1 – Introduction

Do we know what we know?

"The most erroneous stories are those we think we know best
—and therefore never scrutinize or question."

—Stephen Jay Gould

The ability to effectively design, organize, and implement training programs is an absolute requirement for success in all areas of exercise: performance, coaching, physical education, health and wellness, and rehabilitation. Volumes have been written on programming aerobic exercise for a variety of populations. They are usually written by academics with practical experience in aerobic exercise and are backed by research specifically addressing this type of exercise. Precise guidelines exist for programming aerobic exercise for virtually any population. The literature in the scientific, medical, and exercise journals in this topic is abundant.

On the anaerobic side of the street, where weight training resides, the situation is much different. While there is a great deal of material available for consumption by the public, its quality is frequently suspect. The supposed "gold standard" for exercise prescription recommendations, the American College of Sports Medicine (ACSM) *Guidelines for Exercise Testing and Prescription*, provides only a cursory description of a method for programming weight training. Frequently, the "experts" on whom the public relies for guidance come from one of two camps: 1) individuals with practical experience and little or no specific education and training, or 2) individuals with degrees (usually not in the area of anaerobic physiology) who have very little practical experience with weight training

but the best of intentions. The end result is that the typical coach, clinician, gym member, or athlete trying to maximize performance is very poorly served by inappropriate instruction in weight training and inadequate program design.

Professionals, both practitioners and academics, in weight training seem to avoid addressing this issue, likely for a variety of reasons. With little or no available information providing strong evidence in favor of a particular approach to programming, a practitioner can never actually be wrong in programming for a client, athlete, patient, or student as long as the program stays reasonably close to the ACSM's nebulous position. And if it is close, he cannot be legally challenged in terms of professional liability. Even if he obtains less than optimal results for his trainee, he is being "technically correct" in his approach. As a result, there is really no incentive to rock the boat, find out what really works, and potentially be held to more rigorous standards of practice.

Practitioners without education are not truly "professionals," in the sense that one prepares oneself academically as a professional before practicing as such. But it is not only the practitioners who have failed to address the shortage of informed guidance on weight training programming; it is also the academics. Many well-meaning professors have taken it upon themselves to write texts on how to train with weights and how to program weight training. With very few exceptions, there is something missing in these individuals' professional preparation: practical experience. How many of these exercise science teachers have experience on the platform? How many of them have worked in a varsity weight room as athletes? How many have been strength coaches? How many have coached actual weightlifters or powerlifters? How many have coached bodybuilders? How many have operated commercial gyms, serving clients from a wide range of age,

ability, and motivation? How many have taken rehab patients back to functionality and then beyond after the insurance for clinical rehabilitation runs out? A true strength and conditioning professional must be versed in all areas of practice and competition, through experience and education. To ignore the contributions and underpinning concepts of any strength training specialization is to actively choose to be a less competent professional.

Many texts have also been written by practitioners, but they typically lack a sound scientific basis. For each of these, there is a text written by a PhD that lacks the usefulness that only experience can provide. Virtually every professional organization within the weight training community identifies the gap between theory and practice as a large problem within the profession. There is no question about this, but solutions from the field have not been forthcoming.

The training of academics is a problem. How many universities have masters and doctoral programs specifically aimed at the extension of knowledge surrounding weight training and its role in health and human performance? Those programs can be counted on one hand. The paucity of institutions where the physiology, mechanics, and psychology of weight training is a focus at the graduate level means that academics operating as "experts" in the field were not trained by experts in the field. This is a problem. Occasionally (frequently, some would argue), you can find expert field practitioners who have trained themselves through reading and on-site applied research and who possess a much better command of the applicability of research into weight training than many academic "experts."

There is a trickle-down effect here. Academics at universities train our coaches, trainers, and teachers. Poorly trained professors produce poorly trained practitioners. This is an area of tremendous concern, especially in athletics. The

strength coach will likely spend more individual time with an athlete than any other coach during the athlete's career. Would we send an untrained, unmentored, or uneducated person out to run a season of practices for a football or volleyball team? Obviously not. Just because someone has run a marathon or played Division I football does not mean that they are capable of coaching the sport. Playing and coaching are two different skills. This same applies to weight training: just because an individual exercised with weights while they played a sport does not mean that they are qualified to coach strength for that or any other sport. It takes training, mentorship, and education (either formal or practical). Disregarding the value of proven, certifiable knowledge and practical ability and gambling an athlete's or team's physical readiness on the good-ol'-boy system of hiring strength and conditioning staff is not wise. Further, this system of hiring limits the potential for professionalism and public recognition in the career field.

The lack of preparatory courses in the average physical education or kinesiology degree program is a problem. Data from 2004 U.S. exercise participation statistics indicates that 21% of the population trains with weights two or more times per week. The lack of educated and experienced professionals in the classroom, weight room, and fitness club means that there may be 63,000,000 Americans training with weights who were not taught how to do so correctly. Additional data from the Sporting Goods Manufacturing Association shows that weight training is consistently in the top three recreational exercise activities in the United States, which further underscores the importance of providing quality instruction specific to teaching and programming weight training to physical educators, coaches, and personal trainers. This void in professional preparation prevents a huge number of trainees from making the progress that they expect and are capable of. Professional

education programs should begin to address this overlooked area of instruction.

Educating Practitioners

The root of the problem can be found in the lack of a sense of identity within physical education. Who and what are physical educators? Just look at what physical education programs in universities across the United States produce. One academic department frequently generates teachers, clinicians, coaches, trainers, fitness trainers, gym managers, sports administrators, recreation workers, cardiac rehabilitation specialists, exercise rehabilitation specialists, exercise physiologists, biomechanists, and sports psychologists. Programs are typically general in nature, producing generally trained students intended to occupy specific occupational and professional jobs. The names of the university departments that offer what are considered traditional "physical education" degrees are generic, nondescript names that the public does not recognize as being related to physical education. This lack of recognition actually starts on college campuses themselves; other academic program faculty will refer to kinesiology, exercise science, or any other permutation of the name simply as "the PE department."

It would behoove "physical education" departments—whatever their name—to clearly define a mission, a philosophy, and a specific professional employment preparation track, and staff it with experts in the field. A program that is intended to produce public school physical educators, as they are currently prepared, cannot at the same time produce top-flight cardiac rehabilitation specialists. By the same token, a clinical rehabilitation program intended to produce an athletic trainer, a cardiac rehabilitation specialist, or an exercise rehabilitation practitioner, as they are currently prepared, cannot at the same time produce a strength coach. A rethinking of modern

physical education is warranted. Without change, trained professionals capable of contributing to the *profession* of sport and exercise will be a rarity. Graduates capable of occupying low level *jobs* subservient to some other professional managerial group, one that is actually less qualified to supervise and program exercise, will be the rule.

There are more than 300 different certifications available to exercise professionals, with nearly as many businesses and organizations offering them. California alone has nearly 40 entities offering some type of credential. This is an unregulated industry, and as such there are "professional certifications" that can be obtained by writing a check to a company, receiving some course material in an envelope in the mail, taking a test at home or online, and then receiving your certification in the mail in a second envelope. Suddenly you become a certified weight training professional and can put some extra letters after your name. Others offer an evening or Saturday workshop that upon completion renders you a "certified professional." These certifications benefit no one except the business offering the certification. They certainly cannot develop—or even measure—the skills and knowledge required of a competent strength professional. An untrained person, with no previous education or mentored experiences, cannot gain the necessary knowledge and skills to become a successful practitioner by quickly reading a study guide before a test or by spending an afternoon with a certification instructor. An "education" is required, formal or otherwise, as is time in the trenches working with trained, knowledgeable professionals. Only after gaining a satisfactory working theoretical knowledge and a set of practical skills should someone sit for a rigorous certification examination offered by a professional organization with a professional membership. Although credentials from organizations that have no

membership other than an advisory board, or businesses that sell certifications, may serve a public relations function in certain contexts, they should be considered only after a major certification has been obtained (NSCA [National Strength and Conditioning Association] and USAW [USA Weightlifting] in particular for strength training, ACSM for exercise in general). Even these certifications have their limitations, but they are the best currently available. A good rule of thumb is that if the certifying agency does not have an annual convention of its professional membership, does not have a professional education agenda, and does not produce a professional journal, it is likely that the merit and value of its certification is low. A seminar, symposium, or workshop is not a certification. These short-duration educational experiences are quite valuable for professional development, but their attendance and completion should not be considered evidence of expertise.

Periodization in Print

The scientific literature related to weight training is frequently limited in scope and applicability. The individuals conducting the research are not trained to ask the right questions, and they frequently have no concept of how the research they do in the lab actually applies in the field. A common problem is that findings derived from a specific population—untrained college-age males, for example—are frequently considered to be generalizable to all populations, including trained athletes. Experienced coaches and trainers are frequently amused by the writings of the scientific "experts" who dogmatically propose and defend all-encompassing theories of training that have little relevance to the real world or claim that rehabilitation exercise theory is applicable to the performance preparation of healthy athletes.

Specific to the task of programming weight training, lets consider the concept of periodization and its supporting research. Periodization has been called one of the "core principles" in the preparation of athletes for competition. It is a very simple idea: the athlete trains very hard for a "period" of a time and then trains less hard for a "period." One would expect a core principle such as this to be heavily supported in the scientific literature. After all, a joint consensus statement from the ACSM and the United States Olympic Committee states that the primary reason athletes are overtrained is that coaches fail to periodize. The fact is that Western research regarding periodization is sparse. There are more reviews and interpretations of how to use periodization than there is data to support its use. A search on the Medline and SportDiscus academic search engines reveals only a dozen or so reports that can be characterized as controlled experimental studies of periodization. In fact, one of the "hallmark" texts on periodization, written in a very scientific tone, provides 12 pages of more than 120 references to support the author's concepts of periodization. While this may appear impressively thorough, none of the research cited in that text actually came from experiments in periodization. The most definitive case for periodization comes from Hans Selye's 1936 original synthesis of the General Adaptation Syndrome, a statement of hypothesis regarding human adaptation to stress.

The history of periodization is quite interesting. The communist-bloc countries' sports scientists applied a form of periodization to a variety of training models used in the development of Olympic athletes in the 1940s, 50s, 60s and 70s. If you compare their models of periodization with the reviews and opinion pieces in Western sports science literature, you'll see that the ideas and content presented in Western literature are essentially adapted from old Soviet literature.

Bud Charniga (fig. 1-1) did a great service to American sports scientists when he translated a series of Soviet documents into English in the 1980s. However, the information presented in those works must be applied cautiously. Communist-bloc sports science literature is very loosely annotated. It is not

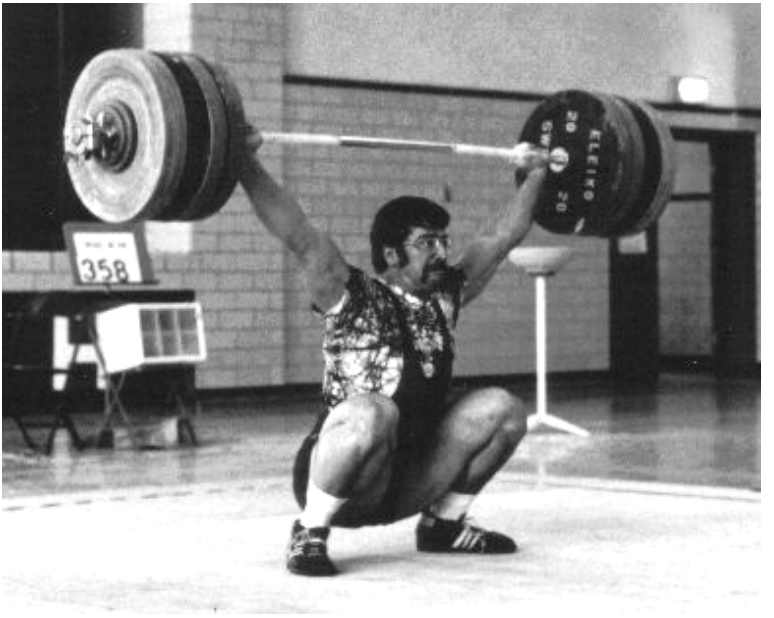

Figure 1-1. Bud Charniga, translator of Russian weightlifting literature into English, snatching 358 lbs. at a 1976 competition in Kansas City.

necessarily bad science, but it is reported in a form that does not lend itself to the independent verification of results. There is no way to accurately and reliably evaluate their conclusions or methods, since they often summarize their findings without providing any substantiating data. And sometimes the literature to which they refer is not accessible. The bottom line is that the works of Leonid Matveyev, Yuri Verkoshansky, Alexey Medvedev (fig. 1-2) and other communist-bloc writers have been adopted as truth without independent confirmation of their theories and practices. And their practices are applied to

all populations without regard to their original intended uses and intended target populations.

Figure 1-2. Don't be shy about asking "experts" questions. Call them, e-mail them, meet with them; it's a rare expert who doesn't like to talk about what they know. Even if you don't agree with what they say, you can learn something from everyone. Alexey Medvedev (left) discusses training theory and the good life with Glenn Pendlay.

Periodization and the American Kid. Periodization fits well with a worldview characterized by a high degree of planning, an attempt to quantify everything, and the need to control it all. (This may be why academics in the American education system like it so well too). Communist societies suffered the consequences of this manic desire to apply order to systems that cannot be easily ordered, systems composed of too many variables to handily control. As a weightlifting regimen, this kind of program works when it has sufficient numbers of available athletes, enough that it can simply replace the ones

who can't function within the training paradigm dictated by the coach's particular periodization model. It doesn't work as well in situations less tolerant of artificially imposed order, as in the culture of American youth.

When evaluating communist-bloc sports science data, we must also consider which data may have been acquired while the subject athletes were taking part in "better lifting through chemistry" experiments. Training models appropriate for chemically enhanced athletes are not applicable to frequently tested drug-free athletes.

Communist-bloc countries had (and still have) large-scale sports performance selection processes intended to direct young athletes into the most appropriate sport, based on specific criteria. Once there, athletes achieve and stay in the program or fail to achieve and are sent home. The result is a pyramidal selection structure that eliminates less competent athletes, leaving only those who have the best chance for international success. In the United States and most Western countries, some sports have a developmental pipeline. Football does. Basketball does. In fact, most nationally recognized high school sports that have a counterpart at the collegiate and professional levels have selection pipelines comparable in scale to those seen at the zenith of the Soviet bloc's sporting success. High school sport in the United States is the base of our selection pyramid. However, a huge difference exists in that a high school student in the United States represents a different population than students of the same age in Soviet systems. U.S. kids play sports to get in shape, while kids in Soviet-type systems get in shape to play sports. In the former bloc countries, sport was one of the few ways to rise above the constraints of the economic system, and this was a very powerful motivator. This difference is fundamental and significant, creating two distinct populations of athletes that

reflect two distinct cultures. Soviet models of periodization were developed for and apply best to only one of these groups.

The U.S. high school student of today does not have the general fitness and movement skills developed by the programs inherent in communist systems, programs in which children learned how to move effectively and began developing base fitness at age 6, long before they entered sport-specific training. Elementary school PE programs in the United States are underemphasized and understaffed. Effective physical education is best done in small groups with adequate time. While the educational literature supports this concept, the actual norm is one instructor, sixty students, and 45 minutes of class time. "Roll out the ball" physical education is the mode in which the teacher operates in the context of overcrowded classrooms, poor administrative support, and inadequate equipment. And now that physical labor (farm chores, household responsibilities, etc.) has been largely removed from the daily life of a child, an incoming high school freshman "athlete" is a huge challenge. He typically has no fitness base, few movement skills, and presents the coach with a daunting task, in that he must be prepared to participate in possibly combative high school sports in as little as two weeks from the day the coach first lays eyes on him. Periodization cannot be applied to incoming freshmen who are going to play fall sports—there is no time. But if there happens to be sufficient time prior to the playing season, the coach must use the most effective means to make the athlete as strong as possible. These methods are examined in detail in subsequent chapters.

Periodization's American Heritage. Periodization is practiced widely in track and field and is used by 69% of NFL and 93% of NCAA strength and conditioning programs. The concept of periodization is sound. Some very avant-garde thinkers and

practitioners, such as Carl Miller in 1974 (weightlifting), John Garhammer in 1979 (track & field), and Mike Stone in 1981 (all sports) turned on the light for those who followed. The idea that the practice of a sport itself was sufficient conditioning for the sport became inadequate for preparing high-level athletes many years ago. The early models of periodization, and advanced strength and conditioning techniques, have been absolutely essential to sport development in the United States. Dr. Stone followed his early work with a few experiments further examining the effects of periodization. But by and large, research on periodization has been extremely limited in volume. What has been produced is narrow in scope and has limited broader application.

Even in the absence of science to support its use, periodization has worked in the field, and 30+ years of Western athletic success has earned it a place in the elite coach's arsenal of training tools. But what is the correct model of periodization for an athlete or team, and how does a coach learn its actual application? In most university physical education programs, periodization is a small footnote somewhere in the curriculum, if presented at all. PE courses are intended to prepare physical educators and coaches to teach general physical fitness and some sports skills. Very few courses, if any, are available that teach exercise programming beyond American ACSM guidelines, which were developed to enhance health and wellness, not to optimize sports performance. Even the best texts on periodization do not teach the reader how to program. Rather they present lots of line graphs and bar charts, lots of data tables, lots of physiology, lots of biomechanics—lots of meat and potatoes, but no fork with which to eat.

So the questions remain: How do you design an effective program for your athletes, students, or clients? When is it appropriate to periodize that program? What follows in

this text is a logical approach to understanding the concepts of programming, including periodization, and examples of how it is used. We have made every attempt to incorporate the relevant science into a practical approach to programming barbell exercise. It is derived from our academic training, a combined 60+ years of experience in the weight room, participation in more than 300 competitive events in powerlifting and weightlifting, and experience in coaching hundreds of elementary, middle school, high school, collegiate, amateur, and professional athletes toward their goals, and from working with thousands of average people who just want to be stronger.

Cooking Up Training Programs for the Gym

This is not a typical programming "cookbook." There are many weight training books for sale—some at rather exorbitant prices—that lay out a program in current use by a winning sports team or an individual of some note (athlete, actor, model, etc.). These are "cookbooks"; they propose to provide recipes for training success. Follow the recipes, they promise, and you will be as good as the Spurs and as ripped as Vin Diesel.

Actual cookbooks are usually written by skilled chefs who design the dishes with their trained staff, test them privately, and then cook them publicly—say, in restaurants or on TV shows—using their skills and experience, specific tools, fully equipped kitchens, and just the right high-quality ingredients. Many people have attempted to cook gourmet food from cookbooks and had results that failed to resemble the dish produced by the author. Why did the recipe fail? After reading a recipe, do you magically develop the skills of a chef? Did you use the right tools? There is a big difference between a good

Solingen steel French knife and a can opener. And the ingredients might not be quite the same. When the recipe called for a shitake mushroom did, you use a can of stems and pieces? When the recipe called for Maui onions, did you use onion salt?

If a coach decides to use a weight training cookbook, the following are required: 1) the coach must be trained and think the same way as the original coach (the chef who wrote the recipe), 2) the training equipment (cooking tools) used in the program must be available, and 3) the athletes to be trained (ingredients) must be exactly like the athletes who trained with the original program, the one that actually might have worked. Failure to meet these requirements will result in a less-than-ideal performance (inedible mess). Following someone else's set program is usually a recipe for failure.

Reading the training cookbooks and seeing how other people solve the programming puzzle is part of the education process, but coaches and athletes must understand why successful programs are put together the way they are so they can develop their own programs specific to their circumstances. Copying and cannibalizing successful programs without understanding why they were successful is never a good idea. An understanding of the realities and practicalities of progressive training and periodization is.

A Theoretical Approach. In this book, the terms "novice," "intermediate," "advanced," and "elite" relate to the trainee with respect to the time it takes for recovery from a homeostatic disruption induced by training. We do not use these terms as descriptors of a trainee's strength or absolute athletic ability. These terms may in fact be applied differently to athletes in different sports, but our use of the terms here is specific to the model illustrated here in figure 1-3.

Because a novice lifts weights that are light relative to his genetic potential for strength and power development, the

rate of recovery following training can be rapid. Essentially, this trainee can recover from a single training session in a period of 24 to 72 hours. The novice trainee can train "heavy" on Monday and be ready to go heavy again on Wednesday. These trainees are quite far away from their genetic potential, and therefore lack the strength and the neural efficiency to generate a stress heavy enough to impede rapid recovery. For them, "heavy" is not really heavy. At the same time that strength and power are improving, recovery ability is improving too. Recovery processes are as trainable as any other physical parameter, and this is an extremely significant factor in training progress. But it is important to remember that recovery processes can always be exceeded by the injudicious application of training stress. Recovery must occur before progress can be made.

Simply put, a **novice**, as we use the term here, is a trainee for whom the stress applied during a single workout and the recovery from that single stress is sufficient to cause an adaptation by the next workout. The end of the novice phase is marked by a performance plateau occurring sometime between the third and ninth month of training, with variations due to individual differences. Programming for the novice is essentially the linear progression model that is described in the ACSM manual and defined specifically for weight training in our book *Starting Strength: A Simple and Practical Guide for Coaching Beginners* (Aasgaard Co., 2005). It is important to understand here that the novice is adapted to inactivity (as it relates to weight training) and therefore progress can be made with training programs that are not specific to the task involved. For example, doing high-volume hypertrophy work would also increase a novice's absolute strength for one repetition. A previously sedentary beginner can even improve

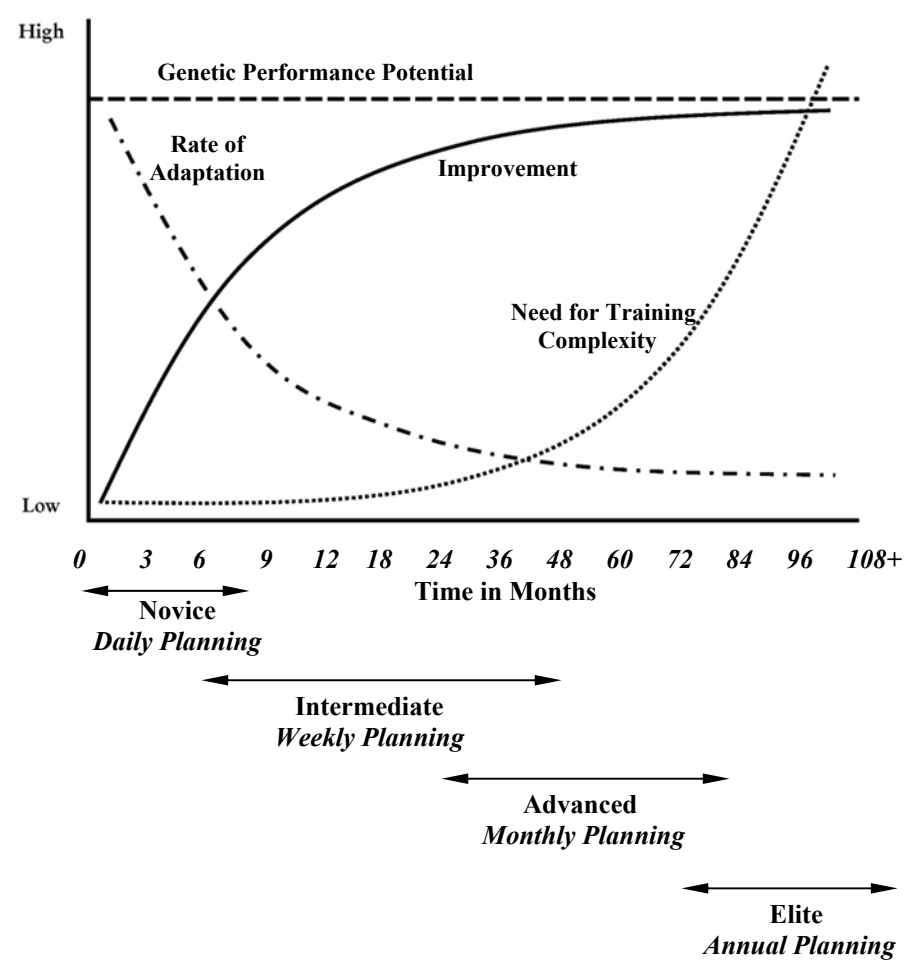

Figure 1-3. The generalized relationship between performance improvement and training complexity relative to time. Note that the rate of adaptation to training slows over a training career.

his 1RM (one-repetition maximum) squat by riding a bike. This would not be the case with intermediate or advanced trainees, where progress in strength, power, or mass is absolutely linked to appropriate application of specific training programs.

Novices accomplish two things with every workout: they "test" their strength, and the test loads the body to become stronger in the next workout. The act of moving 10 more pounds for the prescribed sets and reps both confirms that the previous workout was a success at improving the novice's strength and causes his body to adapt and become stronger for the next workout.

As the intermediate lifter begins to handle training loads closer to his genetic potential, his recovery ability is also affected differently by the stress. Recovery requires a longer period of time—a period encompassing multiple workouts (efficiently managed using a weekly schedule). This is because the athlete has developed the ability to apply stress to the system that requires a longer period of time for recovery. For an **intermediate** trainee, the stress required for a disruption of homeostasis exceeds the capacity for recovery within that period of time (say, within the week). To allow for both sufficient stress and sufficient recovery, then, the training load must be varied over the week. This variation can take several forms, but the critical factor is the distribution, which allows enough stress to be applied in a pattern that facilitates recovery. The key to successful training in this stage of development is to balance these two important and opposing phenomena. Simple weekly periodization of training loads facilitates recovery following one or more heavier training bouts within a single week.

Intermediate trainees benefit from exposure to more exercises than novices. These athletes are developing their skills with new movement patterns, and as this happens they are

developing their ability to *acquire* new skills. It is during this period that trainees actually become athletes, choosing a sport and making decisions that affect the rest of their competitive careers. These decisions are more effectively made if based on a broad exposure to a wide variety of training and competition options.

The end of the intermediate phase of training is marked by a performance plateau following a series of progressively more difficult weekly training organizations. This can occur in as little as two years or in as many as four or more, depending on individual tolerances and adherence to year-round progressive training. It is likely that 75% or more of all trainees will not require programming complexity beyond this level (remember, the amount of weight lifted or years of training do not classify a trainee). Virtually all sports-specific weight training can be accomplished with this model. Athletes in non-weightlifting sports will not train progressively in the weight room all year; they will focus much of their training on their primary competitive sport. This effectively extends the duration of this stage in the trainee's development to the extent that even very accomplished athletes may never exhaust the benefits of intermediate-level weight lifting programming.

Advanced trainees in the barbell sports work relatively close to their genetic potentials. The work tolerance of the advanced trainee is quite high, given that the ability of an athlete to recover from training is itself trainable. However, the training loads the advanced athlete must handle in order to produce an adaptation are also quite high, since the adaptation that brought the athlete to the advanced stage has already occurred. This level of training volume and intensity is very taxing and requires longer periods of recovery than do intermediate training loads. Both the loading and the recovery parameters must be applied in more complex and variable ways and over longer periods of time. When combined, the loading

and recovery periods required for successful progress range in duration from a month to several months. For example, we may apply a single week of very heavy training to induce adaptation. That week of training may require three or more weeks of work at lighter loadings for complete recovery and improvement to occur. The average slope of the improvement curve here is very shallow (fig. 1-3), closely approaching maximum genetic potential at a very slow rate, and rather large amounts of training effort will be expended for rather small degrees of improvement. For this reason too, the number of exercises advanced trainees use is typically lower than for intermediates; they do not require exposure to new movement patterns and stress types, since they have already specialized and adapted to those that are specific to their sport.

Complex manipulation of training parameters is appropriate for use with these trainees. The majority of trainees will never attain the level of development that makes advanced periodization necessary, since most trainees voluntarily terminate their competitive careers before the advanced stage is reached.

The **elite** athlete is in a special subset of the advanced category. Elite athletes are the genetically gifted few who also happen to be motivated to achieve success despite enormous physical and social costs. They have stayed in their sport by virtue of their success and have dedicated themselves to training at this level because their training investment has been returned. An advanced lifter is one who has progressed beyond the intermediate; an elite lifter is one who performs at an elite level within the standards of the sport. (By this definition, the *elite* designation could actually be applied to an intermediate lifter performing at the national/international level. There occasionally exist a few athletes so talented and genetically endowed that this situation occurs.)

Previous training has brought the elite athlete very close to genetic potential, and additional progress requires much greater program complexity to scratch out those small improvements that might still remain unrealized. These athletes must be exposed to training programs that are very complex—highly variable in terms of stress, although probably simple in terms of exercise selection—forcing the already adapted athlete closer to the ultimate level of performance. At this point the program may be considered in terms of several months, a year, or even an Olympic quadrennium. Any approach to the training of an athlete of this caliber is a highly individualized matter and is beyond the scope of this text. We propose that far less than 1% of all trainees regardless of training history reach this level.

Unlike beginners or intermediates, advanced and elite trainees need large amounts of intense work to disrupt homeostasis and force adaptation. This means that the stress required for progress will creep nearer and nearer to the maximal tolerable workload that the body can perform and recover from. An elite athlete who is doing ten sets of squats and making progress may not make any progress with nine sets and may "overtrain" by doing eleven. The window for progress is extremely small.

If workload is not increased, then neither performance nor comprehensive recovery processes will improve, since no disruption of homeostasis is forcing them to do so. The manner in which increases in training load are applied is determined by the level of training advancement. The ability of a novice to adapt to training differs enough from that of the intermediate and advanced trainee that similar training organizations will fail to produce results for both. Each level of training advancement requires its own specific approach.

Periodization is a useful tool in achieving training goals, but like any tool it must fit the job it is being used for. By

understanding the theoretical basis and proper application of the models of programming, anyone who coaches weight training can become better equipped to improve the fitness and performance of those entrusted to their guidance.

"Sometimes exercise can be painful, but it's worth it in the end."

—*The Grim Adventures of Billy and Mandy*