifting training, athletes trained almost exclusively on the competition lifts. Coaches have since added assistance exercises to the training system. This fact has been one of the contributing factors to the dramatic rise in weightlifting standards in the last fifty years. However, in any discussion on assistance exercises, they can never replace training on the competition lifts. Training on the lifts must be an integral part of any program and assistance exercises "assist" the development of certain qualities to improve the competition lifts.

One may classify the assistance exercises or lifts into the succeeding groups for convenience, however, realize there is a great deal of crossover with many. In addition, by no means is this a complete list but rather recommended exercises.

Competition Lifts:

1. Snatch
2. Clean & Jerk

Semi-Competition Lifts:

1. Clean
2. Jerk from Rack (blocks)
3. Snatch from different positions
4. Clean from different positions
5. Lifts from the blocks

Lift Related Exercises:

1. Power Snatch
2. Power Clean
3. Power Jerk
4. Jerk Recovery
5. Jerk Balance
6. Power Jerk Behind Neck
7. Overhead Squats
8. Snatch Balance
9. Drop Snatch
10. Power Jerk Behind Neck + Overhead Squat

Exercises for Power and Strength:

1. Back Squat
2. Front Squat
3. Lunges
4. RDL/Halting RDL
5. Good Mornings
6. Push Press Behind Neck
7. Push Press
8. Press Behind Neck
9. Military Press
10. Bench/Incline Press
11. Seated Press
12. Press Behind Neck- Seated
13. Lockouts
14. Snatch Shrugs
15. Clean Shrugs
16. Clean Pull
17. Clean Pull- to knee Snatch Pull
18. Snatch Pull- to knee
19. Functional Dumbbell Exercises
20. Combination Exercises

Remedial Exercises:

1. Hyper Extensions
2. Reverse hypers
3. V-ups
4. Abdominal Crunches/Sit-ups (weighted)
5. Hanging Leg Raises
6. Isometric Holds

Performance of the Assistance Exercises

Semi-Competition Lifts:

The Clean

Figure 9.1

The clean needs no description, as it is the first half of the second competition lift. However, training on it in isolation often has merit and allows lifters to concentrate on this phase of the lift. It also gives the coach the opportunity to work on technique perfection. Often, lifters can handle more repetition work because the lifter does not have to jerk the weight.

Jerk from the Rack (blocks)

Figure 9.2

The lifter takes the barbell from the rack, always backing out, and sets for the jerk as shown in Figure 9.2. The feet are hip width apart, the chest is inflated and the bar rests comfortably on shoulder and upper chest. This starting position should receive constant emphasis, as any movement, which results from an incorrect starting position, will produce a succession of incorrect events. These actions will cause an enormous drain of energy and strength, as the lifter may have to "save" the lift.

Coaches should caution and drill the lifters into breathing-in and setting the chest before the dip and drive phase. Trying to breathe in as the dip is made is a formula for disaster. This starting position should receive constant emphasis, as any movement which results from an incorrect starting position will produce succession of events which will cause an enormous drain on energy and strength as the lifter attempts to save the lift. The position of the elbows is an individual one, however, the important thing is that their position remains constant in the dip and drive phase. The lifter should attempt to feel the weight of the barbell on his heels.

The lifter then dips by bending the legs and pushing the knees forward. It is essential that the trunk be kept upright and vertical throughout this phase. This action is plyometric in nature, as the legs undergo eccentric contraction and also, if done correctly at the right

tempo, will produce a stretch reflex from their muscles which will cause a more rapid and forceful concentric contraction in the drive phase. The elasticity of the bar can also be utilized in this dip and drive action and lifters should be encouraged to develop the “feel” of the bar movement. The lifter extends the legs vigorously and drives the bar vertically up. The drive of the bar up is made with the legs only; the arms should play no part in attempting to push the bar up.

In the rack position, many coaches encourage the lifter to hold the bar with a “slack” grip. Gripping the bar tightly causes tension in the arms and can cause premature pushing with them. If this occurs, the result will not be the athlete pushing the bar up but rather that the lifter is pushing himself away and back from the bar. Therefore, the drive up must be from the legs. The lifter drives up onto the balls of the feet, this entails shifting the line of action of the combined C.O.G. from the heels to the balls of the feet. This action can be utilized in aiding the lifter to “step into” the jerk. The lifter should aim to move both feet simultaneously from the platform into the split receiving position. The forward foot landing flat, while the rear foot has the heel raised with the ball of the foot touching the platform. As the lifter's feet land in the receiving position, it is then that the arms come into play, punching up hard. This action does not cause the bar to go up but pushes the lifter down into the receiving position. It is important that the feet move fore and aft horizontally from their starting position and do not come into the centerline. Coaches should watch their lifters from back or front to make sure this does not happen. The receiving position, as shown in Figure 9.2, is balanced with the barbell, shoulders and hips in a vertical line. The forward leg angle between the lower and upper leg is in excess of 90 degrees. The rear leg should be slightly bent at the knee and from this position the lifter steps back with the front foot into its original position, the rear foot is then recovered back into line. Coaches must continually insist on this systematic recovery.

This exercise, using a starting position from behind the neck, is an excellent variation. In Russian textbooks, this exercise rates as the number one assistance exercise for the jerk. Lifters perform it identically to the normal jerk with the only difference being the starting position. It has remedial qualities also as it discourages lifters throwing their heads back and stepping away. If doing repetitions in this exercise and jerk blocks are not available, it is a good idea to have spotters assist with lowering the bar back to the shoulders to assist with absorbing the forces of the dropping bar, which can be stressful on the knees and lower back.

Snatch From Different Positions

Most lifter use straps during these exercises, especially if the repetitions are higher. The lifter takes the normal snatch grip, places the feet in the normal pulling position, gets set and lifts the bar to the desired position. Figure 9.3 shows the starting position from below the knee. From an erect position, the lifter takes a deep breath, sets the back, bends at the knees and then lowers the bar to the position shown in Figure 9.3. The hips must move back initially to preserve balance but the lifter must keep the shoulders over the bar, rotate the elbows out and keep the back flat or even arched. From this starting position, the lifter extends the hips and knees, which initiates bar movement. The lifter

Figure 9.3

should keep the bar close and it will actually scrape on the upper thighs as the lifter moves into the "explosion phase." The lifter should stay over the bar with the shoulders as long as possible before transitioning to the second pull where he then "explodes" upward, shrugging the shoulders and driving up onto the balls of the feet. The lifter then jumps his feet apart as he pulls himself down to receive the bar at arms' length. This is an extremely good exercise for developing and coordinating the second pull and explosion phase. In addition, it develops power and speed of movement.

Clean From Different Positions

This movement is very similar to the snatch positions and develops the same qualities in the finish of the pull for the clean. As shown in Figure 9.4, the lifter adopts essentially the same starting position as for snatch but with the clean grip. Some lifters have great difficulty in using straps for cleans but if they have no difficulty then they should use them. The elements of lowering the bar to the knees, or below, are similar to the snatch. The primary difference is the back angle, which is slightly less due to grip width. The lifter then cleans the bar in the normal way. This movement develops the qualities of finishing the pull, receiving the bar at the shoulders, power and speed.

Figure 9.4

Figure 9.5

Lifts From the Blocks

These assistance exercises encourage and develop the technique of lifting from different positions while focusing on the rate of force development (RFD). The rate of force development or the ability to generate maximal muscle tension in a very short time is crucial in weightlifting. Higher rates of force are equivalent to the athlete lifting more weight. Because the lifter is in an unloaded position, these movements can be beneficial to athletes who have difficulty generating initial force.

Training with the lifts from different positions emphasizes the stretch reflex component of muscular activation. Because athletes move from a loaded position, the muscle stretches initially in hopes that this initial stretch will facilitate a more forceful contraction. Although the lifts from different positions have significant rates of force development, doing lifts from the blocks have higher rates. Lifts from the

blocks would be effective with athletes who have difficulty-generating force from an unloaded position and who need to specifically work on explosiveness.

Lift-Related Exercises:

Power Snatch

Figure 9.6

The Club Coach Manual describes this lift in detail however; some additional comments are applicable for this manual. The power snatch should replicate the full snatch in every phase except the receiving position. Lifters should always be encouraged to generate as much acceleration as possible emphasizing the explosion phase. Especially with beginning lifters, it is best to discourage foot movement, which deviates from the foot position in the squat snatch. With more accomplished lifters the feet jumping from the pulling position to the normal snatch receiving position is more natural. In addition, there is a tendency for many lifters in the power snatch to push the head through forcefully as the lifter receives the bar at arms' length. This may carry over to the squat snatch and result in catastrophic results. This action of pushing the head forward produces an opposite reaction of the hips moving back, causing a very poor and unstable receiving position.

There is often debate as how low one can sink to receive the bar in the power snatch before it becomes the squat snatch. A well accepted standard, which lifters can all appreciate, is that if the angle between the lower and upper leg is less than 90 degrees it is no longer a power snatch.

Power Clean

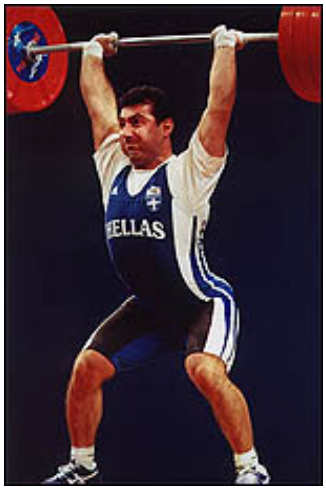
Figure 9.7

The Club Coach Manual describes this exercise in detail as well. Many of the points made above with regard to the power snatch hold true for the power clean, i.e., foot movement, importance of good technique with speed and also depth of receiving the bar. With advanced lifters who suffer from tendonitis of the patella, it is often found that the power clean is the movement which cases greatest discomfort and its use in training programs for individuals who exhibit this problem often has to be curtailed until the affliction has been rectified. Otherwise, the power clean as with the power snatch is an integral exercise in most training programs.

Power Jerk

The Skill Transfer Exercises chapter in the Club Coach Manual discusses this exercise in the progression to learning the split jerk. However, it is also valuable exercise in a training program as it not only develops the timing, coordination and speed of the dip, drive and receiving sequence in the jerk but it also encourages the lifter to drive the bar in the correct direction, i.e., vertically upward. It is also a great power builder in the muscle groups involved in jerking.

Figure 9.8



Although the basic movement and technique have been described, a few relevant points need to be made. It is very important to place the feet in the correct position. The starting position should be identical in all facets to the start for the jerk. It is crucial the lifter have a slack grip so the arms and hands can transfer maximal force from the dip and drive through the chest and shoulders. As lifters adjust to the exercise, especially with heavy weights, they will also learn to use and time the elasticity of the bar. With heavy weights, the bar will oscillate and lifters must learn how to control and use this force in their favor. As the lifter receives the bar at arms' length, they must push up aggressively in the lockout position. It is essential that the timing of this arm action be concurrent with the feet. As in the power snatch, coaches must guard against their athletes attempting to push their heads through and forward of the barbell as this action produces the reaction of the hips moving back and a very unstable position develops.

Jerk Recovery

For lifters who have difficulty overhead in the jerk with poor arm lockouts and as a strength builder in the jerk receiving position, jerk recoveries in the power rack are very useful.

The lifter should start with the bar in the power rack at the height or slightly below his personal receiving position in the split jerk. The bar should be forward in the power rack and nearly touching the front uprights. The lifter takes up his normal jerk receiving position. Coaches should ensure this position is correct before the lifter starts the movement. The lifter then extends the leading leg and moves the weight up and back off the pins. The lifter then recovers his feet, front foot first then the back foot, in the normal way until the feet are in line. Bending both legs, the lifter lowers the bar to the pins for the next repetition.

Jerk Balance

This exercise can remedy many jerk related problems. Incorrect foot placement in the jerk is one. Another being the so called "squatters-jerk" exhibited by some lifters because of immobility in the jerk position, often caused by tight muscles on the front of the thigh from high volume squatting. The lifter shows a very hollow back and a very short split. The lifter bends his rear leg excessively and the knee of the forward foot is over the toe. Coaches sometimes refer to this as the "Vardanian style" after the famous Soviet World

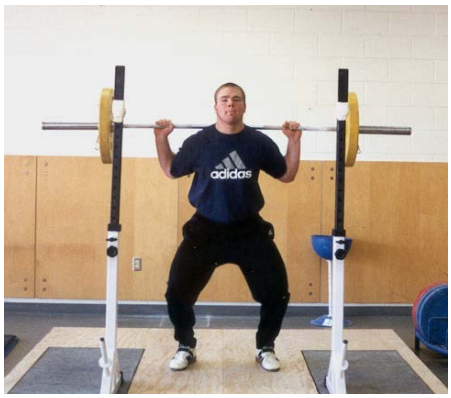
and Olympic Champion. Lifters who “step back” from their jerks will also benefit from this lift-related exercise, as will beginners who have problems coordinating the full jerk movement.

The lifter takes the barbell from the rack and assumes the starting position for the jerk. He then steps his leading leg forward to a position the coach considers about half way into the final split position. The leading foot must be flat on the platform and pointing straight ahead. The heel of the rear foot is raised and the weight on the ball of the foot. The lifter then dips vertically by bending both legs. Then, the lifter drives the bar up while stepping forward with the leading leg into the full jerk position while catching the bar on extended arms. The bar, shoulders and hips should be in line. For the lifter with tight quads, he will really have to force his hips forward. It is vital the rear knee is bent slightly as this allows the hips to come forward off the foot. It is essential the leading foot be straight ahead. Coaches and lifters may find it useful to put a chalk mark on the platform so the lifter can check his foot position after each repetition. Spotters should be used to help the lifter lower the bar to his shoulders while he bring his feet back to the half split position for the next repetition.

Power Jerk Behind the Neck

This exercises too, is from the Skill Transfer Exercises chapter from the Club Coach Manual. The starting position is the same as in jerk from rack, except the bar is behind the neck. The initial dip and drive from the legs however, is identical. Figure 9.9 shows the correct movement in the dip. As the lifter dips and drives the bar up, jumps the feet out and “catches” the barbell at arms’ length. As in the jerk, or any dynamic overhead movement, the movement requires correct timing to ensure success.

Figure 9.9



In most cases, the lifter will find it easier to do overhead movements from behind the neck than in front. This is due to the head. When the bar is in front, on the shoulders and clavicles, there is more of a chance for the lifter to dip forward or toward the toes. When the bar is behind the neck, it is easier to ensure the dip is toward the heels and within the area of base.

Overhead Squats

Also from the Club Coach Manual, this exercise is excellent for the novice as well as the advanced lifter. It prepares the athlete with proprioception, overhead strength and stability, confidence in the low squat position as well as a specific exercise to lead into a snatch workout or warm-up.

The lifter takes a barbell from the squat rack with a snatch width grip. The barbell rests on the shoulders and upper back. The lifter spaces the feet apart as if he were going to do a back or front squat. The athlete presses the barbell from behind the neck to locked arms as shown in Figure 9.10. This is the starting position. The lifter takes a deep breath and holds it throughout the movement. The back is flat and the musculature taught. Then, the lifter slowly moves into a full squat position as shown in Figure 9.12. The lifter then stands upright back to the starting position and breathes out before setting for a further repetition.

Figure 9.10

It is important to move steadily in this important exercise. Controlling the barbell and "feeling" the movement develops confidence in the low receiving position. Once mastered, the weight increases should be gradual. Whenever doing this exercise, it is always good policy to have spotters available, as balance is a key ingredient in successful performance.

Snatch Balance and Drop Snatch

Many coaches think these two exercises are synonymous when in fact they are two separate movements. The Skill Transfer chapter of the Club Coach Manual discusses the snatch balance in detail. It is the last exercise in the learning progression before the squat snatch. The lifter begins with the bar behind the neck, snatch grip and the feet in the pulling position. The lifter dips, as seen in figure 9.11, and drives the bar up. Then, the lifter jumps the feet out into the squat position, and moves as quickly as possible into the low receiving position As the lifter moves under the barbell, he should develop the feeling of pushing up or punching up against the barbell. This action should not result in the barbell moving up, but rather accelerating the descent into the receiving position.

Figure 9.11

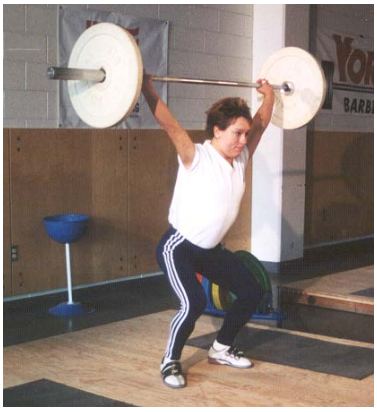
Figure 9.12

The lifter begins the drop snatch in the same position as the snatch balance. Only instead of using the legs to initially drive the bar up, the lifter instead drops under the bar while simultaneously punching up with the arms and jumping the feet out into the receiving position. The arms should lock out as the feet touch the platform. Figure 9.12 shows the low receiving position.

Power Jerk Behind Neck + Overhead Squat

Once the athlete can master the overhead squat and snatch balance movements, the coach may want to begin including combination movements, or multiple exercise movements. An excellent exercise to increase overhead stability, balance, confidence with heavier weights and explosive strength is the power jerk behind neck plus overhead squat. The athlete assumes the snatch grip and begins with the bar behind the neck. Then he will proceed to power jerk the weight and catch it in the high receiving position, as in figure 9.13, and then ride the weight down into the low squat position as in figure 9.12. This exercise is for all lifters however, advanced lifters can benefit from using heavier weights to assist with power, strength and force development in addition to confidence with these heavier weights.

Figure 9.13



Exercises for Power and Strength:

Back Squat

This is a virtual cornerstone in any strength and power training program. It produces enormous benefits immediately transferable into weightlifting performance. It strengthens the extensors of the legs and hips. However strong a lifter becomes in this movement, squats are rarely eliminated from the training program. Often in the competition phase, emphasis may shift to the front squat, but back squatting is usually still included.

The Club Coach Manual describes this exercise. However, to re-emphasize, the "setting" of the back and chest before beginning the exercise, is of supreme importance and maintaining this trunk position throughout the lift is vital. In addition, the bar should rest on the upper back and trapezes, sometimes known as the Olympic squat, versus the bar resting lower on the back, across the scapulae, known as the Powerlifting squat.

Front Squat

This essential exercise needs little comment, as it is one of the fundamental exercises for the Club Coach Course and indeed every lever of weightlifting. It provides an important strengthening movement for the recovery from the clean. It also, of course, strengthens the legs, which athletes use in all facets of Olympic weightlifting.

Some pointers on technique are: a) the athlete must inflate the chest throughout, b) to initiate the start up from the deep squat; the hips are eased back and up, while the elbows are forced up. This movement of the hips causes a forward inclination of the trunk, but opens up the angle between lower and upper leg and makes the start of the concentric movement easier.

Lunges
Although lunges are not as crucial in the training program as squats, they are none-the-less a good assistance exercise especially for athletes who have weak hamstrings. Athletes can do lunges either with a barbell or with dumbbells. For younger athletes, dumbbell-walking lunges help with coordination as well as strength.

With a bar, the athlete should position the bar so it is across the shoulders and trapezes, identical to the back squat or any behind the neck pressing movement. Then, the athlete steps out with the lead foot so that the lower leg is perpendicular to the platform. The back leg should bend almost to 90 degrees but the knee should not touch the platform. The athlete should focus on driving off the front foot to return to the start position and the next repetition.

Athletes can do dumbbell-walking lunges on any stretch of open space. The coach will decide how many steps, or reps, the athlete will take. For younger athletes, as many as ten steps on each leg are appropriate. With advanced athletes, the coach can choose to do higher or lower repetitions, depending on the intention.

RDL/Halting RDL
Coaches sometimes refer to this exercise as stiff leg dead lifts although there is a slight bend at the knee with RDL's. Dragomir Cioroslan, National Men's Coach, introduced this exercise to coaches in 1991. This is a pure strengthening exercise for the muscles used in the second half of the pull for both power snatch and power clean. The hamstrings and gluteals fire concentrically and the erector spinae muscles isometrically.

The lifter grips the bar with clean width spacing, and the feet are in the pulling position and stands up with the bar, as shown in Figure 9.14. The lifter may use straps to accommodate grip strength deficiencies. From this upright position with the bar resting across the thighs, the lifter sets the back, inflates the chest and keeps it elevated. The lifter bends the legs slightly at the knee. Moving only from the hips, the lifter lowers the bar as shown in Figure 9.15. The hips move back to preserve balance, keeping the line of action of combined center of gravity over the feet. The lifter lowers the bar to a position below the knees, but not touching the platform as shown in Figure 9.16. This keeps the muscles in constant tension. From this position, the hamstrings, hips and muscles of the back pull the barbell to the finishing position, which is once again the start position. The lifter must concentrate on keeping the back tight and flat throughout the lowering process and keeping the arms straight. The lifter holds his breath throughout the lowering and lifting and upon completion of the repetition, exhales.

A halting RDL would just demand pausing for one to three seconds below the knee. Altering the grip from a clean grip to a snatch grip can perform an intermediate form of the RDL. This form of the exercise allows the lifter to go lower because the grip is wider. More tension is on the hamstring, gluteals and erector spinae muscles. A more advanced progression of the RDL would entail standing on a block and lowering the barbell to the depth below mid-shin. This exercise is for advanced lifters only and the coach and lifter alike should show caution.

Figure 9.14

Figure 9.15

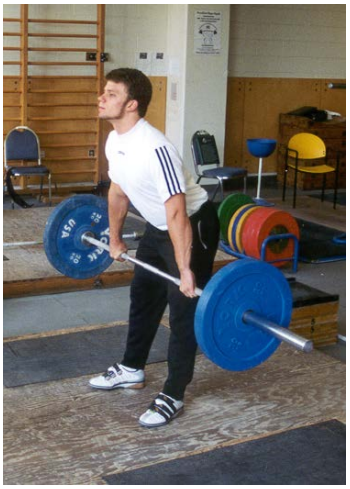


Figure 9.16

Good Mornings

As with RDL's, good mornings are an excellent strength and power developer for the extensors of the hips, the hamstrings and gluteals. These muscles are important in applying force in the second phase of the pull in snatch and clean.

The lifter takes the barbell across the back of his shoulders as shown in the starting position in Figure 9.17. This grip on the bar is slightly wider than shoulder width and the feet are in the pulling position The athlete unlocks the knees and bends forward to the position shown in Figures 9.18 and 9.19. The hips move back keeping the line of action over the combined C.O.G., the feet. The back angle should be as close as possible to the one used in the first pull for snatch. From this position, the lifter extends the hips while the erector spinae muscles isometrically keep the spine straight. Athletes must be careful to not exceed a 90-degree angle of hip flexion. Coaches should also err on the conservative side when deciding load.

Figure 9.17

Figure 9.18

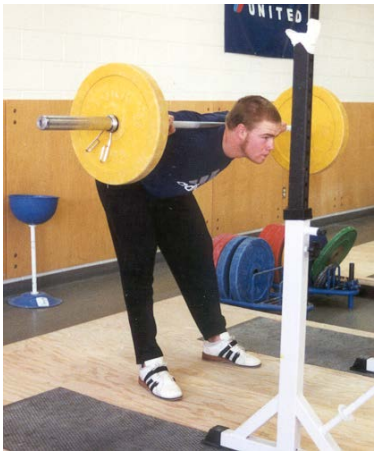
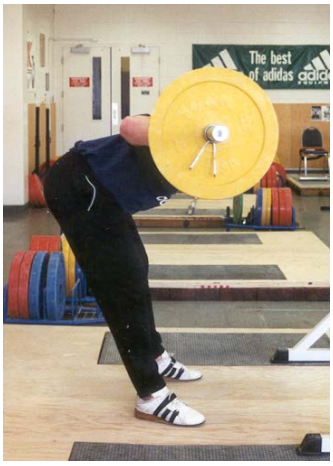


Figure 9.19



The Club Coach Course discusses the following four skill transfer exercises for learning the jerk. We ask you to please refer to the Club Coach Manual for illustrations.

Push Press Behind Neck
Taking the barbell from the squat racks, the lifter assumes the starting position. Instead of just pushing the barbell up with the arms, the lifter now bends the legs to assist in the movement, and then straightens them violently, to drive or heave the barbell up from the shoulders. The arms press the bar into the final finishing position. It is essential to keep the trunk vertical and chest elevated in all phases of this movement. Athletes under the guidance of Senior Coaches should be handle significant amounts of weight in this exercise.

Push Press
The lifter takes the barbell from the squat rack and assumes the start position with the bar across the shoulders and clavicles. The feet will be in the "vertical jump" position. The head position becomes very important as the barbell is going to travel from the chest and shoulders up and over the head. It is essential the lifter set the chest before the movement. In addition, the chin is pulled in to make way for the most efficient vertical bar path. Once the lifter is in the starting position, while keeping the trunk upright, the lifter dips and bends the knees to prepare to drive the bar upwards. It is vital the lifter's weight distribution is on the heels. This will reinforce a vertical bar trajectory. The lifter then extends the legs driving the bar vertically as high as possible. From this position, the arms press the bar to arms' length. The lifter then lowers the barbell to the starting position, breaths and re-sets for the next repetition.

Press Behind Neck
The lifter takes the bar out of the racks, places it across the shoulders and upper back, and fixes his grip, snatch or clean. Before beginning the movement, the lifter takes a deep breath and fills the lungs to set the chest. From the starting position, the lifter pushes the barbell up until the bar is at arms' length. The movement should finish with the barbell slightly behind the lifter's ears. The barbell is within the area of base and the C.O.G is vertically down. The head is in a neutral position while the eyes are focusing straight ahead. This represents a very solid finishing position.

Military Press
This movement is identical to press behind neck only the bar is in front of the neck and rests on the shoulders and clavicles. The lifter should now be comfortable with the bar in the rack position and developed some upper body strength through the course of training, to handle significantly more weight than the novice. The same principles apply in the military press as with all other overhead strengthening exercises.

Bench/Incline Press
The use of this exercise in general weight training is overrated and overused. However, it has its place in weightlifting, especially for younger lifters. It has a positive effect on the strengthening of the muscles of the shoulders, chest and arms. However, if overused, it can have detrimental effects, as the range of movement in this exercise is dissimilar to

most in weightlifting. Especially for the younger lifter it can, if properly used, be an aid to general stability in the upper body and enable lifters to maintain the correct position of the chest in jerking.

To be of maximum use in weightlifting, the athlete should use a jerk width grip. The lifter lies on a flat or incline bench. The lifter takes a deep breath, lowers the weight to touch the chest and then pushes it to arms' length. The lifter breathes out as he completes the repetition.

Seated Press and Press Behind Neck
The lifter either can power clean the bar using a jerk grip or take the bar off of a rack and sit on the end of a bench. The athlete must first find a comfortable foot position. Some athletes prefer both feet in line in front or some prefer when one foot is to the rear and one forward. Whichever foot position the athlete chooses, it must ensure a stable position. Once in the position, the lifter takes a deep breath and pushes the barbell to arms' length then lowers the bar to the starting position for more repetitions.

Lockouts
This is an exercise for lifters with a poor arm lock in the overhead position. They must develop above average strength in the triceps and the muscles of the shoulders if these athletes are to successfully hold up heavy jerks. This short-range exercise will aid them in this task.

The lifter takes up the starting position in the power rack. Grip width is the same as the jerk. The lifter takes a deep breath, holds it and then pushes the weight vertically up to straight arms. The lifter must learn to control the path of the bar and keep his body upright with no backward lean.

Snatch Pulls
Snatch pulls, along with clean pulls, are fundamental exercises in weightlifting training but have a high transfer value into power production. It is essential the lifter perform these pulls at maximum speed once the technique is efficient.

Figure 9.20

Figure 9.20 shows the starting position for the snatch pull, discussed in chapter 8. The feet are hip width apart with the toes slightly turned out. The back is flat and the erector spinae muscles are tense. The shoulders are in advance of the bar and the chest is inflated. The neck is in alignment with the back and the head is up. Arm position is very important. The grip is wide in the snatch position, the arms are straight and the elbows rotate out. This is a balanced strong position and is often termed the "get set" position.

Before moving, the athlete takes a deep breath and holds it throughout the movement. This action stabilizes the upper trunk as the inflated lungs act as a pneumatic brace. Lifters use pulling straps for pulls as they not only save wear and tear on the lifter's hands, but also because fatigue in the grip often causes the lifter to tense up in the arms, causing premature arm bending and power reduction. Using the straps enhances the lifter's ability to keep the elbows relaxed and straight.

Leg extension initiates the pull and the bar eases back from its original position over the balls of the feet to a position over the center of the foot as the shins move backwards. When the bar arrives at approximately the height of the knees, the angle of the back should have remained essentially the same as in the "get set" position. The leg extensors have now finished their work and the extensors of the hip take over. In this muscle transference position, athletes often feel weak and attempt to sit back and alter the starting back angle. Coaches must be aware of this and make changes accordingly. As the hip extensors contract violently, the trunk moves into a vertical position and the knees rebend slightly.

The bar should touch the upper thigh or lower abdomen. The lifter accomplishes this by staying on "flat feet" as long as possible. The final "explosion phase" of the pull utilizes four simultaneous movements:

- Hip Extension
- Knee Extension
- Ankle Extension
- Shoulder Elevation

Figure 9.21

These four movements must be coordinated simultaneously to provide the bar with a most powerful impulsive action. The finishing position of the pull is in Figure 9.21. It is worth noting that the arms are straight, the elbows are rotated out the shoulders are shrugged and the body is maximally extended. This final explosive movement is very important and a great effort from the athlete to exert maximum force in this phase of the pull is essential. The lifter then returns the barbell to the platform for further repetitions.

It is important to make the point that for description and analysis, the pull is often broken down into various phases. In performance, it must be one continuous, coordinated flowing movement. Gradation of effort is important throughout the pull to build the acceleration of the bar upward. In the final explosion phase with the body's strongest power generating sources available, this acceleration should be at its zenith.

Clean Pull
The performance of clean pulls is essentially the same as snatch pulls. However, important differences result from the difference in grip width and normally heavier weights on the barbell.

The narrower grip does cause a difference in back angle at the start in the “get set” position and throughout the initial stages of the pull. At the completion of the explosion phase too, the grip width affects the bar’s height and the part of the body brushed by the bar. Please see Figures 9.22 and 9.23 for reference.

Figure 9.22

Figure 9.23

Snatch/Clean Shrugs
This movement attempts to reproduce the final explosion phase of the snatch and clean pull. It targets the very powerful muscles of the hip and leg extension and the shoulder elevators principally the trapezes. For this exercise, lifters always use straps as the weights used will be off a high percentage and also the lifter does not have to be concerned with holding the bar but can concentrate on keeping the arms straight and shrugging the shoulders. To assist the lifter, the start position of the weights can be either on blocks or in a power rack.

Figure 9.24

The lifter then places the feet under the bar in the pulling position and grasps the bar, using straps, with the appropriate grip. The lifter picks up the bar and gets into the starting position. From this starting position, the lifter then bends the legs, pushing the knees forward and dipping the trunk vertically. The bar will rest on the upper thigh. From this position, the lifter extends

the legs violently and shrugs the shoulders vertically as in Figure 9.24. This is a vigorous and dynamic action with the lifter aiming to hit his ears with the shoulders. The lifter should extend onto the balls of the feet with the elbows rotated out throughout the movement. The arms are straight and the bar scrapes the thigh or lower abdomen. The athlete then lowers the bar to the starting position for the next repetition.

Snatch/Clean Pull to Knee (Lift-offs)

This is a remedial exercise for lifters who have trouble at the start of the pull in either clean or snatch. Any problems in this area are usually manifested to the greatest extent in the clean as the resistance is greater. Very often, lifters do not raise their hips and shoulder at the same rate as they raise the bar. Some lifters do not ease the bar back from the floor and suffer stability problems. Still others round their back as the bar comes off the platform. Lift-offs can remedy these and any other problems with the initial pull from the floor.

Figure 9.25

The lifter assumes the get-set position for the clean, then, extend the legs while easing the bar back until the bar reaches the height of the knees as in Figure 9.25. The lifter then places the barbell back on the platform and repeats. Coaches should observe each repetition and correct any mistakes. Eventually, the lifter should be able to handle high percentage weights.

Functional Dumbbell and Combination Exercises

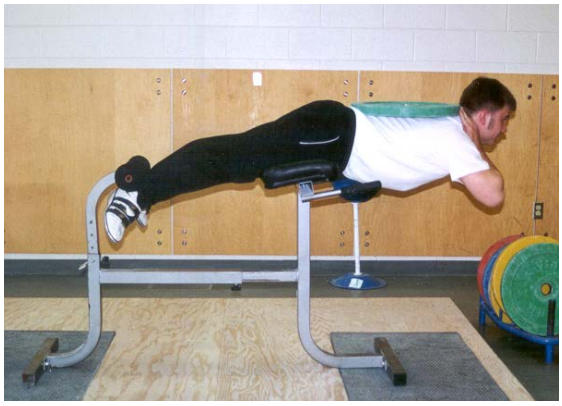
Athletes can also do a majority of the above exercises with dumbbells. Dumbbells are especially useful with younger athletes who have difficulty lifting a barbell or if the club does not have a youth bar. The emphasis should still be on technique and the repetitions should be higher (8-10). The coach can also incorporate combination exercises where the athlete will combine two to five exercises in one set. This works particularly well in increasing work capacity and strength endurance. Initially, the coach should try to improve the athleticism of the athletes and not focus on sport specific exercises. It is important the athlete knows and understands how his body works. As the athletes' kinesthetic awareness improves, so will the qualities related to weightlifting.

Remedial Exercises:

Hyperextensions

A strong core in weightlifting is essential. However, many coaches overemphasize abdominal flexion and overlook back extension. With all weightlifting movements, the erector spinae muscles of the back support the spine isometrically. These muscles must be strong to ensure back stability, safety and mechanical efficiency. Although, during weightlifting, the erector spinae muscles work isometrically, strength gains for this musculature increase through concentric and eccentric work. Although back extension should not be overlooked, it should also not be overworked or overloaded. Consequently,

Figure 9.26

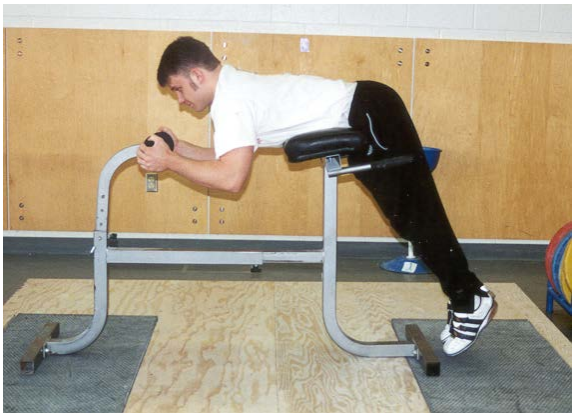


hyperextensions, if done correctly, are an appropriate exercise for strengthening the back. Ideally, athletes should use a hyperextension machine to do this exercise however; a bench or plyometric boxes can also serve the purpose with a partner to hold the feet.

The athlete positions himself on the hyperextension machine with the feet firmly in place. The start position would be with the athlete's back in flexion. Then, the athlete flexes the abdominals and rises until the back is in slight hyperextension, about 190-200 degrees. As the abdominals fire isometrically, the erector spinae, gluteal and hamstrings fire concentrically. The athlete then gradually lowers himself to the beginning position. The athlete should perform this exercise at a steady tempo, which emphasizes the concentric contraction on the way up and the eccentric contraction on the way down. To increase resistance for advanced lifters, they can add external resistance, as shown in Figure 9.26.

Reverse Hypers

Figure 9.27



An alternative exercise to hyperextensions is reverse hypers. Reverse hypers accomplish the same as hyperextensions; it only offers variety with athletes. The athlete uses the same equipment for reverse hypers as hyperextensions. The athlete mounts the apparatus and gets into the start position, as shown in Figure 9.27. Then, flexes the abdominals isometrically and raises the legs until they are at or just above 180 degrees, holds for a moment then, lowers them back to the start position to begin the next repetition. As with hyperextensions, the tempo for reverse hypers is steady and the focus should be on the concentric and eccentric movements.

Bent Knee Sit-ups/Crunches

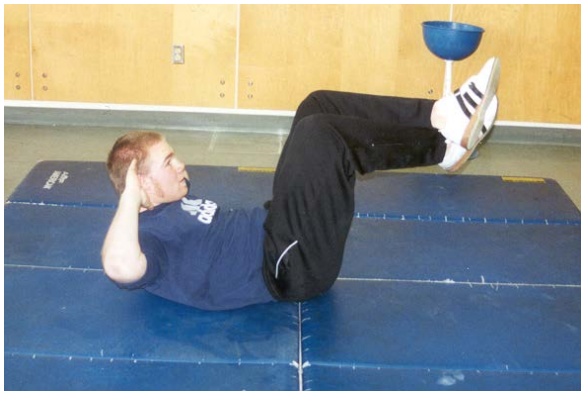
These are popular exercises to strengthen the core. However, bent knee sit-ups do not measure abdominal strength but rather strength and endurance of the hip flexor muscles, aided by the stabilization of the feet. Since abdominal muscles flex the spine, the exercise must be consistent to test for abdominal strength so the trunk must curl. If these muscles can hold the trunk curled as the hip flexors begin to fire, there will be a good indication of upper abdominal strength. Therefore, athletes must initially curl the trunk,

Figure 9.28

then continue to curl the trunk as the hip flexors come into play. This will ensure the emphasis is on the abdominals and not the hip flexors. Please see Figure 9.28. The athlete will eventually have to use external resistance, i.e. medicine ball or weights, to increase abdominal strength. In addition, the lifter can twist the trunk to one side and then the other to put emphasis on the oblique muscles.

Athletes perform crunches with the same emphasis as bent knee sit-ups. Athletes begin with the back completely flat, the feet up at a 90-degree angle with the hands clasped behind the head. Then, flexing the trunk and not pulling on the neck with the hands, the athlete curls up, as shown in Figure 9.29. Range of motion will be less than bent knee sit-ups since the feet are not stabilized. Again, as athlete's abdominals get stronger, athletes will add external resistance.

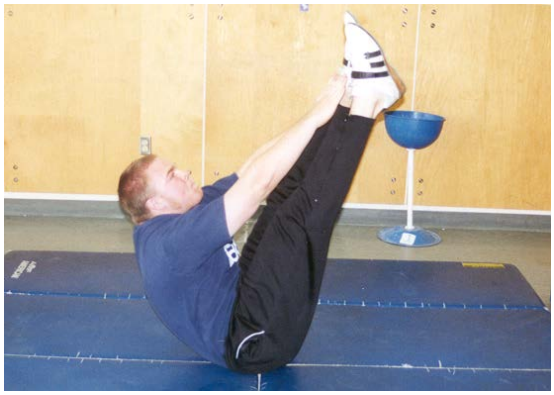
Figure 9.29



V-ups/Hanging Leg Raises

As athlete's abdominal strength increases through training, more challenging abdominal exercises can be implemented. V-ups and hanging leg raises are two examples of advanced abdominal exercises.

Figure 9.30



Athletes begin the v-up in the supine position with the arms extended straight above their head. The abdominals will initiate movement by contraction and the athlete will raise the arms and legs simultaneously to meet at the midline and form a "V". Athletes must try to keep both their arms and legs as straight as possible. Please refer to Figure 9.30. The athlete then lowers the arms and legs concurrently until both touch the ground where a new repetition will begin.

Athletes can do leg raises on any free standing or wall bars. The lifter begins by hanging from the bar and when motionless, initiates movement by abdominal contraction. While performing the movement, athletes should try to stay as vertical as possible and avoid any swinging. Athletes are encouraged to raise their legs as high as possible with the most advanced being touching the bar from which they are hanging from. Please refer to Figure 9.31.

Figure 9.31

In conclusion, please keep in mind; these assistance exercises are only recommendations. There is a plethora of other weightlifting exercises coaches and athletes can implement. We encourage all coaches to explore other resources and experiment with different exercises and create their individual training regimes. However, all training programs, regardless of philosophy should lead to one common goal: improvement! If no improvement occurs, the coach must re-evaluate the training program and implement new exercises or philosophies.

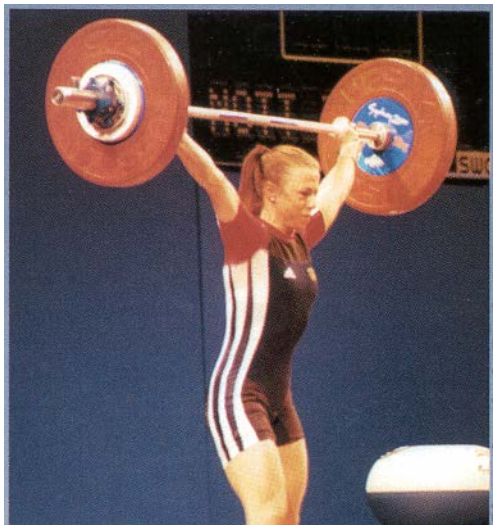


Photo by Alexis Reed

2000 Olympic Gold Medallist Tara Nott

Chapter 10

Faults and Corrections

This is an essential part of coaching, which is challenging to learn. An understanding of the technical principles of weightlifting is as vital as how the coach interprets the technical model. Developing the ability to evaluate an individual's technique problems and provide immediate feedback is an ongoing process. In a competition setting, the ability by the coach to assess a technical problem and be able to communicate this to the lifter may mean the difference between winning and second place. However, it is in the training situation where most of the technical work and reinforcement takes place. This setting allows the coach and lifter to develop a mutual understanding and develop a communication process, which will carry over into the competition.

The coach must work at developing his ability to assess and develop the essential "coaching eye" that all successful coaches possess. A majority of coaches have the ability to evaluate a lift and relay the fault to the lifter. However, having the ability to relay to the lifter why the fault occurs is a different set of circumstances. Once the coach recognizes the fault, then he can prescribe a remedy. Most developing coaches are not able to recognize the fault initially. This is when working with an experienced coach and seeing and learning on a practical level in the weight room is an excellent way to develop the coaching eye.

Fortunately, our weightlifting techniques are standardized movements recognized by elite level coaches and scientists around the world. USA Weightlifting considers the following observations the most common technical errors, which result in failure. The remedies may assist the coach in adjudication and coaching tips while suggesting a solution.

The Snatch

Fault: The lifter loses the bar in front in the receiving position.

Possible Cause:

- Incomplete pull, the lifter pulls himself under the bar before the explosion phase.

Corrections: Reinforce technique. Tell the athlete to finish the pull. The lifter may have difficulty in finishing due to weakness in the second pull position. Strength exercises such as shrugs and training lifts and pulls from different positions will help. With many lifters, technique flaws only show up when they attempt maximal or near maximal weights. Lack of strength and technical flaws in this essential phase is often the reason.

Fault: The lifter swings the bar during the pull.

Possible Causes:

- The lifter throws the head and shoulders back at the top of the pull, trying for greater extension. This action causes the reaction of the bar swinging away.
- The lifter drives up on the toes too early then using the hips to generate more force, which causes the bar to swing.
- The lifter allows the elbows to rotate back and the bar swings away during the explosion phase.

Corrections: Reinforce technique. Emphasize the lifter should finish the pull in a vertical position. The lifter should keep his shoulders over the bar longer, which will assist in staying on flat feet for a longer period. Rotating the elbows out in the start position and keeping them out throughout the remainder of the second pull will help with keeping the bar close to the lifter. In addition, staying active with the arms will assist with speed and keeping the bar from moving away from the lifter during the middle of the lift.

Several exercises will assist in correcting this problem. Performing shrugs from different positions as well as pulls. In addition, high pulls will reinforce elbow rotation and arm speed. Lifts from different positions, especially from the high thigh or waist will aid in the finish position as well as speed through the middle, which will keep the bar close to the lifter. General strength exercises, especially core work, will assist the athlete with staying over the bar longer.

Fault: The lifter sits back from the bar at the start and maintains this throughout the pull.

Possible Cause:

- The lifter's hips are too low in the start position causing the weight distribution to be too far toward the heels, which results in the lifter being in a poor position to produce force throughout the pull position.

Corrections: Change the start position. Shift the athlete forward so the weight distribution is in the middle of the foot. Furthermore, the lifter needs to raise the hips. This weight distribution and hip adjustment will bring the shoulders over the bar, which will put the lifter in optimal position to produce force from the floor and throughout the lift.

An excellent exercise to remedy this fault is pulls to the knee, or lift-offs. The athlete reinforces the start position on every repetition and develops comfort and confidence in this new position. Typically, if the lifter begins in the right position he finishes in the right position. General core strength exercises will also help with abdominal strength to maintain proper positioning and spine stabilization in the lift-off position.

Fault: During lift-off, the lifter actively pulls the bar back instead of pushing the knees back.

Possible Causes:

- Many novice athletes are excited or are "psyched up" for the lift and this emotion results. Another cause may be a lack of strength in the lift-off position. To overcome this deficit, athletes develop a pendulum effect in which they intentionally develop momentum from lift-off by rolling the bar back toward them, then using this momentum to aid in the lift. This lack of strength results in the bar swinging out and forward as the lifter extends the hip.

Corrections: Many athletes have a football player mentality. Coaches must convince the lifter to channel their emotions in a positive way. Coaches can work with athletes in training to develop an appropriate and efficient start position. Furthermore, athletes must improve general core strength.

Exercises, which address the start position from the floor such as pulls and lifts, are appropriate to improve arm pulling from lift-off and the pendulum effect. When athletes emphasize the start position in a calm yet positive demeanor it will aid them in self-confidence, which will directly affect performance. In addition, athletes must incorporate a comprehensive core program focusing not only on abdominal flexion but also on back extension. This will further improve the lift-off position.

Fault: The lifter jumps back or away from the barbell after the second pull.

Possible Causes:

- The lifter finishes the second pull beyond 180 degrees because he holds on to the barbell too long to "try to really finish" the pull.
- The athlete does not stay over the barbell throughout the pull.
- The athlete swings the barbell.

Corrections: Convince the athlete to finish the pull in a vertical position. Holding on to the bar longer will not result in lifting more weight. In addition, help the athlete understand when to pull himself under the bar at the appropriate time. Keeping the shoulders over the bar will also help in assuring a proper receiving position. The athlete will not try to over pull to overcome leverage issues when the shoulders stay over the bar. The athlete will also reduce bar displacement due to a more vertical bar trajectory.

Exercises that will ensure a more vertical pull position are pulls, shrugs and lifts from different positions. This will also assist with staying over the bar as will RDL, good mornings, hyperextensions and reverse hypers. Staying active with the arms and incorporating high pulls with more advance athletes will aid in an efficient bar trajectory.

Fault: The lifter loses the bar behind.

Possible Causes:

- Throwing the head and shoulders back i.e. not finishing the pull in a vertical position
- Swinging the bar away from the body

- The athlete not keeping his shoulders over the bar
- Poor receiving position
- Lack of general strength in the low squat position

Corrections: The first two bullet points outline the two primary reasons a lifter may lose the bar behind. Throwing the head and shoulders back creates an effect on the bar. This effect is the bar moving away from the body. The Club Coach Course and chapter four of this manual discuss this topic at length. Newton's third law is the basis for this action. This law states "For every action there is an equal and opposite reaction." If the action of the bar is moving away from the body, the reaction is to complete the arc created by the action. In addition, if the athlete does not keep his shoulders over the bar he will most likely rely on his hips to generate more force. The result may be swinging the bar. In contrast, the athlete may receive the bar in a poor position or lack strength to keep the bar fixed in a strong, stable position overhead in the low squat position.

The coach can correct the first two points by emphasizing to the athlete to finish in the vertical position and to choose a focal point to prevent him from throwing the head back. By keeping the elbows out and above the bar, especially during the second pull, and stressing arm speed, the athlete will keep the bar close to his body. Pulls, high pulls, shrugs and lifts from different positions are a few exercises to alleviate this problem. These same exercises, particularly lifts from the blocks, will also assist in keeping the athlete's shoulders over the bar. In addition, RDL's, good mornings, hyperextensions, reverse hypers and abdominal work will help.

To improve the receiving position, the athlete must first develop confidence in this position. Some exercises to improve confidence are higher intensity overhead squats, snatch balance, drop snatches and snatch grip push press or power jerk behind the neck plus overhead squat. Speed and meeting the bar in the low position with these higher intensity weights will develop confidence. Some general strength exercises to improve stability in the squat position are any overhead strength and shoulder strength exercises more specifically press or push press behind the neck behind neck with a snatch grip and pressing movements in the low squat position.

Fault: The lifter presses out the snatch in the receiving position.

Possible Causes:
- The lifter does not impart enough force at the finish of the pull
- The lifter is slow in moving under the bar
- Weakness in the receiving position

Corrections: If the athlete does not apply enough force or does not give sufficient energy for developing maximal momentum, the lift may result in a press out. This insufficient force application will most likely result in the lifter being slow in moving under the bar and into the receiving position. If the athlete has weakness in the low receiving position, it will only exacerbate the problem.

Exercises, which emphasize the pull and force application, are pulls, shrugs, and lifts from different positions, particularly from the blocks, squats and RDL's. To improve speed while moving under the bar, the athlete will find snatch balance, drop snatches and lifts from the high thigh will aid. Various general strength exercises to improve strength in the squat position are any overhead strength and shoulder strength exercises more specifically press or push press behind the neck behind neck with a snatch grip and pressing movements in the low squat position.

The Clean

Fault: The athlete's elbow touches the knee or thigh and/or the athlete does not meet the bar properly in the receiving position.

Possible Causes:

- Incomplete pull; the lifter moves under the bar too early
- The lifter does not meet the bar properly in the receiving position
- The lifter bends the arms too early
- The lifter shifts the knees forward, or goes on the toes, too soon
- The lifter jumps back too far in the receiving position

Corrections: If the lifter "rushes" the pull and moves under the bar without full extension, therefore limiting force production, this infraction may occur. In addition, this technical flaw may also lead to another fault. If the lifter does not meet the bar well, it may "crash" on him. This resulting crash may force the upper body and elbows forward with a knee touch ensuing. Should the lifter bend the arms too early, limited force production will be the consequence. The lifter may bend the arms to reinforce his belief of really finishing the pull however, the opposite will occur. The lifter's power source, which he will use to pull himself under the bar, will be limited. Also, if the lifter does not stay over the bar long enough or pushes the knees forward too soon, this will affect power output as well. Finally, a result that may happen is if the lifter jumps back too far. Usually if the lifter throws the head and shoulders back, this will result. Once the action occurs there must be a reaction, which is the lifter jumping back to receive the bar. Typically, the lifter will receive it in a poor position with the bar crashing on him resulting in an elbow touch.

Exercises which will assist the lifter with finishing the pull are shrugs, pulls, lifts from different positions and back strengthening exercises such as good mornings, hyperextensions and reverse hypers. These exercises will also remedy arm pulling. During these exercises, the coach should reinforce correct arm position. RDL's, halting pulls and dead lifts will help the athlete with the strength he needs to stay over the bar. To correct jumping backwards, the lifter should focus on technique during shrugs, pulls and

lifts. Also, reinforcement or implementation of the aforementioned back strengthening exercises.

Fault: Lifter jumps forward during the clean

Possible Causes:

- Poor start position
- The barbell moves away from the lifter at lift-off
- Incomplete extension during the pull
- Poor core strength

Corrections: If the lifter is in a poor start position, there is a greater chance for him to miss the lift. The weight distribution should be toward the center of the foot or toward the heels. In addition, poor chest and hip positions, will likewise adversely affect the lift. During lift-off, the barbell should immediately move back toward the lifter. If the lifter allows the weight to control him, it will most likely move forward. This means the lifter will be on his toes almost from lift-off. If the action were that the weight distribution is on the toes, the reaction would be for the lifter to jump forward to "catch-up" to the weight. In addition, this poor position will also affect the pull. By being so far forward, the lifter is not able to finish the pull. This makes the problem worse. However, many times the athlete is not physically prepared to lift heavy weights and the lifter must address fundamental core strength issues.

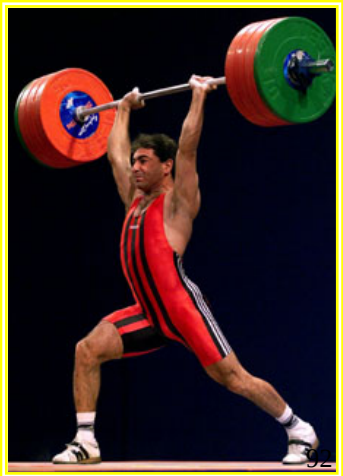
An excellent exercise to improve the start position is lifts-off or clean pull to knee. This movement is very short and focused. It stresses weight distribution in addition to proper chest, hip and back positions. By stressing these points, it will assist with the bar moving back toward the lifter off the floor. If the lifter begins the lifts correctly, he will most likely finish the lift correctly. Because the lifter is in a good position to finish the pull, he will likely do so. If the lifter lacks general core strength, the coach should incorporate abdominal and back strengthening exercises.

The Jerk

Fault: The lifter loses the lift forward either in the receiving position or during the recovery.

Possible Causes:

- The dip is forward due to incorrect weight distribution
- The athlete allows the chest and/or elbows to drop during the dip
- The dip and/or drive is incomplete
- The athlete steps away from the bar during the split
- The athlete pushes the head forward during the split



Corrections: The weight distribution during the dip should be on the heels. Should the weight be on the toes, the lifter will

thrust the bar forward. If, during the dip, the athlete lets the elbows or chest drop, this will not only compromise the rack position, but it will also affect force production therefore decreasing the amount of watts produced during the drive. If the dip of the athlete is premature or the drive is incomplete, the athlete will have a much more difficult time making the jerk. This incomplete drive may cause the lifter to step away from the attempt during the split. Another way a lifter can miss a lift forward is due to pushing the head forward in the receiving position. The action of pushing the head forward leads to the reaction of the hips moving backward and the chest forward. This puts in lifter in a compromising position.

Exercises to assist with proper weight distribution, with keeping the chest and elbows in the proper position and correct dip and drive skill are technique reinforcement, rack jerks, jerk dips and jerk drives. With higher-level lifters, it is imperative to use jerk blocks. There is unnecessary abuse on the body with heavy weights when the athlete does not use jerk blocks. Supplementary exercises to keep the athlete from stepping away or pushing the head through during the split are emphasizing the foot split. Foot movement should initiate simultaneously and end simultaneously. Jerk dips, power jerks, using a focal point for proper head position, jerk balance and the Murray Cross are exercises the coach can implement.

Fault: The jerk is lost behind in the receiving position or in the recovery.

Possible Causes:

- Incorrect dip and drive; the lifter throws his hips forward as he drives up
- The lifter steps too far through with the leading leg in the jerk
- The lifter steps back too far or too aggressively with the leading leg in recovering

Corrections: The dip and drive should be as vertical as possible. If the lifter throws the hips forward or allows the chest to deflate, this will affect bar trajectory negatively. Also affecting the jerk adversely is if the lifter steps too far through with the leading leg. This will not only put the lifter at a disadvantage for recovering but also with stability. If the lifter steps back too aggressively with the lead leg while recovering, this may lead to stability issues due to the momentum created by the front leg.

Any overhead strength, stability or technical exercise will assist with these issues. Any type of pressing movement, power jerk, jerk from the rack (or blocks), jerk from behind the neck, jerk balance and jerk recoveries. Due to the higher technical aspect of these lifts, the coach should try to be present for each repetition.

Fault: The lifter presses out the jerk

Possible Causes:

- Poor or weak dip and drive
- The lifter tries to push the bar with the arms during the drive
- Immobility of the shoulder girdle
- Poor arm lockout

Corrections: If the athlete has a poor dip and/or drive, the result may be the lifter pressing out the jerk. To compensate for the poor dip and drive, the lifter may try to "muscle" up the weight. Here the lifter actively pushes up with the arms to try to get to the finishing position. In addition, poor shoulder flexibility in the shoulder girdle may also affect the jerk adversely. Finally, lifters must have a good lockout or finishing position. Lifters can be successful with a below average arm lockout however, they must be diligent in their remedial training to not lose a lift due to a poor arm lock.

To prevent a poor dip and drive, athletes can due a variety of exercises including push press and power jerks from in front and behind, jerks from the rack (or blocks), jerk dips and jerk drives from the blocks. Athletes who have poor flexibility in the shoulder girdle should do a variety of exercises to increase mobility. Partner exercises have shown positive results not only from a flexibility standpoint but also for compliance.

These are examples of the more common faults and suggested corrections in the sport of weightlifting. However, we must stress that coaches should not just look at the end result but what may have affected the end result. Assisting with this is viewing the lift from different angles as the coach may notice some faults at different areas around the gym. Novice coaches may try several corrections at first and see which exercises work best with each athlete. This will give the coach a better understanding of the different exercises.

Foremost is the technical vigilance of the coach. Especially with beginning lifters, the coach should be at every training session and make every attempt to watch each repetition. Lifters, who develop poor technical habits initially, find it very difficult to correct later. The coach too, should try to develop his own coaching style. One example may be using key words. Instead of the coach saying" keep the arms straight" he may just say "ropes". Immediately the lifter knows to keep the arms straight. Coaching however, is an ongoing process. The better repoire the athlete and coach develop the better the communication will be in training and competition. This then, will lead to positive results.

Chapter 11

Competition Preparation and Execution

Weightlifting training and its processes lead up to the ultimate objective: maximum results in competition. Coaches have ruined excellent training programs due to inexperience and lack of thought about what actually goes on at the competition. Coaches can experience success, or lack thereof, at the local, state, national or international level. Coaching and learning is a never ending process and coaches must be aware of rules changes, venue operations, training, pedagogy and infinite minor details, which must not be overlooked.

Before leaving for a competition, the coach should conduct an equipment check. The coach and lifter must bring with them essential equipment and using a checklist before departure is an excellent investment for success. Coaches must stress these basic essentials to their lifters from the beginning as it builds confidence and responsibility for them. Preparing for the competition not only takes place on the platform but also incorporates various tangibles, which the coach and lifter must take care of first. First and foremost, the athlete must take all training and competition gear and any personal items in a separate duffel bag, which the athlete carries with him at all times. Some items on this checklist include:

- Passport/USAW card
- Proof of date of birth for an age competition (School Age championships)
- Weightlifting shoes
- Socks
- Singlet
- Training/competition t-shirt
- Warm-up suit
- Athletic shorts
- Tape/tape spray
- Belt
- Knee sleeves
- Lifting straps
- Towel
- Rain suit
- Callous file/pumice stone/nail clippers
- Toilet paper
- Food (snacks/fruit/energy bars)

The coach is an enormous resource to the lifter and he must prepare and be prepared for every foreseeable event, which may occur. Not only does the coach need his coaching knowledge and expertise but he needs to be sure he has all essential equipment to assist his lifter. Although a doctor accompanies most trips Team USA makes, only a small percentage of club team have doctors that accompany them on trips. Therefore, it is wise

to include some of the items listed below, although some may not be entirely the coach's responsibility. The coach should have some sort of medical bag, which should contain most of the following items:

- Tape
- Tape spray
- Adhesive bandages
- Liniment
- Cold spray
- Scissors
- Tweezers
- Callous file/cutter
- Nail clippers
- Chewing gum
- Smelling salts
- Ibuprofen/aspirin
- Chalk
- Shoelaces
- Safety pins
- Towel(s)
- Knife
- Spoon
- Bottle opener

The above items are basic equipment and coaches may use this equipment in a domestic or international competition. Although a doctor accompanies a majority of the trips Team USA goes on, there are some smaller international competitions where the coach is the only resource. Consequently, USAW's Medical Committee Chair and members of the Medical Committee can be valuable. In addition, cultivating a relationship with the doctor on duty at the competition would also be advantageous.

Venue Appraisal

Upon arrival at the competition location, the team leader or head coach will be responsible for checking everyone in at the hotel and supplying vital information regarding the competition. Therefore, it is the head coach's responsibility to call a team meeting as soon as possible to set up the ground rules. Immediate concerns for the athletes will be:

- Rooming assignments
- Location of the check scales and sauna
- Location of the dining hall or restaurants, times athletes can eat and if they will need meal tickets
- Shuttle times to the venue and back (if applicable)
- Location of the training hall and shuttle schedule (if applicable)

At their earliest convenience, the coaches and manager should conduct a venue appraisal. This appraisal will give them a better understanding of the logistics of the competition venue. Some of these logistics include:

- Distance from the warm-up room to the competition platform
- Type of equipment
- Lighting and temperature of the competition area and warm-up room
- Location of the warm-up room scoreboard
- Location of the weigh-in room to the sauna
- Layout of the warm-up room
- Availability of drinks and food
- Availability of rest areas
- Availability of ice
- Availability of chairs in the warm-up room
- Location and operation of the closed circuit TV
- Will the competition use Marshals?

Opposition Appraisal

Before departure for the competition, the coach must begin to research the competition. The coach can do this by looking at results of competitions on websites, weightlifting publications, speaking with other coaches, from attending other competitions or any other means available. Coaches should also be familiar with opposing coaches' strategies. For example, always increasing the opening attempt or taking unusual jumps after an attempt. It is essential the coach try to score as many team points as possible. If the coach prepares by research before the competition, it will ensure optimal final placement.

One day before the start of competition, the technical conference takes place. This is the last time delegations/teams can make changes to their athletes and teams whom they have entered in the competition. For example, if the coach wants to move an athlete up or down in a weight category the technical conference is the place to do it. In addition, members of the Technical Committee conduct the athlete lot draws and which officials will work what session. The final schedule of competition is set as well as introduction times and whether there is a ten-minute break between disciplines. These final two points will have a large bearing on warm up time for the athletes.

A helpful document, which the coach can get from the Internet or the National Office, is National or International Ranking list. If a coach is not familiar with an athlete's name, he needs only to look up the total on the ranking list. Once the Competition Secretary publishes the bodyweights, the coach can make further strategic appraisals of the competition including starting and succeeding attempts.

Making Weight and the Official Weigh-In

When a competition is approaching, lifters must be aware of their bodyweights. The coach should also play an active role in this protocol. Many athletes will either think they are at a reasonable bodyweight or will tell their coach so. Many athletes will train above their competition bodyweight. This however, varies on an individual basis.

Approximately one week before the event, the coach should make a bodyweight appraisal and if necessary, may instigate a weight loss procedure. This may include implementing a nutritional plan and/or weight loss procedures such as a sauna.
Two days before the lifter is to compete, depending on the bodyweight category, the lifter should be within one to two and a half kilograms of the category limit. Research in weightlifting has shown that rapid weight loss in the final 24 hours produces the best results for performance. Experience will show how much weight an individual can actually take off without it being a detriment to performance. Limiting the amount of liquids in the final 24 hours will have the biggest influence on final weight loss. If the athlete realizes he cannot make weight by the weigh-in time, the lifter should prepare to use a sauna. If a sauna is not available, sitting in a vehicle with the heater on is an appropriate substitute. Depending on how much weight the athlete must lose will depend on when to use the sauna. If the athlete must lose a significant amount of weight, it may be wise to begin the sauna the day before and leave a smaller amount of time in the sauna for the day of competition. If only a small amount of weight needs to be lost, it may be wise to wait until the day of competition.

Using a Sauna for Weight Loss
When using the sauna to lose bodyweight, the lifter should initially shower to wash away any sweat or body oil and to raise the skin temperature. Then, sit on the lower bench in the sauna until one acclimatizes to the temperature. Then, move to the higher bench, relax and lie down. After ten minutes on the higher bench, the lifter should get out and the coach should immediately wrap the entire lifter in towels and blankets and lie down in the supine position. After five to ten minutes, the lifter should dry off and start the process over. The coach should try to time this procedure as best he can to lose the appropriate amount of weight and immediately go to the official weigh-in. The lifter can then spend the least amount of time in an uncomfortable state and focus on rehydration and optimal results. If no sauna is available, the coach can use the same procedure in a hot tub or whirlpool. The last result would be sitting in a car with the heater on with several layers of clothing.

Warm-up for the Competition
As with training, the coach must go into the competition with a plan. The coach and athlete must communicate about opening attempts, warm-up weights and any other relevant issues before the competition, not during it. The coach should only deviate from this plan if the lifter is not warming up well, experiences an injury or a medal or higher placement is attainable.

The warm-up should begin with the coach asking the athlete if he needs any assistance. Many times this entails rubbing liniment on the shoulders, back, knees, legs or any other areas, which the athlete feels necessary. A vigorous, expedient massage will bring superficial blood to the area and prepare the lifter for competition. This is often a good time for interaction between the coach and lifter. The coach should project a calm "in charge" image to boost the lifter's confidence. Even the most experienced lifters and coaches show evidence of anxiety and nerves before the start of the competition. The coach however, should never convey this concern to the lifter.

Most weightlifters want to warm-up too soon so coaches must be vigilant in their control over this situation. Taking into account athlete introductions and the general warm-up and flexibility work, lifters should begin the actual lifting warm-up with approximately twenty attempts until he is called to the platform. Realizing, this is very individual, it is only a suggestion. Most athletes have a particular warm-up protocol, which may or may not be similar to this example. It is a little better to leave more than less time, though. If there are not twenty attempts until your lifter is up, then the coach can use a combination of attempts and time.

Most athletes begin the warm-up with the bar and add weight accordingly. Athletes typically take bigger jumps at the beginning and smaller jumps, as they get closer to their starting attempt. It is advisable to warm-up to within five kilograms of the opening attempt. If a lifter is opening with 130kg in the snatch, the warm-up may look something like this:

50	50	70	80	90	100	110	120	125
3	3	2	2	2	1	1	1	1

If the coach himself is not counting the attempts of the opponents, he should entrust this vital task to someone he has confidence in. Any mistakes may cost the lifter a medal opportunity. After the opening attempt, the coach should immediately count how many attempts there are until the second attempt. This will determine whether the lifter will need to take an attempt or a pull before the second attempt on the platform. Typically, five attempts or four to five minutes between attempts will determine this.

Following the snatch competition, the lifter should put his sweat suit on and try to relax until it is time to warm-up for the clean & jerk. As with the snatch, the lifter should do some general calisthenics before the actual warm-up with weights. This will "get the blood going" and awaken the nervous system. Most lifters do not need as much time or warm-up attempts in the jerk. They do however; prefer more time in between warm-up attempts for recovery purposes. Depending on the bodyweight category, the last warm-up attempt may be as much as ten kilograms below the opener. So, if the lifter is going to open with 160 kilograms here is a suggested warm-up strategy:

50	50	70	90	110	130	140	150
2+2	2+2	2+2	2+2	1+1	1+1	1+1	1+1

As with the snatch, following the opening attempt in the jerk, the coach must immediately count attempts until the next lift. Based on the amount of attempts, the coach will determine if the athlete should take an extra lift in the warm-up room. The same period applies between attempts for the jerk as in the snatch.

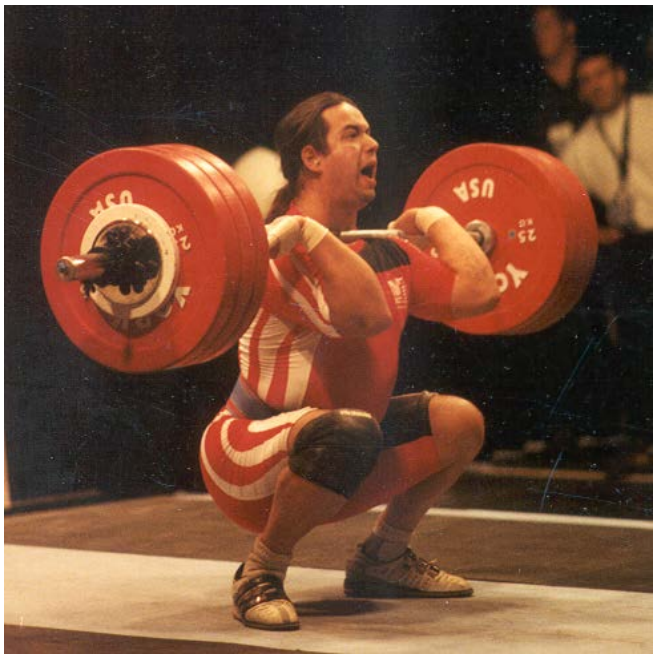
Competition Tactics

It is always a benefit in weightlifting to follow your opponent so that one knows exactly what lifts to make, or take to gain an advantage. This is truer in the jerk as this is the lift,

which decides the total medal. In the snatch, starting attempts and lifting order tend to have a large bearing on the situation as it is foolish to gamble in the snatch, which is the more technical and emotionally charged of the two lifts. In the clean & jerk though, bodyweight has an enormous bearing on tactics and weight increases.

It is essential, although often difficult, for the coach to keep a clear head and keep a calm eye on the progress of the competition. Many successful teams split the responsibility of getting maximum results from the lifter by having the coach, work exclusively with the lifter while the assistant coach or team leader keeps track of attempts and the progress of the competition. This working situation is ideal but all too often the responsibility for all these areas fall on the head coach.

Experience in high-pressure situations in competition coaching has no equal. However, coaches can take comfort in the fact that the possibility of all tactical situations depends on the lifter. If the lifter cannot lift the weight, it is all for nothing. Conversely, many lifters have made great tacticians out of their coaches. Therefore, when all is said and done, the best a coach can do is send his lifter out for the correct weight to win, then as always, it is up to the lifter.



Robert Murphy cleans 187.5 kilos

Chapter 12

Programming

The Club Coach manual introduced cyclical training, or super compensation, and discussed how these principles apply to periodization. These basic principles, illustrated by a very simplistic program, are the foundation for the compilation of more advanced programs. Beginners will show improvement but eventually their bodies will adapt to the stresses this program results in. For the athlete to continue to make progress, the coach must implement greater loading and stress, which the three-day per week program delineates. This chapter will serve as a guideline for coaches to implement a higher volume and intensity program.

Long-term planning will be necessary if the lifter becomes ambitious enough to compete at higher-level competitions. The coach should plan the program so that the athlete will produce the highest results at the major competitions. The coach can use the annual calendar of events as a guideline. This does not mean the lifters will only compete at these major events rather they will only peak at these events. These minor competitions will not only serve as maximum workout or test days but they will also assist the lifter with competing. Young lifters can and should compete frequently do develop commitment, satisfaction and enjoyment from the sport.

For developing lifters, four major events equally spaced throughout the year are ideal. However, equally spaced competitions are unlikely and the coach will most likely have to adjust the program to reflect the competitions. The coach can make these adjustments by counting backwards from the day of competition to the starting point and attempt to divide this period into four-week blocks. Although there are other variations, this four week cyclical approach to training, which alternates light and heavy weeks first introduced in the Club Coach manual, has shown great success. By manipulating several variables such as volume, intensity and number of training days, progressing beginners will now experience a more stressful, cyclical program. We can now look at these variable more closely.

Volume

Factors such as repetitions, sets, percentages, amount of time and days spent training, number of exercises, speed and type of exercises all affect volume. Therefore, many variables can make up the definition of volume. However, we can think of volume as the measurement of the amount of work done in a given period. For novice lifters who do not have a true maximum, the coach can measure volume by the number of repetitions the lifter performs. With advanced lifters, the coach can measure volume by the number of repetitions the lifter performs at higher intensities.

Intensity
One typically measures intensity as a percentage of the athlete's one-repetition maximum. The coach may also find multiple repetition maximums useful during heavy or maximal strength training. One-repetition maximums are calculated only in the major lifts such as snatch, clean & jerk, back squat front squat and several overhead and assistance exercises. Calculate snatch or clean pulls off the actual lift.

Number of Workouts per Week
Increasing the number of workouts per week will influence the volume of any program. With athletes who are just beginning to increase the number of workouts per week, the coach can simply spread out the workouts so the workload is the same only the athlete is performing them over more workouts. This serves as an introductory phase so the athlete is not too overwhelmed initially. However, for the athlete to move forward and keep making progress, the coach will eventually have to increase the amount of work. In addition to an increase in workload, the coach can increase training effect by increasing intensity as well. The coach can do this not only by increasing the number of workouts per week but also per day.

The most dynamic training effect in weightlifting is produced by an increased overload for the higher intensity repetitions. The Club Coach manual refers to this as progressive overload, which is a systematic increase of training load, over time, in accordance with an individual's capacity. Essentially, the coach should increase the athlete's workload from novice to elite level. A volume and intensity increase can be developed within those workouts by using the following plan:

Week	1	2	3	4
Volume	Medium	Maximum	Low	Medium
Intensity	Medium	High	Low	Maximum

This four-week cycle plan begins with two increasing loading weeks, followed by a light recovery week and then a high intensity week, similar to the Club Coach plan. Although this training program parallels the Club Coach plan, coaches must realize weightlifting training is a progression. Athletes may spend several years developing an adequate foundation for increased training. Revisiting Matveyev's principle, which indicates high volume and low intensity work initially and as the competition gets closer, higher intensities are stressed with lower volume. Coaches must have patience, fortitude and a selfless interest for themselves to work with these athletes. Continuing to use this advanced plan, athletes will see results and coaches will reap the benefits of these results. If the coach has three months (13 weeks) or three four week cycles plus a competition week, to plan a program the coach can use the following cycle as a guideline.

	Cycle 1	Cycle 2	Cycle 3	Comp. Week
Week	1 2 3 4	5 6 7 8	9 10 11 12	13
Intensity of Top sets (%)	70 75 65 80	75 85 70 90	85 95 75 100	75
Reps/set	5	3	2/1	3/2/1

Cycle 1

In this cycle, the emphasis is on work capacity and preparing the athlete's body for higher intensities in the weeks to come. Therefore, in the majority of exercises and lifts, there will be five repetitions per set. One exception would be in the clean & jerk due to the stressful nature of the lift on the body. Here, the coach can break up the movement into two exercises so the cleans are done separate from the jerks. These higher repetitions will not only have a positive effect on the technique of younger lifter it will also assist with more advanced lifters. This type of work will increase work capacity and strength in addition to having a hypertrophy effect. The number of exercises per workout and the number of sets with the top intensity will depend on the individual. The coach can manipulate these intensities to emphasize the lifter's weak areas or to stress a certain lacking quality. The following table is an example how the coach can structure a four week plan.

	Week 1	Week 2	Week 3	Week 4
Set 1	50% x 5	50% x 5	50% x 5	50% x 5
Set 2	60% x 5	60% x 5	55% x 5	60% x 5
Set 3	65% x 5	70% x 5	60% x 5	70% x 5
Set 4	70% x 5	75% x 5	65% x 5	80% x 5
Set 5	65% x 5	75% x 5		80%+ x 5
Set 6		70% x 5		70% x 5
Total reps	25	30	20	30

In week 4, the 80%+ set would only be done in a given exercise or lift in one workout as this is a repetition maximum for the exercise. The coach records a best of five reps for each exercise so a benchmark is set. These new benchmarks are then a guideline for future planning. As the athlete progresses through the cycle, he would attempt to increase the weight for his best for five, which would be a genuine indication of progress. In addition, the coach may plan to increase the number of sets at the higher percentages. This will also serve as a precursor to progress throughout the cycle.

Cycle 2

In this cycle, the emphasis changes from work capacity and preparation to more specific weightlifting training. The repetitions per set are reduced to three but the intensity increases throughout the cycle while the volume decreases. With the increase in intensity, the number of sets also increases. The athlete will be able to handle this due to the four-week preparation phase in cycle 1. As with cycle 1, the coach may find the following table useful in programming cycle 2.

	Week 5	Week 6	Week 7	Week 8
Set 1	50% x 3	60% x 3	50% x 3	60% x 3
Set 2	60% x 3	70% x 3	60% x 3	70% x 3
Set 3	70% x 3	80% x 3	65% x 3	80% x 3
Set 4	75% x 3	85% x 3	70% x 3	90% x 3
Set 5	70% x 3	85% x 3		90%+ x 3
Set 6		75% x 3		80% x 3
Total reps	15	18	12	18

Once again, in week 8 the workout can incorporate a set with 90%+ to establish a benchmark for three repetitions.

Cycle 3

In this final cycle, the intensity increases again and the work becomes very weightlifting specific focusing mainly on the competition lifts. The repetitions drop to doubles and singles while the number of sets increases and volume continues to decrease. By this cycle, the athlete has built a solid foundation to attempt maximal and near maximal weights on a consistent basis. This will give the athlete confidence in the weeks leading up to the competition. Below is a table, which the coach may use as a guide for cycle 3.

	Week 9	Week 10	Week 11	Week 12	Week 13
Set 1	60% x 3	60% x 3	60% x 3	60% x 3	60% x 3
Set 2	70% x 2	70% x 2	65% x 3	70% x 3	65% x 3
Set 3	75% x 2	80% x 2	70% x 2	80% x 2	70% x 2
Set 4	80% x 2	85% x 2	75% x 2	90% x 2	75% x 2
Set 5	85% x 2	90% x 2	70% x 2	95% x 1	80% x 1
Set 6	80% x 2	95% x 1		100% x 1	
Set 7		95% x 1		100%+ x 1	
Set 8		95% x 1		90% x 2	
Set 9		90% x 2			
Total reps	13	16	12	15	11

As in prior weeks, week 12 may have a 100%+ day for the athlete to try to establish a new one repetition maximum. This will then become the basis for future planning. Week 13 will be the pre-competition week and will consist of loads of approximately 75% for one to three repetitions.

Given these three cycles, the overall plan will emphasize the following objectives during each:

- Cycle 1 Weeks 1-4 Strength, power, conditioning and hypertrophy
- Cycle 2 Weeks 5-8 Strength, power and technique
- Cycle 3 Weeks 9-13 Power, technique and competition preparation

Once the coach calculates the volume and intensity of the overall training plan, he will now implement the actual lifts and exercises into the program. Which exercises to include and exclude now becomes critical. This manual dedicates a whole chapter (chapter nine assistance exercises) to this very issue. This chapter lists many exercises than one can ever include in one training session. In contrast, there are many more which are not in chapter ten that the coach can include. Consequently, the coach must look at the objective of the cycle, the individual lifter and prepare an appropriate training regime.

Below is an example of lifts and exercises in a program for a lifter who is entering cycle 1. The emphasis will be on strength, power and conditioning. An assessment of the lifter indicates the individual has technical problems with the finish of the pull in both lifts and the jerk is lower than the clean. In addition, the lifter has upper back and core strength

weakness. Considering these points, an appropriate plan is written to address these deficiencies with a special bias to correcting these issues and producing general improvement. The workout regime calls for training five days per week, which consists of two on one off three on one off (Monday - Saturday).

Cycle 1

Monday	Tuesday
Snatch pull + power snatch	Snatch
Back squat	Box jumps
Romanian Dead lift (RDL)	Power jerk (snatch grip) + overhead squat
Military press	Snatch pull
Dumbbell (DB) reverse flies	Shoulder shrugs- snatch grip
Weighted abdominals	Lower and oblique abdominals
Hyperextensions	Static isometric hold (side supports)

Thursday	Friday
Clean pull + power clean	Jump rope
Front squat	Clean & jerk
RDL	Power jerk behind neck
Press behind neck	Clean pull
Upright row	Shoulder shrugs- clean grip
Weighted abdominals	Lower and oblique abdominals
Reverse hypers	Static isometric hold (superman)

Saturday	
Dynamic medicine ball throws	Lunges
Low-level plyometrics	Incline press
Push press	Abdominals (no weight)

In cycle 2, the technical aspect of the lifts increases in addition to the continuation of work for the lifter's deficiencies. The emphasis shifts to strength, power and technique. The workouts will include more lifts and lift related exercises and all movements should emphasize faster work that is more dynamic. The workouts are the same five-day per week training regime as in cycle 1. Below is an example of a cycle 2 program.

Cycle 2

Monday	Tuesday
Power clean- blocks	Power jerk
Clean & jerk	Shoulder shrugs- clean grip
Clean pulls	RDL
Back squat	Clean pull to knee
Weighted abdominals	Alternate DB press
Good mornings	Weighted lower and oblique abdominals

Thursday
Power snatch- blocks
Snatch
Front squat
Snatch pulls
Weighted abdominals
Weighted hyperextensions

Friday
Jerk from rack
Shoulder shrugs- snatch grip
RDL
Snatch pull to knee
Incline press
Weighted lower and oblique abdominals

Saturday
Snatch
Clean & jerk
Back squat

Military press
Weighted abdominals
Reverse hypers

Cycle 3 is designed for competition preparation and consequently, the bulk of the exercises are the competition lifts and lift related exercises, which are fast and dynamic. All of the power and strength work from the previous cycles will now come into fruition. The focus should constantly be on speed and technique. The coach should make a valiant effort to emphasize to the lifter how important the technical aspect of this cycle is. Missed lifts should be at a minimum and the lifter should focus on perfect technique on each attempt. Please refer to cycle 3 below, which has the same regime as the two previous cycles.

Cycle 3

Monday
Box jumps
Clean & jerk
Clean pulls
Back squat
Push press
Weighted abdominals

Tuesday
Overhead squats
Power clean
Jerk from rack
Abdominals
Hyperextensions

Thursday
Jumps over barriers
Snatch
Snatch pulls
Front squat
Push press behind the neck
Weighted abdominals

Friday
Snatch balance
Power snatch- blocks
Power jerk
Abdominals
Reverse hypers

Saturday
Box jumps
Snatch
Clean & jerk

Back squat
Military press
Weighted abdominals

By comparing these three cycles, one can see that many of the remedial and strength exercises that figure heavily in cycle 1 gradually reduce through the succeeding cycles as

the emphasis shifts to more competition oriented work. However, the remedial work is not eliminated to ensure reinforcement of technique and maintenance of strength. This particular program illustrates how one can emphasize a program to produce the intended effects.

The Week Before Competition

This is week 13, the week that leads up to the competition, which usually takes place on a Saturday. Consequently, the week will contain work, which is not too stressful in nature given the preceding weeks. No lifts should exceed 80% in intensity and the number of workouts is reduced to encourage recovery and recuperation. The lifts themselves are done for single and double repetitions. Therefore, training sessions would take place on Monday and Wednesday and perhaps some bar work or stretching on Friday to loosen up. The lifter should also begin to monitor bodyweight, which may be a factor if the athlete has not yet made any concessions to make weight. In addition, the athlete should begin to prepare for travel if the competition is not local. Last but no least, the athlete should begin to mentally prepare himself for competition and get as much rest as possible.

The Law of Diminishing Returns

As lifters repeat these macro-cycles leading up to competitions, the human body will eventually adapt to the stresses. This adaptation is normal and the athlete can overcome this by doing more work. Actually, the athlete must do more work to see increased results. The athlete can increase stress in several ways. The first way would be to increase volume, or the amount of work the athlete does in a given period. A second way would be to increase intensity, or increasing the amount of work based of a one repetition maximum. After the athlete accumulates a solid foundation of work capacity, increases in intensity will be the more efficient way to increase performance. Consequently, in the cyclical program the number of sets with the top weights would increase. As an example, cycle 1 can vary with the same athlete in the following manner:

Week	1	2	3	4
Top sets	1	2	1	2

These can gradually increase to:

Week	1	2	3	4
Top sets	3	5	2	3

Therefore, Matveyev's Principle is still applicable in the training prescription. The athlete does the higher volume work at the beginning of the training cycle and as the competition draws near, volume is reduced and intensity is increased.

Segment Work

This system, which aids in the increase of volume and enables the lifter to handle greater intensity, also prepares the lifter for competition. This system produces a superior training effect with the competition and competition related lifts, assists the coach with technical flaws with the higher percentage lifts and prepares the lifter for competition by

mimicking a competition situation in which the lifter has several attempts before he is up again. To better, illustrate this system; please refer to the training program below that gives an example of a workout for a 56-kilogram lifter whose best snatch is 100 kilograms.

Week 9- Six sets with the top percentages

Snatch	60	70	75	*80*	*85*	*87.5*	*80*	*85*	*87.5*
	3	2	2	*2*	*2*	*1*	*2*	*2*	*1*

Week 10- Eight sets with the top percentages

Snatch	60	70	*80*	*85*	*90*	*95*	*97.5*	*90*	*95*	*97.5*
	3	2	*2*	*2*	*1*	*1*	*1*	*1*	*1*	*1*

Week 11- One set with the top percentage

Snatch	60	65	70	75	*80*	75
	3	2	2	2	*1*	2

Week 12- Six sets with the top percentages

Snatch	60	70	80	90	*95*	*100*	*102.5*	*95*	*100*	*105*
	3	2	2	1	*1*	*1*	*1*	*1*	*1*	*1*

There is a tremendous amount of work associated with this system not only physically but also mentally. The heavy singles at the higher percentages allows the lifter to build confidence with these weights. Please keep in mind, segment work is not for the novice lifter but for lifters who have established a solid foundation of training and have a sound understanding of technique.

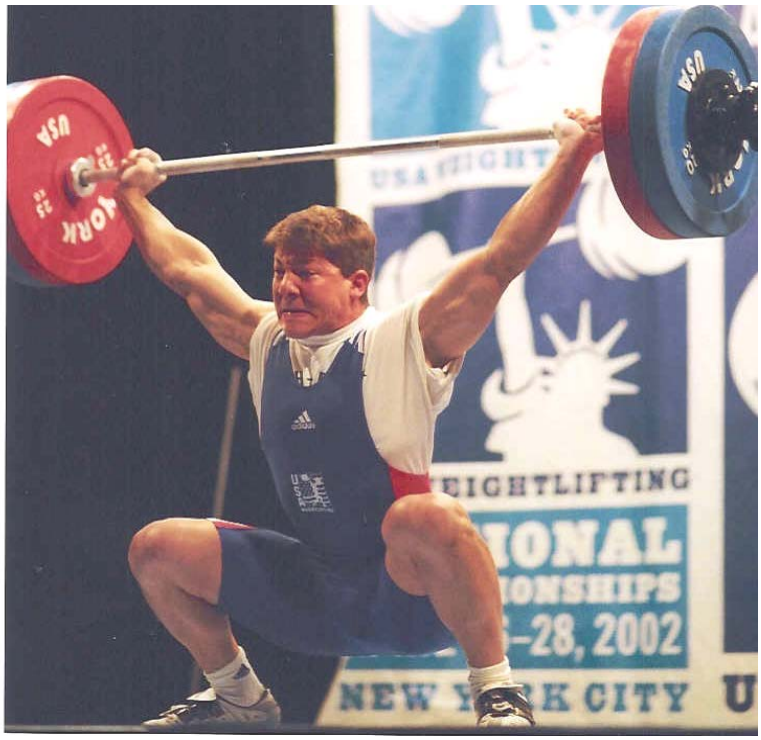
A word of caution in regards to segment work: progress slowly! Initially, the coach may introduce segment work once a week with one lift i.e. the snatch or clean & jerk, but not both in the same session. As the lifter progresses and becomes comfortable with the workload and intensities, the amount of work is increased.

Training More Than Once per Day

When introducing two a day training sessions, it is wise to proceed with caution and it is not a system to introduce to beginners. However, coaches can introduce it at an earlier age than previously thought. A tested way to begin introducing two day training would be to simply split a one-day workout into two parts. In addition, to not overwhelm the athlete, it is suggested that the athlete start with one or two twice a day training sessions that are well spaced i.e. Monday and Thursday. Consequently, the athlete does the same amount of work only it is over two workouts. Gradually, the lifters acclimate and adapt to the training and the amount of work is increased.

The time commitment for this type of training is demanding and a total reorganization of the lifter's lifestyle may be required. Not only does the lifter have to re-evaluate his lifestyle but also the coach must make the same assurance. However, if both are willing to make this commitment, the results will be gratifying. A high percentage of lifters who

decide to dedicate themselves to this pledge will have the satisfaction of success at the national level and perhaps the international level. To be competitive at the international level, this type of training and commitment is obligatory. Although it is a high price to pay, the rewards are unparalleled. The motivated athletes who are willing to fulfill this promise may be the next generation of Olympians!



Three time Junior World Team Member Matt Bruce

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