13

Program Design Concepts

OBJECTIVES

After completing this chapter, you will be able to:

- Define and describe the acute training variables within the Optimum Performance Training (OPT™) model.
- Describe the phases within the OPT™ model.
- Design programs for each phase of training.

KEY TERMS

Acute variables
Annual plan
Exercise selection
Monthly plan
Program design
Repetition
Repetition tempo
Rest interval
Set
Training duration
Training frequency
Training intensity
Training plan
Weekly plan

Program Design

INTRODUCTION TO PROGRAM DESIGN

Traditionally, most training programs are based on the experiences of the health and fitness professional (whether he or she is a bodybuilder, group exercise instructor, power lifter, Olympic lifter, or an athlete). This has led to many scientifically unsupported training programs that have created confusion for health and fitness professionals. Indeed, science has been slow to validate anecdotal evidence that still continues to be used in the fitness world.[1,2]

To be safe, effective, and productive, all health and fitness professionals must be competent at designing resistance-training programs for a variety of clients. This entails the proper utilization of acute variables (repetitions, sets, and so forth) and exercises in a structured, progressive manner. For many health and fitness professionals, this can become a daunting task, causing them to ask, "How many exercises should I use? How many sets and repetitions should I use? How many days per week should my client train?" When using a structured, scientifically based program design model, answers to these questions become very simple.

WHAT IS PROGRAM DESIGN?

Program design: A purposeful system or plan put together to help an individual achieve a specific goal.

Program design simply means creating a purposeful system or plan to achieve a specific goal. The key words here are "purposeful system." The purpose of a training program is to provide a path for the client to achieve his or her goal. Providing a path requires the health and fitness professional to have a comprehensive understanding of a few key concepts:

Acute Variables

- What are they?
- How do they affect the desired adaptation?
- How do they affect the overall training program?

The OPT™ Model (Planned Fitness Training—Periodization)

- How and why must the physiologic, physical, and performance adaptations of stabilization, strength, and power take place in a planned, progressive manner to establish the proper foundation for each subsequent adaptation?

The Five Phases of Training in the OPT™ Model

- How do these phases promote specific adaptations?
- What are the acute variables for each of the phases?

Application

- Selecting the right exercises.
- Selecting the right acute variables.
- Applying both in a systematic manner to different populations with different goals.

IS THERE AN EASIER WAY?

Taking the Guesswork Out

If a health and fitness professional has a proven system that he or she can follow, the needed information can simply be plugged in, without the worry of using the correct formula for success. This is exactly what the OPT™ model provides (Figure 13-1).

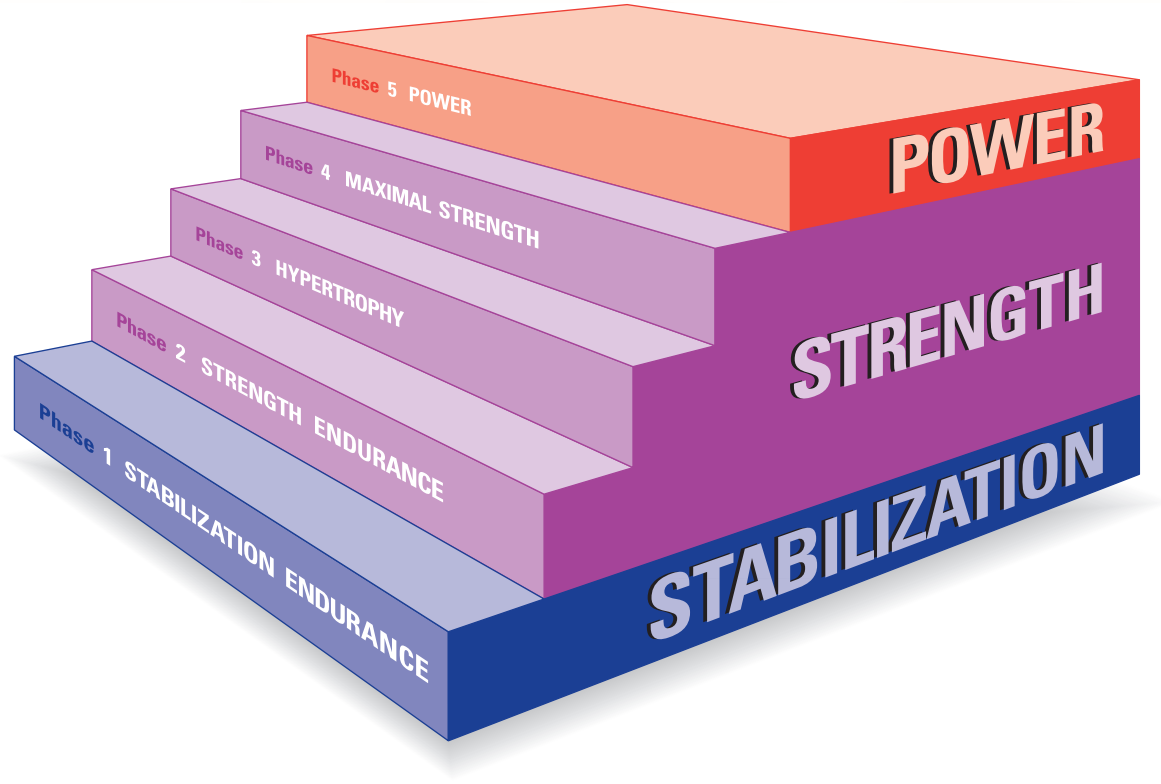

Figure 13.1 The OPT™ model.

NASM designed the OPT™ model as a planned, systematic, periodized training program. It was established to concurrently improve all functional abilities, such as flexibility, core stabilization, balance, power, strength, and cardiorespiratory endurance. The OPT™ program has been extremely successful in helping all populations to reduce body fat, increase lean muscle mass and strength, and improve performance and overall health.

The remaining modules of this chapter will detail acute variables of planned fitness training (or periodization) as it relates to the OPT™ model, the five phases of the OPT™ model, and how to apply the OPT™ program design model to various goals.

SUMMARY

Health and fitness professionals must be competent at designing training programs for a variety of clients, using acute variables and exercises in a structured, progressive manner. A structured, scientifically based program design model makes this easy. The Optimum Performance Training (OPT™) model provides the health and fitness professional with a proven system in which a client's information can simply be plugged in. Program design is creating a purposeful system or plan to achieve a specific goal. To do so, the health and fitness professional must understand acute variables, the OPT™ model, and its phases, as well as how to apply it all.

Acute Variables of Training

Acute variables: Important components that specify how each exercise is to be performed.

Acute variables are the most fundamental components of designing a training program. They determine the amount of stress placed on the body and, ultimately, what adaptations the body will incur.

The body will specifically adapt to the demands placed on it (known also as the principle of specificity). The acute variables dictate these demands.

Table 13.1

Program Design Continuum

Adaptation	Reps	Sets	Intensity	Rest Period
Power	1–10	3–6	30–45% of one rep max or ≤10% of body weight	3–5 min
Strength	1–12	3–6	70–100%	45 s–5 min
Stabilization	12–25	2–3	50–70%	0 s–1.5 min

The OPT™ model takes the guesswork out of program design and allows for a planned, systematic progression by preassigning specific acute variables for each of the five phases of training to elicit the desired adaptation.[3-11] Collectively, the acute variables are the foundation of program design and fall within the program design continuum seen in Table 13-1.

As discussed in Chapter 12—Resistance Training, the stabilization adaptation includes both endurance and stability, the strength adaptation includes strength endurance, hypertrophy, and maximal strength, and the power adaptation includes power (rate of force production).

To ensure proper development and progression of an integrated training program, the health and fitness professional must understand the acute training variables, which are shown in Figure 13-2. Each of the acute variables will be explained in this module as they relate to the OPT™ model.

REPETITIONS

Repetition (or "rep"): One complete movement of a single exercise.

A **repetition** is one complete movement of a particular exercise. Most repetitions will involve the three muscle actions, concentric, isometric, and eccentric (not necessarily in that order).

These muscle actions can be seen in the example of a biceps curl. A single repetition includes raising the dumbbell up against the direction of resistance (a concentric contraction), pausing for any specified amount of time (an isometric contraction), and then lowering the dumbbell with the direction of resistance back to its starting position (an eccentric contraction).

Another example of this can be seen when performing a squat. Starting from a standing position, one repetition includes lowering the body (with the direction of resistance) toward the ground (eccentric), pausing for any specified amount of time (isometric), and then raising back up (against the direction of resistance) to the starting position (concentric).

Repetitions are simply a means to count the number of movements performed in a given amount of time. They can therefore be a means to count the time the muscles are under tension (*time under tension*).

Each phase of training in the OPT™ model has specific goals and therefore requires a specific number of repetitions to achieve these goals. The number of repetitions performed in a given set is dependent on the client's work capacity, intensity of the exercise, and the specific phase of training.

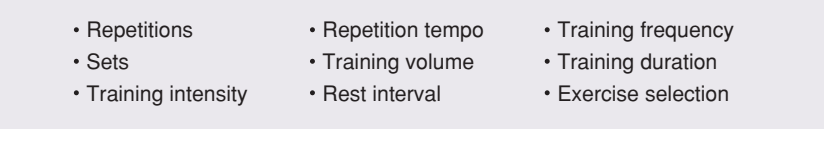

Figure 13.2 Acute variables of training.

Table 13.2

Repetition Continuum

Training Adaptation	Repetition Range
Power	1–10
Strength	1–12
Stabilization	12–25

The health and fitness professional must keep in mind that all acute variables are interdependent. This means that the specific use of one will affect the others. For example, the more intense the exercise or heavier the load, the fewer the number of repetitions that the individual can perform.[11-17]

Research demonstrates that training in a specific repetition range yields specific adaptations.[11-15,17,18] Therefore, depending on the goal of the individual and the phase of training, it is possible to define a specific repetition range (Table 13-2).

- Power adaptations require 1 to 10 repetitions at 30 to 45% of the one-repetition maximum (1RM), or approximately 10% of body weight.
- If maximal strength adaptations are desired, the repetition range is one to five at 85 to 100% of the 1RM.
- Hypertrophy is best achieved using 8 to 12 repetitions at 70 to 85% of the 1RM.
- Endurance is best achieved by performing 12 to 25 repetitions at 50 to 70% of the 1RM.[11-17]

The OPT™ model uses the specified repetition continuum to provide the desired adaptations in a systematic manner. The beginning phases consist of higher repetition schemes necessary to build proper connective tissue strength, stability, and endurance. This is especially important for the beginning client. However, a common mistake of many advanced clients is to not use a planned training program that provides periods of low-repetition training alternated with periods of high-repetition training. Higher intensities of training (lower repetitions) can only be sustained for a short period without running the risk of overtraining.[19,20] Using the OPT™ model enables the health and fitness professional to use a systematic training approach to prevent overtraining and yield specific results by using planned intervals of training.[21]

SETS

Set: A group of consecutive repetitions.

A **set** is a group of consecutive repetitions.[14,16,17,22] The quantities of the other acute variables (i.e., repetitions, training intensity, number of exercises, training level, and recoverability) determine the number of sets an individual performs.[14,16,17,23]

There is an inverse relationship between sets, repetitions, and intensity. The individual usually performs fewer sets when performing higher repetitions at a lower intensity (endurance and hypertrophy adaptations) and more sets when performing lower repetitions at a higher intensity (strength and power adaptations), as seen in Table 13-3.[11,13,22]

- For power adaptations, three to six sets of between 1 and 10 repetitions at an intensity of 30 to 45% of 1RM or approximately 10% of body weight are recommended.
- For maximal strength adaptation, four to six sets of between one and five repetitions at an intensity of 85 to 100% of 1RM are recommended.

Table 13.3

Set Continuum

Training Adaptation	Set Range
Power	3–6
Strength	2–6
Stabilization	1–3

- Hypertrophy adaptations require three to four sets of 8 to 12 repetitions at 70 to 85% of 1RM intensity level.
- Endurance is best developed with one to three sets of 12 to 25 repetitions at 50 to 70% of 1RM intensity.[11,13,16,17,22]

It has been suggested that, to prevent overtraining, 24 to 36 total sets should be performed in a given workout (24 total sets for low volume or up to 36 total sets for high volume).[15] For the beginning client, this number may be as low as 5 to 12 total sets (one set of 5 to 12 exercises).

As a training program advances and the desired adaptations change from stabilization and endurance to hypertrophy or maximal strength, the number of sets capable of being performed will also change.

When training for strength adaptations, the number of sets performed needs to increase to place enough stress on the tissues to provoke the desired changes.[11,12,15] As shown in Table 13-4, a beginning client may perform one to two exercises per body part for two to three sets per exercise, whereas an advanced client may perform three to four exercises per body part for three to five sets per exercise. This manipulation will have a large impact on the total training volume and must be planned (periodized) with phases that include a higher and lower number of sets over the course of the training program. Also, using the numbers in Table 13-4 in conjunction with the total number of sets per workout discussed above (24 to 36 sets), it is clear that the intermediate and advanced client may only train two to three body parts per workout, owing to the total volume of training in a given workout and time constraints.

TRAINING INTENSITY

Training intensity: An individual's level of effort, compared with their maximal effort, which is usually expressed as a percentage.

Training intensity is one of the most important acute variables to consider when designing an integrated training program.[11,13,16,17,22] **Training intensity** is defined as an individual's level of effort compared with their maximum effort.[11,13]

The specific training phase and an individual's training goal will determine the number of sets and repetitions for an exercise. Intensity is then determined by the number of sets and repetitions to be performed, which is based on the individual's specific training goals (Table 13-5).

Table 13.4

Set Manipulations per Body Part

Client Level	Exercises per Body Part	Sets Each Exercise	Total Sets per Body Part
Beginning	1–2	2–3	2–6
Intermediate	2–3	3–4	6–12
Advanced	3–4	3–5	9–20

Table 13.5

Intensity Continuum

Training Adaptation	Intensity Range
Power	30–45% of 1RM or approximately 10% of body weight
Strength	70–100% of 1RM
Stabilization	40–70% of 1RM

1RM, one repetition maximum.

- Power (high velocity) adaptations are best attained with 30 to 45% of 1RM when using conventional weight training, or approximately 10% of body weight when using medicine balls.
- Maximum strength adaptations require training with 85 to 100% of 1RM.
- Hypertrophy is best achieved by training with 70 to 85% of 1RM.
- Endurance is best developed with a training intensity of 40 to 70% of 1RM.[8,14,22–33]

Training intensity can also be derived from the percent of maximal oxygen consumption, as in the case of cardiorespiratory training programs.[34,35]

Training in an unstable environment, as seen in the stabilization phases of the OPT™ model, can also increase the training intensity because it requires more motor unit recruitment. This leads to more energy expenditure per exercise,[36–39] which allows for optimum development of neuromuscular efficiency. Changing other acute training variables such as rest periods and tempo also changes the training intensity. In short, intensity is a function of more than just external resistance. An integrated training program must focus on a holistic approach to force continued adaptations.[32,40]

REPETITION TEMPO

Repetition tempo: The speed with which each repetition is performed.

Repetition tempo refers to the speed with which each repetition is performed. This is an important variable that can be manipulated to achieve specific training objectives such as power, hypertrophy, stability, and endurance.[11,13,16,17,41–47]

Movements also occur at different velocities. Therefore, to get the appropriate results from training, the health and fitness professional must select the appropriate speed of movement for the exercise, based on the repetition tempo spectrum (Table 13-6).[47]

Table 13.6

Repetition Tempo Spectrum

Training Adaptation	Repetition Tempo (Eccentric/Isometric/Concentric)
Power	Explosive (x/x/x)
Strength	Moderate (2/0/2)
Stabilization	Slow (4/2/1)

x/x/x, As fast as possible.

The amount of time that a muscle is under tension yields a specific result (*time under tension*). For example, the optimum tempo for hypertrophy is approximately 20 to 70 seconds per set (8 to 10 repetitions in a range between 4/2/1 and 2/0/2 tempos).[48] The optimum tempo for power is as fast as the individual can move.[41–44,47] Therefore, based on the client's specific goals, the health and fitness professional must use the entire repetition tempo spectrum to achieve the desired results.[11,15–17,42,43]

The OPT™ model places a major emphasis on the repetition tempo spectrum as it has a significant impact on the functional outcome of the stressed tissues. By emphasizing eccentric and isometric muscle actions at slower velocities during the initial stabilization phases of training, more demand is placed on the connective tissue (as well as the stabilizing muscles) and better prepares the nervous system for functional movements. This is important for building the appropriate structural and functional foundation for more specific forms of strength and power training that will follow.

REST INTERVAL

Rest interval: The time taken to recuperate between sets.

The **rest interval** is the time taken to recuperate between sets or exercises and has a dramatic effect on the outcome of the training program.[11,16,17,22,33,47] Each exercise that is performed requires energy. The primary type of energy used during training depends on the training phase, intensity, and goal (Table 13-7).[13,14]

Power and maximal strength adaptations may require up to 5 minutes of rest between sets and exercises, depending on the client's level of fitness. Hypertrophy adaptations are maximized by decreasing the rest interval to 45 to 90 seconds between sets and exercises, but are dependent on the load being used. Stability and endurance adaptations should involve 30 to 90 seconds of rest.

Dynamic resistance training, as well as isometric training, can significantly reduce adenosine triphosphate (ATP) and creatine phosphate (CP) supplies.[49,50] The ability to replenish these supplies is crucial for optimal performance and the desired adaptation. By adjusting the rest interval, energy supplies can be regained according to the goal of the training program. Rest intervals of:[51]

- 20 to 30 seconds will allow approximately 50% recovery of ATP and CP.
- 40 seconds will allow approximately 75% recovery of ATP and CP.
- 60 seconds will allow approximately 85 to 90% recovery of ATP and CP.
- 3 minutes will allow approximately 100% recovery of ATP and CP.

The rest interval between sets determines to what extent the energy resources are replenished before the next set.[13,14,47] The shorter the rest interval, the less ATP and CP will be replenished and consequently less energy will be available for the next set.[11] In the beginner client, this can result in fatigue, which can lead to decreased neuromuscular control, force production, and stabilization by decreasing motor unit recruitment.[52,53] Therefore, inadequate rest intervals can decrease performance and could lead to excessive compensation and even injury. As the

Table 13.7

Rest Interval Continuum

Training Adaptation	Rest Interval	Energy Source
Power	3–5 min	ATP-CP
Strength	45 s–5 min	ATP-CP and glycolysis
Stabilization	0 s–1.5 min	Oxidative and glycolysis

ATP, adenosine triphosphate; *CP*, creatine phosphate.

Figure 13.3 Factors for appropriate rest intervals.

client advances, this can be used as a means to increase the intensity of the workout and promote better adaptations especially for stability, endurance, and hypertrophy.

Conversely, if rest periods are too long between sets or exercises, the potential effects include decreased neuromuscular activity and decreased body temperature. If the beginner client is then asked to perform an intense bout of exercise, this could entail a potential increased risk of injury. For the advanced client, this may be necessary if heavy weight is being used repetitively. The goal of the training program should establish the appropriate rest periods.[11,14,15] There are several factors to consider when prescribing appropriate rest intervals (Figure 13-3). [11,13,15]

Individuals who are beginning an integrated training program may respond better to longer rest periods (60 to 90 seconds) until they adjust to the demands of their program. This also helps to ensure proper neuromuscular efficiency. By decreasing the amount of fatigue experienced by the client, that individual will be able to recruit the appropriate motor units and perform each exercise with greater precision. Individuals who are at advanced levels of training and have larger muscle mass or higher fitness levels may respond better to shorter rest periods, but it is still dependent on the phase of training and the goal.

TRAINING VOLUME

Training volume: Amount of physical training performed within a specified period.

Training volume is the total amount of work performed within a specified time.[13,16,17,23,34] It is extremely important to plan and control training volume to prevent overtraining, as all training is cumulative.[19–21] Training volume varies among individuals and is based on:

- Training phase
- Goals
- Age
- Work capacity
- Recoverability
- Nutritional status
- Injury history

For an individual to achieve optimum results from an integrated training program, the program must provide them with the appropriate planned training volume for extended periods (Table 13-8).[21]

One of the most important training concepts to remember is that volume is always inversely related to intensity. In other words, you cannot safely perform high volumes of high-intensity exercises for any extended length of time.[13,14,23,24] For example, when working with loads exceeding 90% of an individual's maximum, one rarely exceeds a workout volume of 20 repetitions (four sets of three to five repetitions) per exercise. However, when working with loads of 60% of maximum, the trainee can easily perform a workout volume of 36 to 60 repetitions per exercise

Table 13.8

Volume Continuum

Training Adaptation	Total Volume of Reps per Exercise (Sets × Repetitions)
Power	6–30
Strength	8–36
Stabilization	36–75

(three sets of 12 to 20 repetitions). The exception here is the beginning client who may only perform 12 to 20 total repetitions per exercise (one set of each exercise).

The training phase and the training goal dictate the repetitions, sets, intensity, rest, and tempo, and these combined dictate the volume.[11,13–17,21,22,23] Research demonstrates that higher volume training (three to four sets of 9 to 20 repetitions) produces cellular adaptations shown (Table 13-9).[54–59] Conversely, high-intensity training with low training volumes (four to six sets of one to five repetitions) produces greater neurologic adaptations (Table 13-9).[11,13,15–17,32]

TRAINING FREQUENCY

Training frequency: The number of training sessions performed during a specified period (usually 1 week).

Training frequency refers to the number of training sessions that are performed during a given period (usually 1 week). There is considerable debate concerning the adequate number of training sessions per body part per week necessary for optimum results.[13,14,17,22] The number of training sessions per week per body part is determined by many factors, including training goals, age, general health, work capacity, nutritional status, recoverability, lifestyle, and other stressors.[16,17]

For example, a first-time client may begin by training his or her entire body two times a week.[11,13,14,60] However, an experienced bodybuilder with the specific goal of hypertrophy may have a training cycle in which he or she trains with a split routine of six sessions per week, training each body part two times per week with a larger volume per session.

The specific training goal dictates the program design. Research on training frequency indicates that the optimum training frequency for improvements in strength is three to five times per week. There is no significant difference noted between three days and five days.[11,13,16,17,60] Other research indicates that training at least one to two times per week is sufficient to maintain the physical, physiologic, and performance improvements that were achieved during other phases of training.[11,13,16,17,60]

Table 13.9

Training Volume Adaptations

High Volume (Low Intensity)	Low Volume (High Intensity)
Increased muscle cross-sectional area	Increased neuromuscular efficiency
Improved blood lipid serum profile	Increased rate of force production
Improved lean body mass	Increased motor unit recruitment
Decreased body fat	Increased rate coding
Increased metabolic rate	Increased motor unit synchronization

Table 13.10

Durations for a General Fitness Program

Sets	3
Reps	12
Tempo	4/2/1
Rest interval	30 s between sets
Number of exercises	7
Total duration	25–40 min of workout (excluding warm-up and cool-down)

TRAINING DURATION

Training duration: The timeframe of a workout (including warm-up and cool-down) or the length of time spent in one phase of training.

Training duration has two prominent meanings:

1. The timeframe from the start of the workout to the finish of the workout, not including the warm-up or cool-down.
2. The length of time (number of weeks) spent in one phase (or period) of training.

The training duration for a workout is a function of the number of repetitions, number of sets, number of exercises, and the length of the rest intervals (Table 13-10).

Training programs that exceed 60 to 90 minutes (excluding warm-up and cool-down) are associated with rapidly declining energy levels.[11,18,22,61,62] This causes alterations in hormonal and immune system responses that can have a negative effect on a training program.[18,47,61,62]

The training duration for a phase of training is dictated by the client's level of physical ability, goal, and compliance to the program. Typically, a phase of training will last between 4 and 8 weeks as this is the amount of time it generally takes for the body to adapt to a given stimulus.[63–73]

EXERCISE SELECTION

Exercise selection: The process of choosing appropriate exercises for a client's program.

Exercise selection is the process of choosing exercises for program design that allow for the optimal achievement of the desired adaptation. It has a tremendous impact on the outcome of the training program.[13,16,17,22,33,47]

The kinetic chain is a highly adaptable organism and readily adjusts to the imposed demands of training (principle of specificity). Therefore, exercises should be specific to the training goals and based on the principles of the exercise selection continuum (Table 13-11).[13,16,17,22,33,47]

In the OPT™ model, exercises from all components (core, balance, reactive, and resistance training) are categorized by the adaptation for which they are primarily

Table 13.11

The Exercise Selection Continuum

Training Adaptation	Training Level	Exercise Selection
Power	Power level	Total body; multijoint (explosive)
Strength	Strength level	Total body; multijoint or single joint
Stabilization	Stabilization level	Total body; multijoint or single joint; controlled unstable

Table 13.12

Exercise Selection—Examples

Level	Total Body	Multijoint	Single Joint
Power	Squat jump	Two-arm medicine ball chest pass Medicine ball pullover Medicine ball oblique throw	N/A
Strength	Squat to two-arm dumbbell press	Bench press Seated row machine Shoulder press machine Squat	Standing two-arm dumbbell curl
Stabilization	Step-up, balance to overhead press	Ball dumbbell chest press Ball dumbbell row Standing overhead press	Single-leg dumbbell curl

used. For example, exercises that are used in phase 1 of the OPT™ model (stabilization) are termed *stabilization level* exercises because they are used and progressed for the stabilization adaptation. Similarly, the exercises used in phases 2 to 4 are termed *strength level* exercises, and exercises used in phase 5 are termed *power level* exercises (Table 13-11).

Exercises can be broken down simplistically into three different types on the basis of the number of joints used, movements performed, and adaptation desired (Table 13-12):[47]

1. Total body: These exercises include multiple joint movements such as a squat, biceps curl, to a shoulder press (squat, curl, and press).
2. Multijoint: These exercises use the involvement of two or three joints.
3. Single joint: These exercises focus on isolating one major muscle group or joint.

The OPT™ model enables the health and fitness professional to effectively select the appropriate exercise for each client. Completing a fitness assessment and reviewing the specific training goals will allow the health and fitness professional to implement these exercises into a properly planned, integrated training program.

For example, to develop optimum stability, traditional exercises can be *progressed* to a more-unstable environment, such as standing up (two-leg, staggered-stance, single-leg) or from a stable environment to an unstable environment (stability ball). Research has shown that exercises performed in unstable environments produce superior results for the goal of stabilization and training the core stabilizing muscles.[65,66,67] Stabilization exercise examples include:

- Crunch on a stability ball
- Cobra on a stability ball
- Chest press on a stability ball
- Cable rows on one leg
- Shoulder press or lateral raise on a stability ball
- Step-up to balance

To develop optimum strength, the use of total body and multijoint exercises has been shown most beneficial.[10,17] Strength exercise examples include:

- Bench press (barbell or dumbbell)
- Row (machine or free weight; seated or bent over)
- Shoulder press (barbell, dumbbell, machine, seated or standing)
- Squat

Table 13.13

The Progression Continuum

Stabilization Continuum	Lower Body	Upper Body
Floor	Two-leg Staggered-stance	Two-arm Alternating arms
Sport beam	Single-leg	Single-arm
Half foam roll Airex pad Dyna Disc 3D-board		

To develop optimum power, explosive medicine ball and body weight exercises can be performed during functional movement patterns.[13,16,17,22,33,47] Power exercise examples include:

- Overhead medicine ball throw
- Medicine ball chest pass
- Medicine ball soccer throw
- Squat jump
- Tuck jump
- Box jump

All exercises, once selected, can be progressed or regressed in a systematic fashion by following the progression continuum (Table 13-13).

SUMMARY

Designing the appropriate program for a client is the primary function of the health and fitness professional. Programs should be individualized to meet the needs and goals of each client. Therefore, it is important that a scientifically based, systematic, and progressive model is used. The OPT™ model provides the health and fitness professional with all the necessary tools to properly use acute variables (repetitions, sets, and so forth), scientific concepts, and exercises to design programs.

Acute variables determine the amount of stress placed on the body and, ultimately, what adaptation the body will incur. The acute variables to consider when designing a program are as follows:

- Repetitions: The more intense the exercise, the fewer the number of repetitions that the individual should perform.
- Sets: The individual usually performs fewer sets when performing higher repetitions at a lower intensity (endurance and hypertrophy adaptations) and more sets when performing lower repetitions at a higher intensity (strength and power adaptations). Twenty-four to 36 total sets should be performed in a given workout.
- Training intensity: This should be determined after sets and reps. Altering other variables (such as environment stability, rest periods, and tempo) changes the training intensity.
- Repetition tempo: Different times under tension yield specific results. By emphasizing eccentric and isometric muscle actions at slower velocities, more demand is placed on the connective tissue.
- Rest interval: This has a dramatic effect on the outcome of the training program. By adjusting the rest interval, energy supplies can be regained

according to the goal of the training program. The shorter the rest interval, the less ATP and CP will be replenished, and consequently less energy will be available for the next set. To avoid making rests too long or short, consider the following factors: training experience, training intensity, tolerance to short rest periods, muscle mass, general fitness level, training goals, nutritional status, and recoverability.

- Training volume: Plan and control training volume to prevent overtraining. Volume is always inversely related to intensity.
- Training frequency: Optimum training frequency for improvements in strength is three to five times per week. Training at least one to two times per week is sufficient to maintain improvements achieved during other phases of training.
- Training duration: Programs should not exceed 90 minutes. Typically, a phase of training will last between 4 and 8 weeks.
- Exercise selection: Exercises should be specific to the training goals and based on the principles of the exercise selection continuum.

Periodization and the OPT™ Model (Planned Fitness Training)

Understanding the need for program design and the purpose of acute variable manipulation is important fundamental information for all health and fitness professionals. Applying this knowledge will determine the success of a health and fitness professional. A system is required to properly organize this base level of information.

The science behind the OPT™ model of program design lies in the concept of periodization. As discussed in Chapter 12 (resistance training), periodization is a systematic approach to program design that uses the general adaptation syndrome and principle of specificity to vary the amount and type of stress placed on the body to produce adaptation and prevent injury. Periodization (or planned fitness training) varies the focus of a training program at regularly planned periods of time (weeks, months, and so forth) to produce optimal adaptation. It involves two primary objectives:

1. Dividing the training program into distinct periods (or phases) of training.
2. Training different forms of strength in each period (or phase) to control the volume of training and to prevent injury.[11–14,74,75]

TRAINING PLANS

Training plan: The specific outline, created by a fitness professional to meet a client's goals, that details the form of training, length of time, future changes, and specific exercises to be performed.

Annual plan: Generalized training plan that spans 1 year to show when the client will progress between phases.

To accomplish these objectives, a client's training program should be organized into a training plan that involves long-term and short-term planning. A **training plan** is a specific plan that a health and fitness professional uses to meet the client's goal. It will determine the forms of training to be used, how long it will take, how often it will change, and what specific exercises will be performed. The long-term plan of a training plan in the OPT™ model is known as an *annual plan* whereas the short-term plans are termed *monthly and weekly plans*. By providing a training plan, the client will be able to see the future achievement of his or her goal in a timely, organized fashion.

An **annual plan** organizes the training program for a 1-year period (Figure 13-4). The annual plan allows the health and fitness professional to provide the client with a blueprint (or map) that specifically shows how the OPT™ training program will progress for the long term, from month-to-month, to meet the desired goal.

	PHASE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Stabilization	1												
Strength	2												
	3												
	4												
Power	5												
Cardio													

Figure 13.4 Annual plan.

This gives the client a clear representation of how the health and fitness professional plans to get the client to his or her goal and how long it will take to get there.

In Figure 13-4, the column on the far left represents the period or main strength adaptation. The second column shows the specific phases of the OPT™ model that make up each specific adaptation of training.

Monthly plan: Generalized training plan that spans 1 month and shows which phases will be required each day of each week.

Each month within the annual plan is further broken down into periods of training called **monthly plans** (Figure 13-5). The monthly plan details the specific days of each workout, showing the client exactly what phase of the OPT™ model (type of training) will be required each day of the week as well as when the reassessment will occur. The monthly plan also shows the client the necessary cardio and flexibility requirements.

Weekly plan: Training plan of specific workouts that spans 1 week, to show which exercises are required each day of the week.

Each monthly plan will also illustrate one's **weekly plans**, which are the specific workouts that the client will do for that week (Figure 13-5). The weekly plan gives the client a picture of exactly what phases will be used in his or her workout for that period.

Much of the literature regarding periodization refers to dividing the training program into specific cycles termed macro-, meso-, and microcycles (Figure 13-6). For ease of understanding, a *macrocycle* is the largest cycle and, typically, covers a year-long period of training (or annual plan). The macrocycle is divided into *mesocycles,* which are typically 1 to 3 months in length (or monthly plans). Each mesocycle in turn is divided into *microcycles,* which are usually a week in length (or weekly plans).[48,76]

Periodization has been shown to be an effective form of program design for many fitness-related goals, and yet, to date, it is not a common practice among fitness professionals.[48,77–79] It provides for the repeated use of different forms of training at specific times in an annual training program to elicit different adaptations in the body (stabilization, strength, and power). By intentionally cycling through different periods (or phases) of training, the acute variables are manipulated to adjust the volume of training. By controlling the volume of training as a function of time in any given program, periodization allows for maximal levels of adaptation, while minimizing overtraining. This is a primary benefit of periodization, because overtraining will lead to fatigue and eventual injury.[48,74,77,78,80]

Week	1							2							3							4						
Day	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
Phase 1																												
Phase 2																												
Phase 3																												
Phase 4																												
Phase 5																												
Cardio																												
Flexibility																												
Re-assess																												

Figure 13.5 The monthly or weekly plan.

Annual Plan = Macrocycle
Monthly Plan = Mesocycle
Weekly Plan = Microcycle

Figure 13.6 Periodization cycles.

Stretch Your Knowledge

What is the Evidence to Support the use of Planned, Periodized, Integrated Training Programs?

- Making gradual increases in volume and decreases in intensity was the most effective program for increasing muscular endurance (Rhea et al., 2003).[1]
- A 9-month periodized resistance-training program was superior for enhancing strength and motor performance in collegiate women tennis players (Kraemer et al., 2003).[2]
- Making program alterations on a daily basis was more effective in eliciting strength gains than doing so every 4 weeks (Rhea et al., 2002).[3]
- Planned, integrated strength-training programs led to superior physical, physiologic, and performance improvements compared with nonperiodized training programs (Kraemer and Ratamess, 2000).[4]
- Planned variations in an integrated training program are essential because they enable continuous adaptations to occur during a training period and prevent injury (Tan, 1999).[5]

1. Rhea MR, Phillips WT, Burkett LN, Stone WJ, Ball SD, Avlar BA, Thomas AB. A comparison of linear and daily undulating periodized programs with equated volume and intensity for local muscular endurance. J Strength Cond Res 2003;17(1):82–87.
2. Kraemer, WJ, Hakkinen K, Triplett-McBride NT, Fry AC, Koziris LP, Ratamess NA, Bauer E, Volek JS, McConnell T, Newton RU, Girdon SE, Cummings D, Hauth J, Pullo F, Lynch JM, Mazetti SA, Knuttgen HG. Physiological changes with periodized resistance training in women tennis players. Med Sci Sports Exerc 2003;35 (1):157–168.
3. Rhea MR, Phillips WT, Burkett LN, Stone WJ, Ball SD. A comparison of daily and undulating periodized programs with equated volume and intensity for strength. J Strength Cond Res 2002;16(2):250–255.
4. Kraemer WJ, Ratamess NA. Physiology of resistance training. Ortho Phys Ther Clin North Am 2000;9 (4):467–513.
5. Tan B. Manipulating resistance training program variables to optimize maximum strength in men: a review. J Strength Cond Res 1999;13(3):289–304.

SUMMARY

Planned fitness training (or periodization) shifts the focus of a training program at regularly planned intervals of time to vary stress placed on the body to produce adaptation and prevent injury.

A training plan clarifies what forms of training will be used, how long it will take, how often it will change, and what specific exercises will be performed. An annual plan organizes the training program for a 1-year period to show when the client is in which phase. The annual plan is further broken down into periods of training called monthly plans, which detail the specific days of each workout, showing the client exactly what type of training will be required each day of the month. Weekly plans are the specific workouts and exercises that the client will do for that week.