

The Personal Fitness Trainer Study Guide

What do you need to Know? NESTA PFT Exam Domain Breakdown

Exercise Sciences (A&P, Biomech, Kines)	15%
Assessment, Safety and Prevention, Special Populations, Emergency Care	18%
Business	20%
Program Design	16%
Exercise Applications and Instruction	10%
Exercise Psychology	11%
Nutrition	10%
	100%

The PFT exam is multiple choice and there will be 125 questions. 100 questions will be graded, and the other 25 will be used as research for future exams. This is standard practice for most certification exams. The best way to prepare is to study a little over many days. Seek to understand, not memorize, or you will have a great challenge ahead of you. Try to study for one hour every day with the information in this study guide leading up to the workshop, then review your workbook information as you are guided through the workshop weekend. You must resign yourself to making learning an ongoing process, and not a short-term process, or you have already failed.

The science component of your exam includes nutrition, kinesiology, biomechanics, physiology, and functional anatomy. You must familiarize yourself with the basics of nutrition, understand the basic planes of movement and motion (kinesiology), recognize the internal and external forces and how these forces affect exercise application during movement (biomechanics), be conscious of the effects of exercise on the body during AND after exercise (physiology), and LASTLY, be aware of the function of the various muscles in movement. Muscles should be your least focus, not the greatest focus.

The assessments are evaluations of your client(s) on an ongoing basis and you must understand how to assess in a way that is beneficial to you AND your client(s).

Safety and injury prevention includes information to help keep your workouts safe, efficient, and effective. The business information is included as business is a key component to your success as a personal trainer. Since you are reliant upon gaining clients, your ability to communicate effectively, with respect, is of the utmost importance. If you do not have adequate rapport with your client, and buy-in to your methods and training ideas, neither you nor your client can succeed.

The program design section covers the basics of periodization (cycling of a fitness program to meet a desired goal or goals). You must understand where your client must start and how to progress your client based upon training age (training experience) and client goal(s), with recognition toward how the body adapts to exercise. This includes foundation training for function and movement control, strength endurance, hypertrophy, basic strength, and skill-related fitness (as it applies to power, speed, and sport training).

Lastly, you must be able to safely (least risk possible), efficiently (no wasted effort), and effectively (accomplishes desired goal), apply the proper exercises to meet your client's goals while taking into account the client's training age, proper biomechanics, and taking into account expected physiological responses to exercise and movement stress.



As you progress, keep an open mind. It is just about at the moment you think you have things figured out, that you will realize you have a long way to go. It should be this way for everyone. There is a reason why no one has all the answers. No one has all the answers because there is always something to learn and there is too much to know. Be easy on yourself and do not expect to know everything. And do not be so ignorant or arrogant to believe that you know more than other trainers. Simply seek to do what is best for your client(s) by constantly improving your knowledge, skills, and abilities.

Your journey either starts, or simply continues here...

Obtaining and Retaining Clients

Traits of a Professional, Certified Personal Fitness Trainer

A professional personal trainer must be a strong communicator, confident, professional, action-oriented, energetic/enthusiastic, and must employ the “Platinum Rule”.

To be professional means to be consciously aware of not only your client’s needs, but of the needs of other club members, your manager, your fellow employees, and anyone else who might be affected by your performance and actions while you are training or at your place of work. It is not enough to singularly focus on your client while training, you must constantly be aware of the training environment around you and not infringe upon the efforts or performance of anyone else in any way. This is a challenge, but a challenge that you must undertake.

Being an effective communicator means getting your ideas across clearly to your clients at all times, and recognizing how to adapt and communicate differently in different client situations. This is perhaps your most important business skill to learn and improve upon. And it is the most important skill toward your success as a personal trainer.

Being confident is not being arrogant. It is believing that you can help anyone and that you will always seek to help in any way you can. You are not better than other trainers, but you are as good as anyone.

To be action-oriented is to always be proactive while you are at work. Save studying, socializing, and anything that does not move you toward helping others immediately for another time.

Energy and enthusiasm are a must. You must be outwardly passionate so that everyone wants to be around you because your training attitude is infectious and motivating.

You must also employ the “Platinum Rule”, which is to say that you must treat others BETTER than you want to be treated. Treat the gym like your home and all those present as though they were guests at your party. Your job is to give of yourself and help others in any way that you can AT ALL TIMES. If you are at work, you are there to help, not do what you want to do.

What does a professionally Certified Personal Fitness Trainer do?

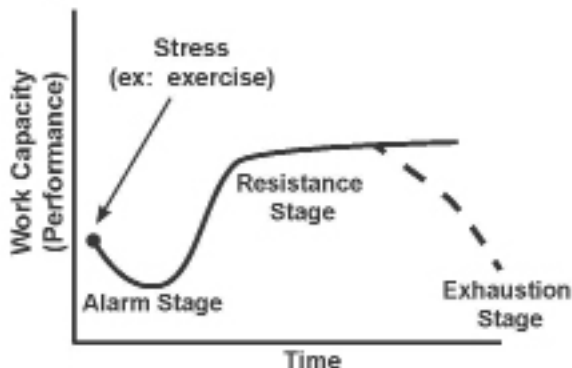
Big Picture = Bridging the Gap

Get your clients to their goals the quickest and safest way possible. Do not cut corners. Understand the sciences, and understand the person you are working with.



Exercise Physiology Overview

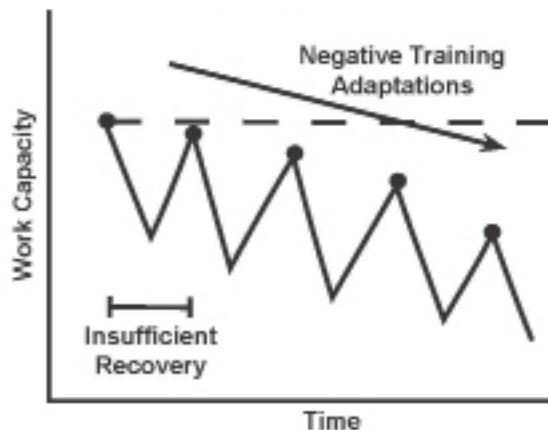
The General Adaptation Syndrome



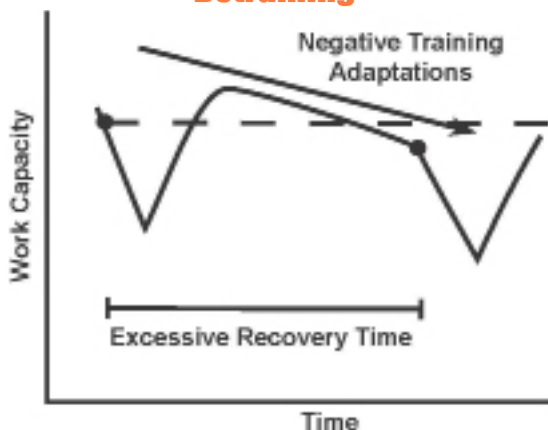
Optimum Training



Overtraining



Detraining



The General Adaptation Syndrome was formulated by Hans Selye and Walter Cannon, and describes how your body adapts to stress. There are good stressors (eustress) and there are dangerous stressors (distress). Whether exercise is eustress or distress depends on many factors. The body will do its best to adapt (optimum training), but will have negative responses if the training is too much (overtraining) or too little (detraining). Optimal work time and intensity coupled with appropriate rest and recovery periods will help your clients achieve positive adaptations to the stress of exercise on an ongoing basis.

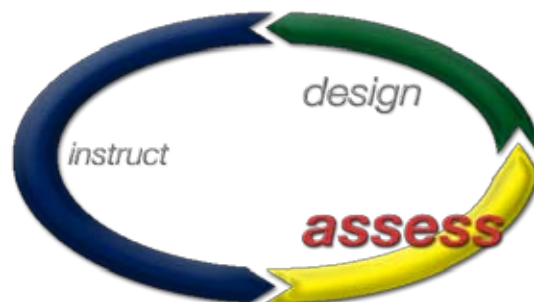
The NESTA System

Step 1: Assess

Determine individual WANTS and NEEDS.

Form a baseline for comparison

Discover the specific capabilities and limitations of your client.

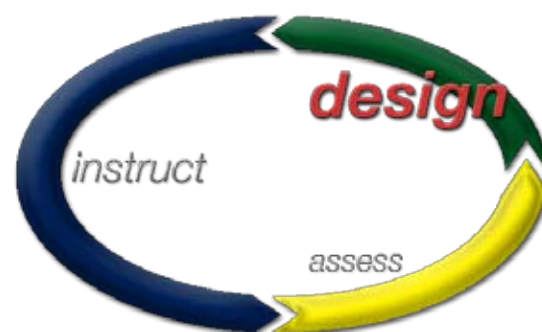


Step 2: Design

Form program based on information gathered from initial and ongoing assessments

Base design on established exercise science (not merely anecdotal evidence)

Have a plan for EVERY SESSION as a basis to follow



Step 3: Instruct

Base your instruction on sound principles of biomechanics and kinesiology

Have a clear idea of what you expect to see (before you see it) for proper form and technique

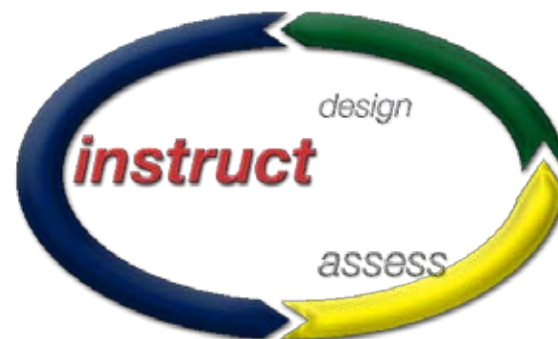
Teach each movement prior to exercise execution

Communicate using different modalities (**VAK**)

V = Visual (your client sees your example/ technique)

A = Auditory (your client hears you describe what to do and your constant instruction and motivation during exercise)

K = Kinesthetic (your client is shown what to do by proper and professional "touch" to show your client what to do)



Step 4: Re-assess

MICROASSESS

Every rep of every set is an assessment!!

MACROASSESS

Compare current abilities to initial assessment and evaluate progress every 4-8 weeks as this is the approximate (not exact) time frame for physical adaptation to an exercise stress.



Sales

Many trainers do not like to think of themselves as salespeople. Trainers ARE salespeople. You are constantly selling others on the professional service you offer. You are simply doing all you can to show that you have a level of knowledge, skill, and ability to help others in a way that they cannot and will not be able to do alone. Since no one can be objective about themselves or fully understand all there is to training, you will have something to offer EVERYONE.

If you perform your initial assessment protocol (to be explained and reviewed later) efficiently and effectively, you will not have to “sell” anything. You are providing a service, not a product, so treat your client and potential customer with the highest level of respect. The client’s wants come before what you perceive to be the client’s needs. When you sell a service, there is an ongoing relationship. When you sell a single product, the relationship is not intended to last in the same way. Never aggressively “sell” anyone on training. If your potential client says “No” when you ask the person if he/she wishes to train with you, either you have not properly performed your job leading up to that point, or the person was never going to train in the first place. If you want to know why the person said “No”, then feel free to ask. No means no, and you must resign yourself to a learning experience that you will perform better next time.

Fitness Practice

You must look at training as though it is your own fitness practice. It is up to you to determine your own success. No amount of blaming others for your inability to succeed will suffice. Everyone will face obstacles in terms of a tough to work with manager, hard-to-convince gym members, a member base without a lot of money, or other people that are hard to work with and around. It will still come back to you and your attitude toward training, educating yourself, and learning how to better help others along the way. If you keep doing this on an ongoing basis, nothing will get in your way.

Marketing

Always carry business cards with you. If your employer does not provide you with any, have some made (with the permission of your employer). Make the cards professional-looking, yet simple with your name, contact information, and job title. Add no more than one line or slogan that describes what you do. If it cannot be explained quickly and concisely, it is not worth putting on your business card. If you work outside of the gym, employ a wide variety of media including focused advertising (be careful with your money), and networking with other professionals (physical therapists in particular), All trainers should be come comfortable with asking your clients and others for referrals (always), If you choose to advertise, use a variety of media forms and only post an ad that is persuasive and worth using.

Free sessions?

You are now and will always be a hard worker. Your time is not free. With very few exceptions, your “fee” for your work should be the professional value of your time based on what your time and efforts are worth.

Kinesiology

Kinesiology is the study of movement. It is IMPOSSIBLE for a trainer to effectively choose and apply an appropriate exercise in a safe, efficient, and effective manner unless the trainer understands the joints affected in movement, the effects on connective tissue, and then, therefore, the muscles involved in the exercise. Movement, not muscles, is king. The only time focus should be on a particular muscle when exercising is to ensure hypertrophy (recognizing that it is never truly possible to “isolate” any particular muscle). Otherwise, the primary focus for the trainer and trainee during exercise with focus on goals of either function, strength endurance, basic strength, or power, should be on MOVEMENT, not muscles. Anatomical neutral is the position from which all movements begin. Anatomical position is a medical reference that you may encounter.

The 3 planes of motion are the sagittal plane (dividing the body into left and right, incorporating all flexion and extension movements, and incorporating all movement forward or backward.), the frontal plane (dividing the body into front (anterior) and back (posterior), incorporating all adduction and abduction movements, and incorporating all movements out to the sides away and toward the body), and the horizontal plane (dividing the body into top and bottom, incorporating all rotational movements). Many typical weight training exercise are sagittal plane dominant, but functional exercise, by definition, encompasses all 3 planes, and has no specific plane.

Functional exercise, however, is not just multi-planar. Functional exercise is any exercise that enhances movement skill (not just something we do in everyday life, this is overly simplistic and not quite correct as that would incorporate even the less efficient and higher risk motions we sometimes employ) AND utilizes proper biomechanics (no easy task as the area of biomechanics is where most trainers are lacking). One of the many challenges for any trainer is to release notions of a muscle-focus and obtain a movement-focus.

Functional Anatomy & Kinesiology

Kinesiology

The scientific study of human movement

A trainer should know:

Basic movement terminology

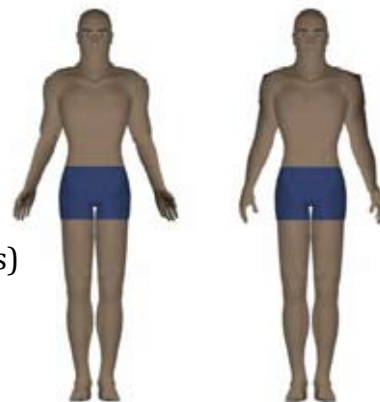
Functional anatomy

Considers muscle location as well as movement produced by the muscle(s)

Anatomical Position and Neutral

Anatomical Position - standing erect with the palms facing forward

Anatomical Neutral - standing erect with the palms facing the body

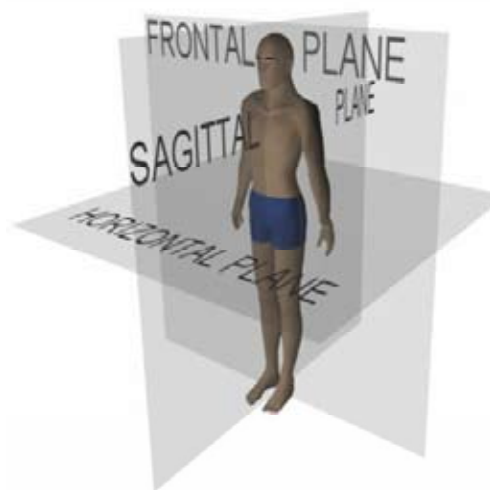


Planes of Motion

Sagittal Plane: Divides the body into right and left halves

Frontal Plane: Divides the body into front and back halves

Horizontal Plane: Divides the body into top and bottom halves



Anatomical Movement Descriptors

Anterior - front of the body relative to another reference point

Posterior - the back of the body relative to another reference point

Superior - above a reference point

Inferior - below a reference point

Medial - relatively closer to the midline of the body

Lateral - relatively farther away from the midline

Proximal - closer to a reference point

Distal - farther from the reference point

Bilateral - refers to both sides

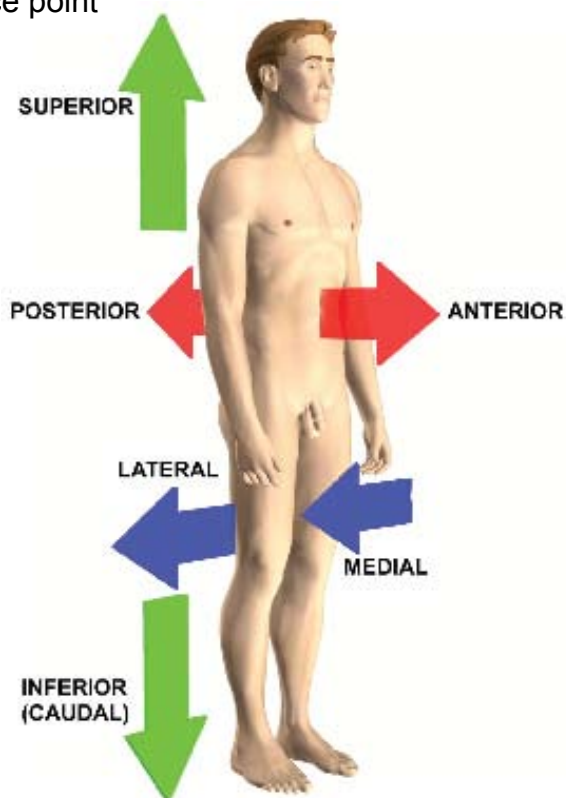
Unilateral - Refers to only one side

Superficial - Near the surface

Deep - Further beneath the surface

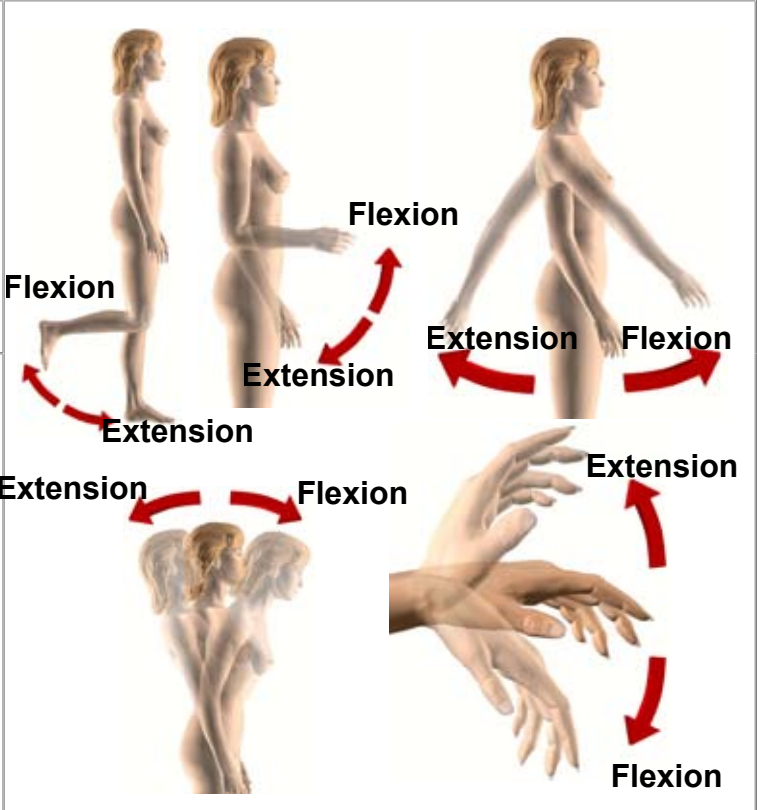
Prone - Lying face down

Supine - Lying on one's backside

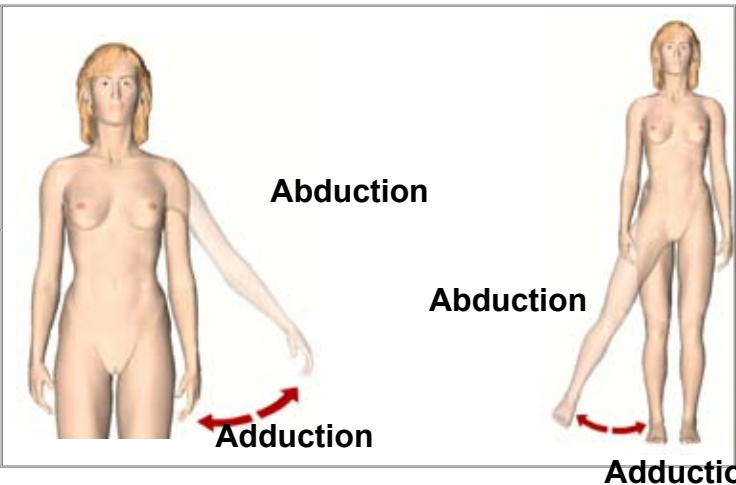


Direction of Motion

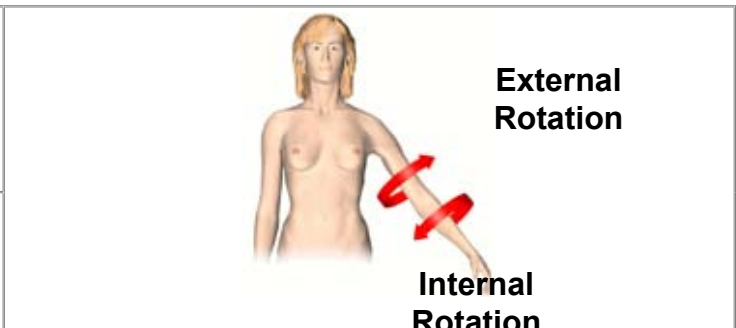
Sagittal Plane Movements (Coronal Axis)

Flexion	A bending movement where the relative angle between two adjacent segments decreases	
Extension	A bending movement where the relative angle between two adjacent segments increases. <i>Hyperextension is a movement which continues past anatomical (zero) position. (a.k.a. Extension beyond neutral.)</i>	

Frontal Plane Movements (Anterior-Posterior Axis)

Abduction	Movement away from the midline of the body	
Adduction	Movement towards the midline of the body	

Transverse Plane Movements (Longitudinal Axis)

Internal/Medial Rotation	The rotation of a body part towards the midline (inside) of the body	
External/Lateral Rotation	The rotation of a body part away from the midline of the body	

Muscular System Overview

Structure and Function

Skeletal Muscle

Largest cells in the body that create our movement

More than 400 skeletal muscles in the body (600 total muscles) vs the smooth muscles that make up the organs.

Composed of bundles of fibers that are divided further into filaments and then sarcomeres

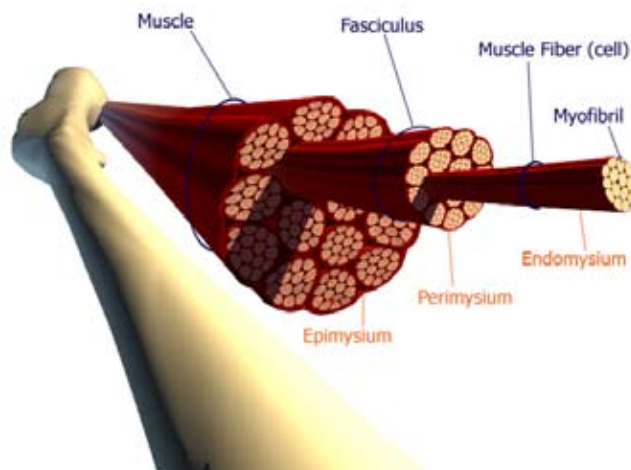
Connective Tissue (Fascia, Tendons)

- 3 layers of fascia for separate innervation of muscle fibers

- Tendons - connect muscle to bone. Transmit forces from muscle to bone.

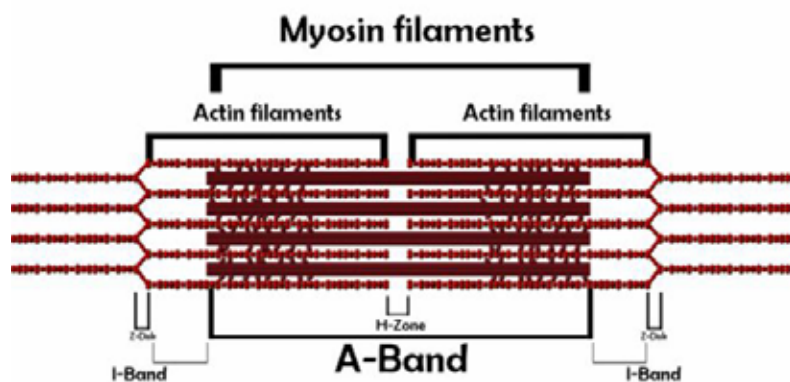
- Ligaments - connect bone to bone, restrict motion

3 Parts to a muscle (Belly, Origin, and Insertion)



The Sliding Filament Theory

The actin and myosin overlap one another as the muscle contracts (shortens), creating a visual representation of increased size.



Contractile Proteins of Muscle

Actin and Myosin

Roles of Muscles

- Prime Mover/Agonist (moves joint(s))

- Assistant Mover (assists movement)

- Antagonist (opposes movement)

- Stabilizer (maintains joint position)

Muscle Action

- Concentric - muscle shortens under load (contracts)

- Eccentric - muscle lengthens under load

- Isometric - muscles stabilize under load

Neuromuscular Adaptations to Resistance Training

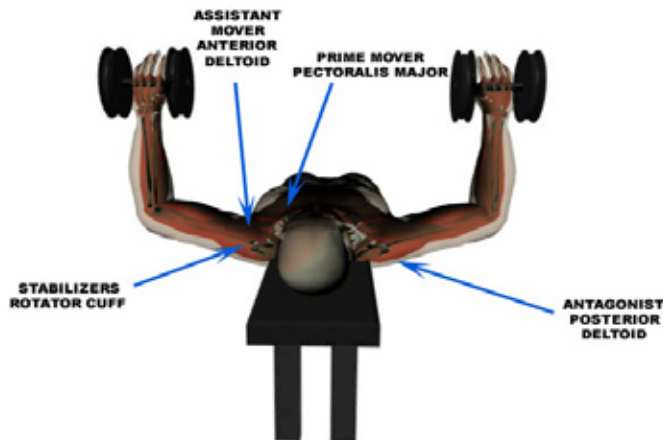
- Muscular Strength - ability to exert force

- Muscular Power - ability to exert force quickly

- Muscular Endurance - sustain repeated near-maximal or maximal forces for an extended period of time

- Muscle Soreness - short-term immediate soreness (PEMS, within 24 hours and DOMS 24-48 hours) is common, but not desired, when a new stress is introduced, and should never last more than 48 hours.

ROLES OF MUSCLES ON THE SHOULDER JOINT (GLENOHUMERAL JOINT) DURING A DUMBBELL BENCH PRESS



Assessments and First Client Meeting

What do we Assess?

When you first meet your client for the 1st session, it is imperative that you perform a thorough assessment. This means taking 20-30 minutes to perform a health/fitness history question-and-answer period, and taking 30-40 minutes to perform several physical and fitness assessments. The typical trainer will go right into exercise training with a new client while knowing nothing about the client's background/ability. It is not enough, and not professional, to have the client fill out the health/fitness history questionnaire. The client (like anyone), in a hurry to exercise, will rush through completion of the form, and important information will be missed. When you perform a thorough assessment, you and your client will both receive more information and you will be more safe, efficient, and effective with your programming. Your client will now come up with a laundry list of goals as he/she realizes there is much more to this "training thing" than he/she could possibly have imagined.

Ask questions until you feel that enough information is obtained. Expect to take at least 75-90 minutes the first time you perform a thorough assessment. After a couple times, you will be able to hone it down to less than 60 minutes, but you must be very efficient and active in order to ensure everything is accomplished during this time.

After you finish the health/fitness history questionnaire in the first 20-30 minutes, you will perform the physical and fitness assessments. The physical assessments include blood pressure, resting heart rate, weight, body composition, and girth measurements. The fitness assessments include static posture, dynamic posture (squat test), balance test, upper body strength, lower body strength, and cardiovascular fitness. When all is said and done, you will have performed 20-30 minutes of questioning, and 30-35 minutes of fitness assessments which include 13 different tests/evaluations. This is no easy task and should not be taken lightly.

Health History

Identifies medical concerns that could be irritated by exercise or require medical attention

Provides specific points of focus for the client and trainer

Generates opportunity to "interview" a potential client and create rapport for a long term relationship

How often should a person get a complete physical?

For adults 19-39 years of age, the exam should be completed every 5 years; for 40-49 years of age, the exam is recommended every 3 years. Those 50 years and older should receive an exam every 1 to 2 years.

Modified Physical Activity Readiness Questionnaire (PAR-Q)

Name			Date
DOB	Age	Home Phone	Work Phone

Regular exercise is associated with many health benefits, yet any change of activity may increase the risk of injury. Completion of this questionnaire is a first step when planning to increase the amount of physical activity in your life. Please read each question carefully and answer each question honestly:

Yes	No	1) Has a physician ever said you have a heart condition and you should only perform physical activity recommended by a physician?
Yes	No	2) When you perform physical activity, do you feel pain in your chest?
Yes	No	3) Have you had chest pain, while not performing physical activity, in the past month?
Yes	No	4) Do you ever lose consciousness or do you lose your balance because of dizziness?
Yes	No	5) Do you have a joint or bone problem that may be made worse by a change in your physical activity?
Yes	No	6) Is a physician currently prescribing medications for your blood pressure or heart condition?
Yes	No	7) Are you pregnant?
Yes	No	8) Do you have insulin-dependent diabetes?
Yes	No	9) Are you 69 years of age or older?
Yes	No	10) Do you know of any other reason you should not exercise or increase your physical activity?

If you answered yes to any of the above questions, talk with your doctor **BEFORE** you become more physically active. Tell your doctor your intent to exercise and talk about the questions to which you answered yes to go over concerns.

If you honestly answered no to all questions you can be reasonably certain that you can safely increase your level of physical activity gradually.

If your health changes so you then answer yes to any of the above questions, seek guidance from a physician.

Participant signature	Date
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Health and Fitness History Questionnaire

1. What is your birth date?	
2. Has a doctor diagnosed you with any heart conditions? Examples include: mitral valve prolapse, myocardial infarction, angina, dysrhythmia, atherosclerosis of the coronary artery.	Y / N
3. Has a doctor diagnosed you with any obstructive pulmonary disease? Examples include: asthma, interstitial lung disease, emphysema, bronchitis, cystic fibrosis.	Y / N
4. Has a doctor diagnosed you with any form of metabolic disease? Examples include: diabetes mellitus (type 1 or type 2), thyroid disorder, renal or liver disease.	Y / N
5. Has anyone in your immediate family had any heart problems prior to age 55?	Y / N
6. Have you been diagnosed by a doctor as hypertensive (high blood pressure)?	Y / N
7. Have you been diagnosed by a doctor as having high cholesterol?	Y / N
8. Have you been diagnosed by a doctor as having hypoglycemia?	Y / N
9. Have you been diagnosed by a doctor as having high triglycerides?	Y / N
10. Are you epileptic?	Y / N
11. Have you ever suffered a concussion or been knocked unconscious?	Y / N
12. Do you smoke (or have you quit within the last 6 months)?	Y / N
13. Are you pregnant?	Y / N
14. Are you pre or postnatal?	Y / N
15. Do you consider yourself to have a sedentary lifestyle (i.e. do you sit a large part of your day)?	Y / N
16. Have you ever experienced chest pain?	Y / N
17. Have you ever experienced abnormal dizziness?	Y / N
18. Have you ever experienced shortness of breath (with mild exertion)?	Y / N
19. Are you on any medications right now?	Y / N
20. Have you been diagnosed by a doctor as having osteoporosis?	Y / N

21. Do you have arthritis or joint pain?	Y N
22. Do you have any back pain or a spine disorder?	Y N
23. Have you ever had any broken bones?	Y N
24. Do you have any musculoskeletal pain/injury?	Y N
25. Are you sensitive to touch or pressure in any area?	Y N
26. Have you ever had a hernia?	Y N
27. Have you ever had surgery?	Y N
28. Do you have difficulty sleeping?	Y N
29. Do you experience poor circulation in your extremities (cold hands and feet)?	Y N
30. Do you have any gastrointestinal disorders?	Y N
32. When was your last complete physical?	
Name of your Emergency Contact (Name and daytime and evening phone numbers)?	

Coronary Artery Disease Risk Factors

(Determined from PAR-Q and Health History Questionnaire)

Low Risk	Males or females who meet no more than one of the coronary artery disease risk factors
Moderate Risk	Males 45 or older and females 55 or older, and any male or female who meets two or more coronary artery disease risk factors.
High Risk	Individuals with known cardiovascular, pulmonary or metabolic disease

If a client is either moderate or high risk a medical consent form must be signed by a doctor or physician and returned to the fitness professional before exercise programming may begin. If an individual has a disease or ailment which is not known or understood by the trainer or fitness professional then medical consent is also required. Not obtaining medical consent when significant risk is present is unprofessional and puts the client at considerable health risk with considerable financial liability for the trainer. It would always be in the best interest of the trainer to request a medical consent under any questionable circumstances. Your primary goal is to help your clients, but to be sure everyone is protected, get liability insurance whether you are an employee or an independent contractor. When you are negligent, regardless of intent, you can still be held responsible in a court of law.

Coronary Artery Disease Risk Factors defined by the ACSM

- 1) A **family** history of myocardial infarction, coronary revascularization, or sudden death before 55 years of age for a male relative (father, brother, or son) or before 65 for a female relative (mother, sister, or daughter).
- 2) A current **cigarette smoker** or one who has quit in the past six months.
- 3) Current **diastolic** or systolic blood pressure above 140 mm/Hg or diastolic blood pressure above 90 mm/hg. This must be confirmed by the trainer on measurements from two separate occasions or diagnosis by a doctor. Hypertension is having high blood pressure at or greater than 140/90. Hypotension is having low blood pressure at or below 90/55. A person who has such low blood pressure may also be prone to fainting (loss of consciousness also known as syncope).
- 4) Current hypercholesterolemia or total serum cholesterol of greater than 240 mg/dl or HDL of less than 35 mg/dl or on current cholesterol medication.
- 5) Impaired fasting glucose of greater than 110 mg/dl (**diabetic** concerns). Hypoglycemia is being prone to having low blood sugar and hyperglycemia (diabetes) is being prone to having excessively high blood sugar either due to an inability to produce insulin or the body's learned inability to properly process blood sugars (due to the combination of first, no exercise, and 2nd, a poor diet high in processed foods). The best form of exercise to help better process blood sugars is performing at least 30-40 minutes of cardiovascular exercise each day, whether it be walking or something else, it must be performed.
- 6) **Obesity** or body composition of greater than 35% for a female and greater than 25% for a male (waist girth of greater than 100cm or 40 inches).
- 7) **Sedentary** lifestyle or person not participating in a regular exercise program.



Medical Clearance and Physician's Consent Form

To: *(Your name, address, city, state and zipcode)*

Dear Personal Trainer:

My patient, _____, has advised me that he or she intends to participate in a fitness assessment. This assessment will include muscular endurance and flexibility tests, body composition assessment, a blood pressure reading, and cardiovascular fitness assessment. An exercise program will be designed based on this assessment which will include, but not be limited to, resistance training and cardiovascular training. The sessions will last approximately one hour, and will begin at a very moderate, sub-maximal level.

Please be advised that my patient, _____, should be subject to the following restrictions in the fitness assessment and/or in his or her exercise program:

In addition, under no circumstances should he or she do the following:

I have discussed the foregoing restrictions and limitations with my patient and, with these specific restrictions, he or she has my permission to participate in a fitness assessment and pursue an exercise program under your guidance.

Truly yours,

(Sign name here)

Date: _____

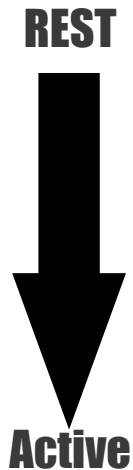
(Print name here)

Phone number: _____

Physical Assessments

Order from Rest to Active

- Resting Heart Rate
- Blood Pressure
- Weight
- Body Fat
- Girth
- Balance
- Posture
- Flexibility/Mobility
- Muscular Strength
- Muscular Endurance
- Aerobic Capacity



Resting Heart Rate (RHR)

Taken first thing in morning before getting out of bed. Measure for 60 seconds. Take the average of three mornings. If RHR varies more than 10% high either rest completely or reduce activity intensity to 50-55% max until normal morning RHR is achieved.

Resting Blood Pressure (BP)

Taken at the left brachial artery after resting for at least 2 minutes

Weight

Assess no more than once weekly for general fitness, only athletes should be measured more often for body water changes due to sweat loss for current hydration status.

Body Composition

Body Composition Testing is the use of various methods to determine the proportion of fat to lean tissue through:

- Hydrostatic Weighing (underwater weighing, the gold standard for body composition)
- Near-Infrared Reflectance (infrared light on biceps of dominant arm, 0-5% variance)
- Calipers (skinfold measurement in mm of 3, 7, 0r 12 sites, 0-9% variance)
- Bioelectrical Impedance (current travels through body to determine body fat, 0-8% variance)

ACSM Standards of Body Composition		
Gender	Ideal	Obese
Female	16-19% BF	> 35% BF
Male	11-13% BF	> 25% BF

Athletic individuals often have a bodyfat/body composition % below "ideal" because athletes, although high physical performers, are often at higher health risk than those with more moderate levels of body fat. Performance in sport and health do not necessarily go hand-in-hand. Those in ideal BF% category have simply had the least health-related problems so this category has the lowest health risk.

Girth Measurements

Measure shoulders, chest, arms, waist, hips, thighs and calves for perhaps the best visual indicator of progress before weight changes can be observed.



Balance, Static and Dynamic Postural Assessments

What is the status of the client's kinetic chain?

Balance Test/Assessment:(2-3 minutes to perform and transition onward) Have the client stand on one leg for 30 seconds, then the other leg for 30 seconds. Then perform again with eyes CLOSED. If the client cannot perform the assessment with eyes open, do not perform with eyes closed. Otherwise, use this test to observe spatial control, emotional response of your client (watch his/her facial expressions and body language during the assessment), and to determine possible movement imbalances. Train movement, NOT muscles.

Static Assessment - Standing Posture (1-2 minutes to perform and transition onward) Have the client stand still in a relaxed posture (posture is just current position in space). If you feel the client is standing abnormal to their "true" posture, have the client march in place with increasing range of motion and speed and then have the client relax to find a more "natural" position of standing. Observe the client from the anterior, lateral, and posterior views. You are looking for gross abnormalities of postural problems. If you don't see anything noticeable, don't write anything down. Do not TRY to find problems, the problems will either be obvious or not. This is not the time to nitpick, but to determine if there are any possible points that may create concern in more challenging movements. Look from head to toe at each angle. Take note of position at each major joint position (head/neck, shoulders, spine, arms, hips, knees, and ankles/feet). You will simply note any joint area that appears to be away from anatomical neutral more than is desirable. This is a moderately subjective (professional judgment) test, be efficient and timely as there will be time to observe in detail over many sessions.

Dynamic Assessments - Overhead Squat and Gait (2-3 minutes to perform and transition onward) Have the client hold a dowel or foam roller overhead with arms straight. Feet must maintain full contact with the ground at all times with the feet neutral hip-width (middle of hip to middle of knee and middle of toe). The client should perform a slow squat while descending as far as possible toward the ground and returning upward. This should be performed between 12-20+ times until the trainer has had the opportunity to observe from the anterior, lateral, and posterior. Like the balance and static posture tests, this test is meant to be quick to look for gross abnormalities. Can the person squat well or not? Do not try to determine muscular deficiencies, only note MOVEMENT deficiencies or points of concern. We are looking for global recognition of the body, again, not to nitpick every small motion as there is no such thing as a perfect squat. Remember that a squat is simply sitting and standing and EVERYONE can do this. To what extent they can squat is up to you as the professional trainer when working with your clients. Loading a squat will not necessarily incorporate the same form/position as is performed during the squat test. These tests are designed to determine the efficiency of the kinetic chain.

The kinetic chain is composed of 3 systems. These 3 systems are the nervous system (controls muscular functions and communicates within the body's systems between cells), the skeletal system (provides the structure and movement support for the body at joints, where 2 bony surfaces make contact), and muscular system (provides movement of bones at joints based on feedback from and communication with the nervous system). If any of these 3 systems is not functioning properly, none of the systems will function properly, which is once again why movement, not muscle, is king. Note also that the endocrine system is not mentioned, but is vitally important, as the endocrine system is composed of glands which have numerous regulatory functions and controls over the body's cells and plays an integral role with the nervous system. Many times programming can seem to be progressive for the kinetic chain, but the effects on the endocrine system (the unseen system) can be devastating. When an individual is tired, worn down, or not progressing, and problems within the kinetic chain have been ruled out, there is a good chance the endocrine system, and glandular function (adrenal, thyroid, testes, ovaries, pineal, pituitary, thymus, and pancreas) is impaired and medical attention should be sought. Only a blood test can determine possible endocrine dysfunction.

Purpose of Blood

Transports nutrients and oxygen to the body from the heart and lungs, and transports carbon dioxide and metabolic waste back to the heart and lungs for removal and replenishment.

Basic Anatomy

4 Chambers of the Heart

Left and Right Atria

Left and Right Ventricles

Flow of Blood

LA - LV - Aorta - Arteries - Capillaries - Veins - Sup/Inf Vena Cava - RA - RV - Pulm Artery - Lungs - Pulm Vein - LA

Blood Pressure

Normal = 120/80 mm/Hg

Too High = 140/90 mm/Hg or more

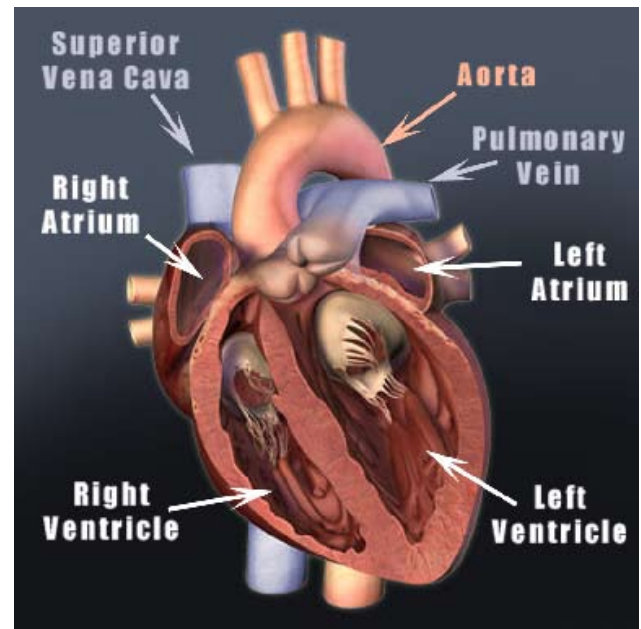
Too Low = 90/55 mm/Hg or less

Systolic = upper number in blood pressure measurement, pressure on ventricular walls during ventricular contraction

Diastolic = lower number in blood pressure measurement, pressure on ventricular walls during ventricular filling (relaxation of ventricles)

Valsalva Maneuver = holding of breath, closing the glottis of throat, while under stress to create greater momentary force with effect of raising blood pressure and heart rate significantly

Cardiac Output = Stroke Volume x Heart Rate (an efficient heart has a stroke volume with large amounts of blood pushed out with each ventricular contraction AND a lower heart rate displaying little effort required by the heart during many activities)



Heart Rate (HR)

Resting Heart Rate (RHR) = heart rate at rest following period of sleep (to obtain RHR it must be taken at least 3 days in a row, and ongoing, to determine the average RHR. If, on any given morning, RHR is 10-15% higher than normal, either light or no exercise should be pursued or illness will result along with poor performance. Should be taken EVERY DAY by EVERYONE, not just endurance athletes to determine current response to internal stressors. The heart rate is the ONLY objective measurement of exercise intensity AND overall stress outside of blood testing or gas exchange testing at a doctor's office)

Target/Training Heart Rate (THR) = heart rate goal. Note that the heart rate is not something anyone should try to increase. The goal is on performance and the highest performers accomplish more work with a lower heart rate. The goal is on the performance with the expectation of a given heart rate. If performance is being obtained, there is never any reason for a trainer or coach to say, "get your heart rate up". The goal has been obtained.

Maximum Heart Rate (MHR) = maximum heart rate is the total number of beats in one minute that the heart can maximally reach. This is estimated by taking 220-age. The only way to objectively measure MHR is by doing a maximal treadmill test with a doctor (a trainer only performs submaximal testing) or by performing the Conconi Test on a track (only for advanced endurance athletes, running lightly for 10-15 minutes, then as hard as possible for 4.5 minutes, followed by 30 seconds of all-out running to achieve maximal heart rate).

The Conconi Test cannot be performed on a bike or treadmill.

Recovery Heart Rate (ReHR) = The heart rate determined to be the goal before the next set or interval is pursued. Must always be performed just as heart rate should constantly be measured during every set of every strength OR cardiovascular exercise.

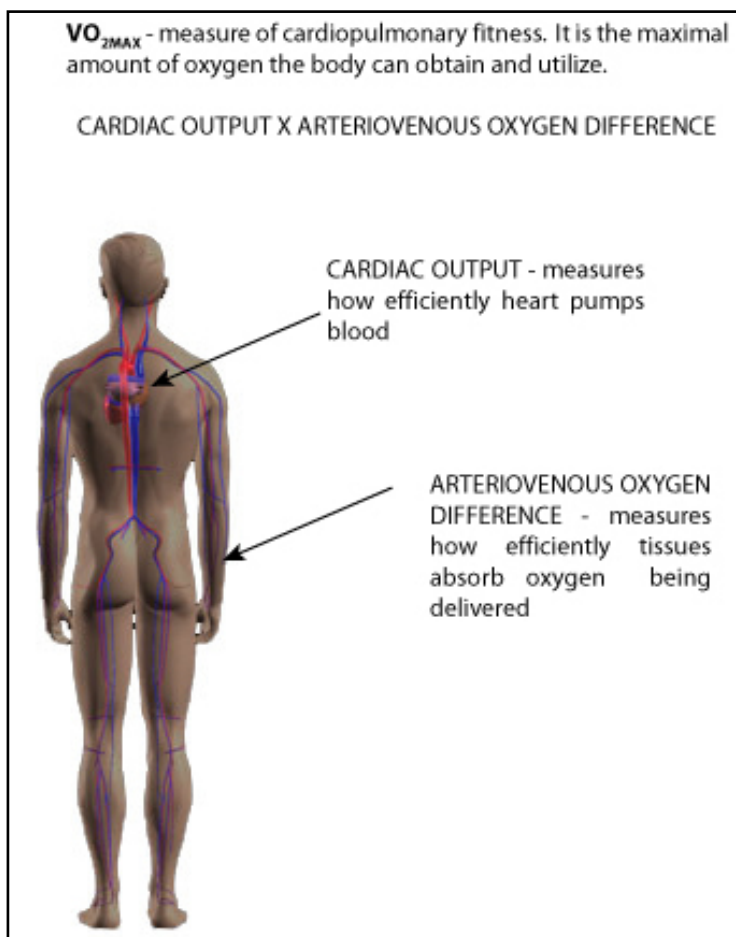
Initial Heart Rate (HR_i) = the heart rate measured by the personal trainer or client every time the client trains. This is different from true resting heart rate and is an objective determination of the client's internal response to stress at the moment before the workout begins. Note this for each workout and be aware of changes over time as sometimes, even though the workout is intended to be intense, if the client's current internal response is not strong (lower HR_i) then the intense workout will be detrimental rather than progressive.

Heart Rate (HR) = measure of ventricular contraction and relaxation (the two phases of the heartbeat). Should be taken preferably at radial artery by thumb at wrist. Often taken at carotid artery at throat, but this number can be misrepresented at this location due to pressure on the throat and more tissue in the way. The brachial artery is on the inside of the upper arm and where blood pressure is taken. Heart rate should be measured throughout all exercise and is the objective measurement of intensity. Factors such as load lifted and speed are objective but not necessarily indicative of internal response.

Rate of Perceived Exertion (RPE) = Along with HR, the RPE is one of the two best indicators of current exercise intensity. Taken on a scale of 1-10, during and after exercise, with 1 being lowest and 10 being the highest intensity possible, to determine subjective (opinion) intensity.

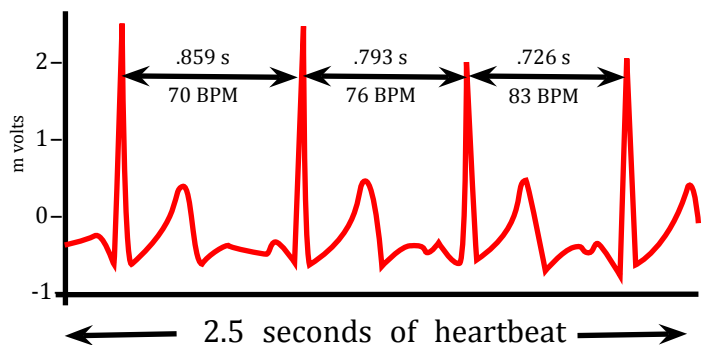
The client's valuation of intensity, not just the trainer's, is crucial and should never be ignored.

Aerobic Capacity (AC or VO₂max) = The maximum amount of O₂ the body can obtain and utilize. Also known as maximum oxygen uptake or VO₂max.



Heart Rate Variability

Heart Rate Variability (HRV) is a measurement of heart rate response timing with beat to beat measurement. The HRV provides information about the quality of the body's cardiovascular response.



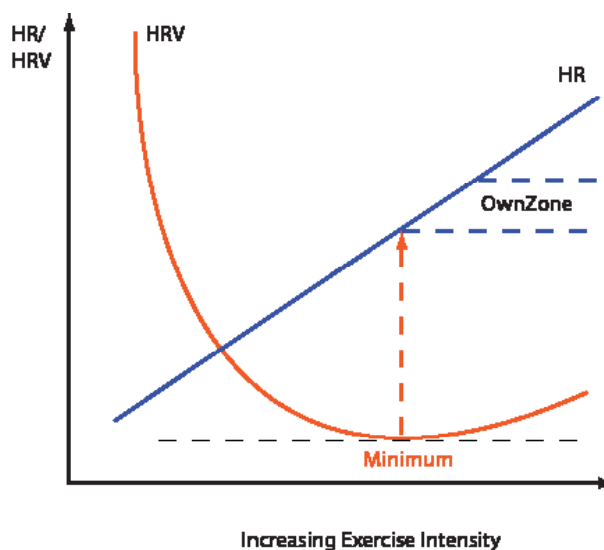
The more fit the individual, the greater the heart rate variability at rest (i.e. the body is constantly able to make the minute adjustments in heart rate).

Why do we care? Since you will most likely never measure Heart Rate Variability, why is it important?



Two Reasons:

1. Heart Rate Variability is a benefit and sign of cardiovascular fitness
2. Heart Rate Variability is one of the primary variables used to estimate aerobic capacity by the Polar



Cardiovascular Assessments

Aerobic Capacity (VO₂ Max/Submax) – usually performed at end of session

Physician supervised VO₂Max TM test IN ideal (can trainers perform a true VO₂Max test?)

3 Minute Step Test

Take HR for 1 min

Utilize 12-24 inch step

Step for 3 minutes at 96 bpm

Immediately take HR for 1 min

Treadmill Test - Bruce Treadmill Test

Various CV Exercise Machines/Types (go to www.brianmac.co.uk for more free training info)

Muscular Strength & Muscular Endurance

1 RM Assessments (not advisable)

10 RM = 75% of 1 rep max (suggested)

Recommended Assessments (30 min protocol)

Balance/Posture – Static/Dynamic (What is “Ideal Posture”?)

Plank – core strength/stability

Pushup – upper body strength endurance

(Assisted) Pull-up – UB strength endurance

Leg Press – lower body strength endurance

GOALS (Implicit and Explicit)

Following the initial assessment, you must discover what your client wants (now that you know what they need)

Ask detailed questions to elicit explicit and implicit goals after physical and fitness assessments:

SMART Goals

- Specific – clearly defined goals
- Measurable – set observable goals in which progress can be assessed
- Action plan organized – clearly describe goals with dates for certain levels of achievement to keep client motivated
- Realistic – set tangible, practical goals
- Timed – set monthly goals to allow the client to adapt to a new stimulus and observe changes

WHY'S **ASKING DETAILED QUESTIONS (“THE ROLLING WHY”)

MUST SHOW EMPATHY, OPEN COMMUNICATION IS VITAL

WHAT IS THE BENEFIT TO THE TRAINER?

INCREASES CREDIBILITY AND PROFESSIONALISM

BETTER EQUIPPED TO CREATE PROGRAM

AS GOALS BECOME MORE DETAILED, AND MOTIVES ESTABLISHED, MEMBER WILL BE VERBALIZING SENSITIVE TOPICS THAT THEY MAY NOT HAVE SAID BEFORE.



“PAINTING THE PICTURE”

The 4 Levels of Fitness

- While we may live the fitness lifestyle, our clients most likely do not. We take a lot for granted in others and their motivation, desires and expectations. They do not understand that fitness has well-defined stages.
- They don't know HOW or WHY exercise works! We need to explain to them how their body will adapt and how we'll help to make the changes they want – PAINT THE PICTURE!!

Exercise Instruction and Biomechanics

Biomechanics Overview

Evaluates the motion of a living organism and the action of forces on it

Biomechanics – What do you REALLY need to know (at least to start)?

Be able to “Feel the Force” (see it too)

Look at Movement (Joints) 1st, Forces 2nd, Muscles 3rd

See how the Force affects the Joint through the ROM (Torque, Compression, Distraction, Shear, etc.)

What happens when speed increases?

Knowing the goal, the basic joint structure and function, the muscle alignment – does the exercise make sense for the wants (goals) and needs of the client? What are Forces?

F = ma (force=mass x acceleration)

Force is a change in an object's motion. Mass is measure of an object's matter, and acceleration is a change in velocity

Really force is just a push or a pull

You can also look at it as something which over time will change an object's momentum ($p=mv$)

Momentum = mass x velocity

Momentum (p) is a measurement of an object's motion and is not desirable in strength training at any time.

Momentum is a crucial part of power, agility, and speed, but should never be present in normal weight training and functional training.

So a force will start something in motion, stop its motion, speed it up or slow it down

Forces on the Body

The same forces that move and stabilize the body also have the potential to deform and injure the body.
– Neumann

Internal Forces – produced by structures inside the body

Active – muscle (will only be as effective as the health of the connective tissue and movement control exhibited through the nervous system to the muscular system)

Passive – connective tissue (tendons, ligaments, fascia all take longer to adapt than muscle to a given level of stress)

External Forces – produced by forces outside the body. Some examples include...

Gravity (gravitational pull on mass)

Bodyweight

External load

Fluid (drag) resistance

Air/wind

Water

Elastics

Bands

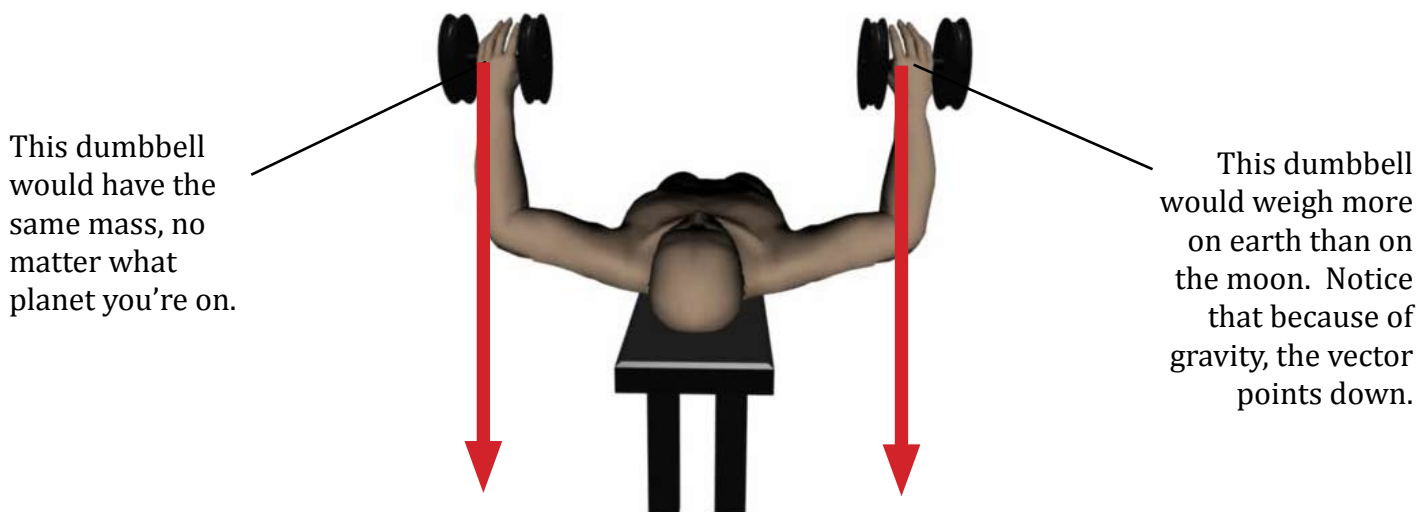
Springs

Work = Fd (work = force x distance)

Power = W/t = F x v (work/time = force x velocity) (so if you increase tempo, you increase POWER)

Weight

Weight - Is a type of force, measuring an object's gravitational attraction to the earth or another object.



“Seeing Forces and Joints”

The importance of understanding a joint's structure and function

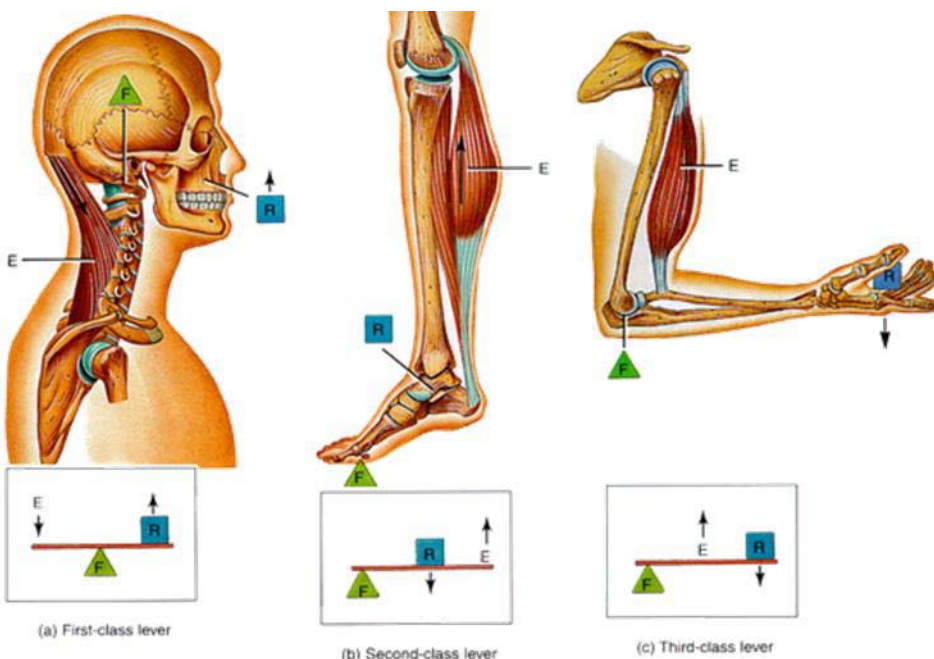
The ONLY way to know which muscles are truly working is to first look at the joints and then the forces causing movement

Lever Classes

- A First Class Lever is a lever in which the axis lies between the effort force and the resistance force. (nearly equal mechanical advantage between internal and external force) (shown by head/neck here)

- Second Class Lever is a lever in which the resistance force acts between the axis and the effort force. (mechanical advantage for internal over external force) (ankle here)

- A Third Class Lever is a lever in which the effort force acts between the axis and the resistance force (how most joints work in the body with the external load having a greater mechanical advantage than the internal force created by the muscle) (elbow here)



What is Torque?

It is the rotational analog of Force

It has 3 components:

F = the force applied to the lever (external load, speed of movement)

r = the distance of the application of force to the axis (from load to moving joint)

$\sin\theta$ = the angle of application applied (direction of force)

It is also written $t = F (MA)$

MA = Moment Arm

MA is the shortest distance between the axis and line of force (always perpendicular)

MA is simply the force angle ($\sin\theta$) x the lever arm (r)

The MA is the easiest indicator to determine external loading stress at any moment during motion on the joint. Crucial for maximizing training gains.

*****It is really how much load is on the muscle at any particular time during the movement*****

Key Exercise Design Questions Prior to Application

- What is your client's main goal?
- Does the exercise fit this goal?
- Do you know what you expect from the client during the exercise?
- Can the client control the movement sufficiently?
- Does the intensity of the exercise fit the client's current abilities?

Various Forms of Resistance

Bodyweight – improving coordination, movement patterns and basic stability

Machines – beginning exercisers AND hypertrophy/mass building

Cables – improving coordination, stability strength

Dumbbells – improving coordination, strength

Barbells - hypertrophy/mass building or strength

Medicine Balls – building advanced stability strength and/or power

Other (Non-gravity) – Water, Bands/Tubing

Exercise Progression Guidelines

Stable to Unstable

Slow to Fast

Isolation to Integration (simple to complex)

Bilateral to Unilateral

Static to Dynamic

INTRODUCTION TO FUNCTIONAL TRAINING

Functional Training is training that stimulates our bodies to move the way it is naturally engineered (not necessarily how we treat our bodies in everyday life) and:

- Develops proper motor patterns
- Is multi-planar
- Requires more neuromuscular control than non-functional
- Incorporates many full-body movements
- Is dynamic movement under control
- Stays within the biomechanical limitations of the body (as all exercise should)

The Functional Warm-up

Warm-Up prior to exercise or competition

A 5-10 minute sport-specific or general warm-up (activation exercises for weak muscles)
Warm-up allows for increased bodily temperature and blood circulation. In turn, it increases work capacity and force production

Activation/functional exercises include: Bridge, plank, cobra, Ys and Ts, anklebets, bird dog, etc.

The Efficient Cool-down

Cool-Down following a workout or competition

Take 10-15 minutes to cool-down – to increase blood flow and removal of metabolic waste
Perform light continuous activity between 40-55% of max heart rate – to allow efficient return to homeostasis. The better the recovery, the faster training can be incorporated again and the better the adaptations to exercise.

Cool-down decreases soreness by removal of metabolic waste products and increasing blood flow to stimulate nutrient response to affected area and avoid venous pooling in tissue

Flexibility

Flexibility Training Overview

A foundation of flexibility involves a balance of muscular and connective tissue elasticity

Flexibility is the ability of a joint to achieve a full range of motion (ROM)

Increased flexibility can be achieved through various types of “stretching”:

- Static stretching
- Dynamic stretching
- Ballistic stretching
- Proprioceptive Neuromuscular Facilitation (PNF)
- Self-myofascial Release (SMFR)

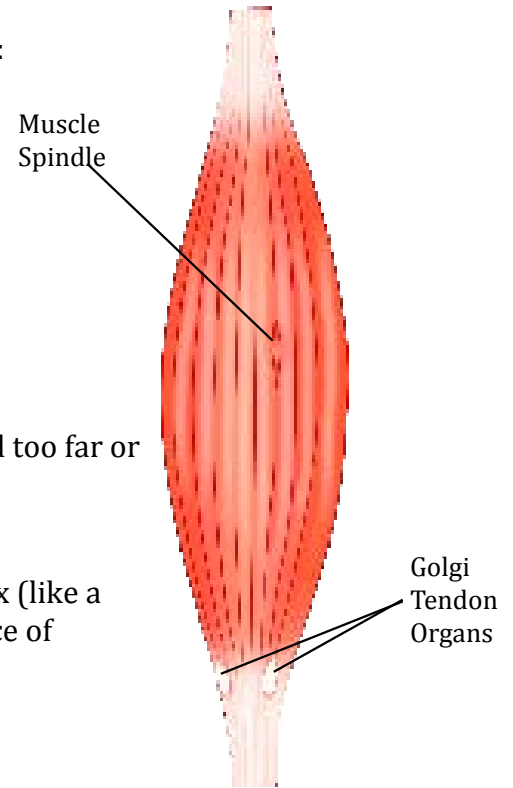
Neural Control of Flexibility

Muscle Spindle

Lies between skeletal muscle fibers
Monitors the length of the muscle
Triggers reflexive muscle action if muscle is stretched too far or too fast to reduce chance of injury

Golgi Tendon Organ

At the muscle-tendon junction
Monitors the tension of the muscle-tendon complex (like a strain gauge) Inhibit muscle action to reduce chance of injury



Types of ROM

- Active Range of Motion (AROM) (Individual ability to move)
- Passive Range of Motion (PROM) (Another person initiates movement) (Greatest joint ROM)
- Resisted Range of Motion (RRM) (Under load or resistance, greatest risk)

Types of stretching

Static Stretching requires gradual lengthening of the muscle:

Hold position at the first point of resistance for 20-30 seconds
Allow GTO to override the muscle spindle. Muscle relaxes and is able to reach a greater ROM
Best performed at end of workout as static stretching causes muscle to lose short-term force production and work capacity, (not harmful) which may not be beneficial prior to exercise if the muscle being statically stretched is needed in the exercise that follows

Dynamic Stretching is constant, controlled motion through a full range:

Stimulates blood flow and warms-up desired muscle group
Continuous movement (i.e. skipping, lunges, high knees and butt kicks) (Best performed before exercise or between sets to stimulate blood flow and excite the motor units which activate muscles. Not beneficial for a tight individual)

Ballistic Stretching uses quick, uncontrolled, explosive movements:

Associated with bouncing, bobbing, and jerking to prepare muscles for maximal lift or sport related movement (Not recommended for average individual)

Proprioceptive Neuromuscular Facilitation (_____) is a partner-assisted stretch:

Includes passive and active muscle actions
Utilizes autogenic and reciprocal inhibition principles
The agonist contracts against the partner while the antagonist relaxes, allowing the antagonist to reach a new ROM

Program Design

A well designed program includes all components of fitness

Components of Fitness

Health-Related Fitness (HRF)	Flexibility
	Muscular Strength (MS)
	Muscular Endurance
	Cardiovascular Fitness
	Body Composition (BC)

Skill-Related Fitness (SRF) Related to sport performance	Agility
	Balance
	Coordination
	Speed
	Power
	Reaction Time (reactive abilities)

Physiological Fitness (PF) Includes non-performance components relating to biological systems influenced by habitual activity	Metabolic Fitness
	Morphologic fitness
	Bone integrity

Program Design Overview

Basic Format (Goal Specific)

Warm-Up/Flexibility (5-15m)
Resistance Training (30-60m)
Cardiovascular Training (2-45m)
Cool-Down/Flexibility (5-10m)

PROGRESSION, PROGRESSION, PROGRESSION (FITRR, SAID, Specificity)

Acute Exercise Variables

Type of Exercise
Order of Exercises
Sets
Repetitions
Rest between sets and exercise days
Speed of Movement (Tempo)



Program Design Strength Training Progression

Four Levels of Fitness

- 1) Foundation Fitness
- 2) Basic Strength & Hypertrophy
- 3) Skill-Related Fitness
- 4) Peak

Level One - Foundation Fitness (8-12 weeks)

Level 1, Stage 1 - Motor Learning (4-6 weeks)

- Coordination is established between the nervous system and the muscular system (kinetic chain)
- Pattern establishment phase or corrective exercise phase
- Focus upon correcting muscular imbalances and establishing proper technique
- Development of strength-endurance (work capacity)
- High repetitions, low number of sets, slow tempo and longer rest periods for novice clients

- (1-2 sets per exercise, 15-20 reps per set, 4-0-4 tempo per repetition, 60-180s TUT (time under tension per set), less than 50% max, 0-24 hours between workouts, 30 sec to 2 minutes between sets depending on training age)

Level 1, Stage 2 - Structural Integrity & Strength Endurance (4-6 weeks)

- Focus is on increasing the work capacity developed in Stage 1 as well as strengthening the connective tissue network (Structural Integrity).
- Increase in volume and intensity
- Decrease rest time
- Use both objective (time, HR) and subjective (RPE) measures of rest
- (2-4 sets per exercise, 15-25 repetitions per set, 4-0-3 tempo per repetition, 60-180s TUT, 24-48 hours between workouts, 30-60 seconds rest depending on training age)

Level Two - Basic Strength and Hypertrophy (16 weeks)

Level 2, Stage 1 - Strength Endurance and Hypertrophy (8 weeks)

- Beginning of *Undulating Periodization*. Focus on increasing hypertrophy while alternating with strength endurance (3 weeks hypertrophy /1 week strength endurance x 2)
- For strength endurance weeks, see Level 1 Stage 2. For hypertrophy weeks, 3-5 sets per exercise, 6-12 repetitions per set, 4-0-2 tempo per repetition, 60-80% maximal exertion, 48-96 hours between workouts,
- 45-75s TUT, 60-90s rest between sets)

Level 2, Stage 2 - Hypertrophy and Basic Strength (8 weeks)

- Focus on increasing strength while alternating with hypertrophy training (3 weeks strength/1 week hypertrophy x 2)
- For hypertrophy workouts see Level 1, Stage 2. For basic strength weeks, 1-5 sets per exercise, 4-8 repetitions per set, 4-0-2 tempo per repetition, 80-90% maximal effort, 48-96 hours between similar workouts with other workouts between, 10-20+ sec TUT, 2-3+ minutes rest between sets)

Level Three - Skill-Related Fitness (8-12 weeks)

Slow Isolation at Higher Loads and Intensities

- Focus is on a different workout each day of the week, alternating between a hypertrophy workout, strength endurance workout, strength workout, and skill-related fitness workout (agility, speed, power).
- As workout goals are always different, training can be accomplished almost every day with a different goal. For skill-related fitness level workouts, 1-5 sets, 1-20 reps, 1-0-1 tempo, 90-100% maximal effort, never more than 30% bodyweight external load, 72-96 hours between skill workouts with other workouts between, 1-20 s TUT, 2-3+ minutes rest between exercises

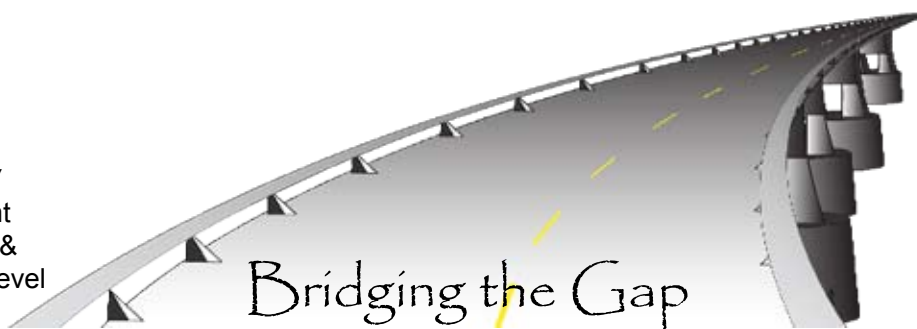
Level Four - Peak (4-8 weeks)

Continuation of Level 3 with greater focus on workouts toward client's primary goal.

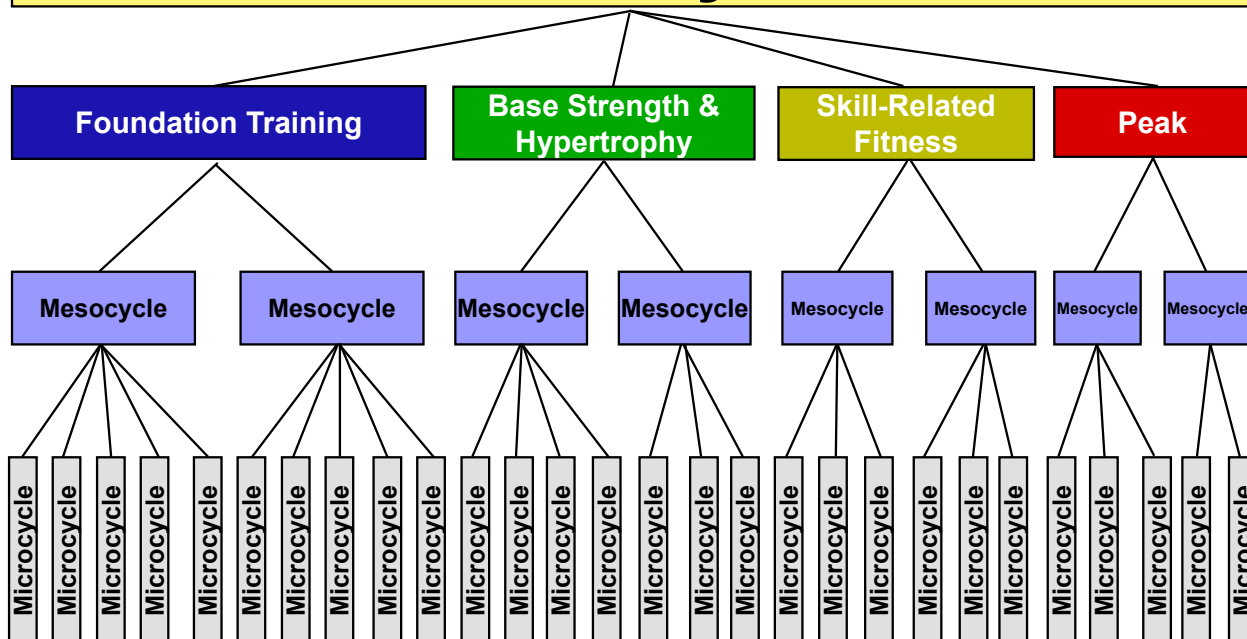
Periodization

A NOW
Current
Health &
Fitness Level

B GOALS
Fitness
Wants and
Needs



A Macrocycle B



Macrocycle	Entire Training Period (often 1 year)
Phases of Training	Proper progression through each of these phases ensures both safety and efficiency of program
Mesocycle	Smaller periods, often months
Microcycle	Smaller still, often weeks



Stage	Goal	Frequency	Intensity	Time	Load	Recovery	Progression
Foundation (8-12 wks)	Function (4-6 wks)	5-7x/wk	1-2 sets 15- 25 reps	4-0-4 60-180s	< 50% max	0-24 hrs 30s-2m	10% FITRR variable(s) increase weekly
	Strength Endurance (4-6 wks)	3-4x/wk	2-4 sets 15-25 reps	4-0-3 90-180s	40-60% max	24-48 hrs 30-45s	
	Base Strength & Hypertrophy (16 wks)	Hypertrophy & Strength Endurance (8 weeks)	2-4x/wk 3 wks H 3-4x/wk 1 wk SE (x2)	3-5 sets, 6-12 reps 2-4 sets, 15-25 reps	4-0-2, 40-75s 4-0-3, 60-180s	60-75% max, 40-60% max	48-72 hrs, 60-90s 24-48 hrs, 30-45s
Skill-Related Fitness (8 wks)	Skill Base Strength Hypertrophy	1-3x/wk 1-2x/wk	1-5 sets, 1-10 reps	1-0-1, 2-20s	85-100% max	48-96 hrs, 90s-3+m	
			3-5 sets, 4-8 reps	2-0-2, 20-40s	70-85% max	48-72 hrs, 1-3+m	
			3-5 sets, 8-12 reps	4-0-2, 40-75s	60-75% max	24-48 hrs, 60-90s	
Peak (4-8+ wks)	Primary Client Goal	4-6x/wk (2-4x/wk primary goal)	2-4 sets, 15-25 reps	4-0-3, 90-180s	40- 60% max	24-48 hrs, 30-45s	
			Same as SRF	Same as SRF	Same as SRF	Same as SRF	

Client _____
Date _____
Goal _____

**Level 1, Stage 1:
Motor Learning**



Warm-Up

- SMFR
- Dynamic Stretching
- Light CV
- Full-Body Movements

Strength Training

- Focus on correcting muscular imbalances and establishing proper technique

Muscle Group	Exercise	Set 1		Set 2		Rest	Notes
		RST		RST			

Cardiovascular Training

- Focus on current fitness level as well as goals of Client

Exercise	Time	Intensity
Notes		

Cool-Down

- SMFR
- Static Stretching

Level 1 Recommendations

Motor Learning Strength Program	
Stage	Level 1.1
1 RM	<50%
Tempo	4-0-4
TUT	2-3 min
Rep Range	15-20
Sets	1-2
Rest Between Sets	1-3 min

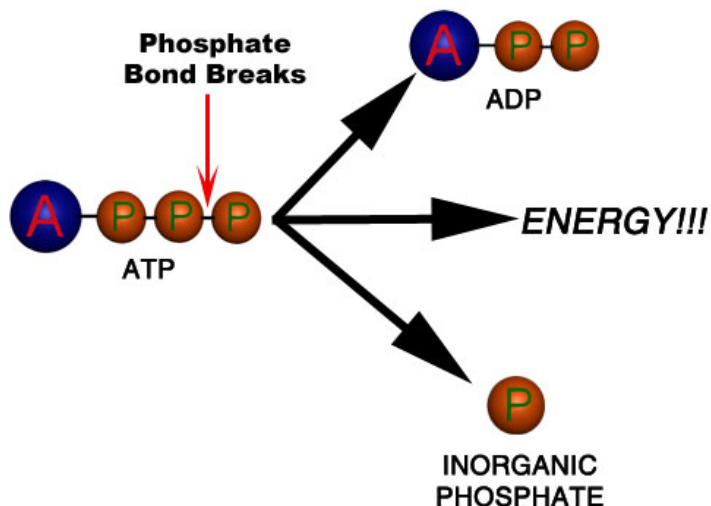


*RST = Resistance

Cardiovascular Exercise Training and Energy Systems

ATP (Adenosine Triphosphate)

(All food is converted to ATP for use in cells as energy source)



Anaerobic Pathways

ATP/CP System (CP- Creatine Phosphate)

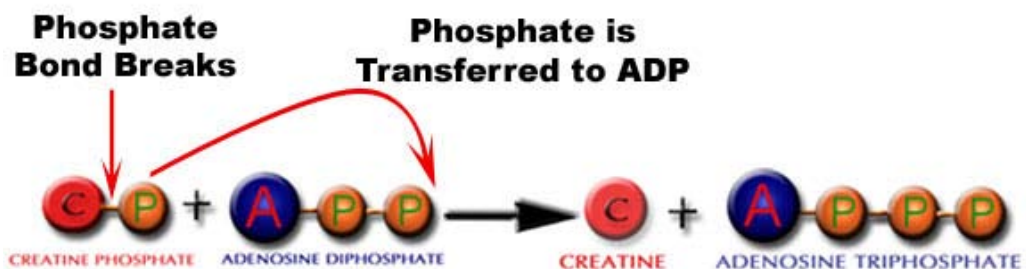
Glycolysis

Aerobic Pathway

Aerobic Oxidation

Unless the proper diet is consumed, muscles will have no energy to perform work as there will be no ATP. Carbohydrates must be stored as glycogen in the muscle cells and liver to be converted later to glucose for moderate to high intensity work.

ATP - CP



- Anaerobic Pathway (oxygen breakdown to energy too time-intensive for short-term bursts)
- Fuel Source: Creatine-Phosphate
- Duration: 1-5s ATP, Less than 15s CP
- Intensity: 95-100%
- End Products: ATP, Creatine
- Recovery: 90 seconds up to 5 minutes for full ATP replenishment in muscle cells

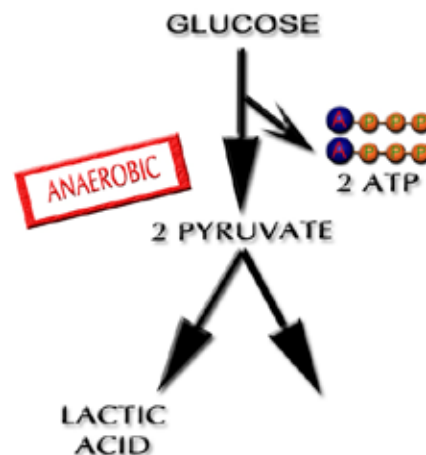
Remember, if your client has not worked out for several months (whether or not he or she was once an athlete) the client must start by performing only aerobic (not anaerobic) cardiovascular exercises. This means that the HR should not exceed the anaerobic threshold (whatever you determine that to be) for at least the first 3-4 months of training. The body is very complex and there is much more to training than raising the heart rate. Hormonal responses must also be understood. Gradual progress is the key. This could include aerobic intervals during the first 3-4 months, but no anaerobic interval work. Do this and the results in months 6 and beyond will be astounding to you AND to your client.

Glycolysis

- Anaerobic Pathway
- Fuel Source: CHO (carbohydrates)
- Duration: 30-90s
- Intensity: 80-95%
- Lactate Threshold (OBLA)
- End Products: ATP, Pyruvate (to Lactate OR TCA)
- Recovery: 60-90 seconds between intervals as only 80-90% of ATP replenishment is needed.

2) GLYCOLYSIS (BREAKDOWN OF GLUCOSE)

FUEL SOURCE: CARBOHYDRATES
(BROKEN DOWN TO GLUCOSE AND GLYCOGEN)



Aerobic Oxidation

- Aerobic Pathway (utilizing oxygen)
- Fuel Source: CHO, Pro, Fat
- Duration: 2m and up
- Intensity: 0-80%
- End Products: ATP, CO₂, and H₂O
- Recovery: 0-60 seconds (generally work is continuous with little or no recovery as there are no sets, unless aerobic intervals are performed where rest is active recovery such as very light jogging or walking between such intervals)
- While fat is consumed at a higher rate than carbohydrate at aerobic level intensities, it is only about 55% fat to 45% carbohydrate at such levels. Carbohydrate is always necessary for proper conversion of fats for energy. There is no “fat burning zone” for this reason.

3) AEROBIC OXIDATION

FUEL SOURCE: CARBOHYDRATES,
FATS AND PROTEIN (AEROBIC - O₂
REQUIRED)



Energy Systems Summary

Energy System	Aerobic/ Anaerobic	Fuel Source	Duration	Intensity
Phosphocreatine	Anaerobic	Mainly PCr	Less than 30 seconds	Very high
Anaerobic Glycolysis	Anaerobic	Glucose (Carbohydrate)	30 seconds to 3 minutes	High to moderate
Aerobic Glycolysis/ Cellular Respiration	Aerobic	Carbohydrate, Fat and Protein	More than 3 minutes	Moderate to low (rest)

Muscle Fiber Types

There are essentially three muscle fiber types in human muscle:

Type	A.K.A. (Also Known As)	Function
Type I Fibers	RED, Slow twitch, Aerobic fibers	These fibers are fatigue-resistant. They are rich in capillaries and myoglobin (enhancing oxygen delivery). They also have increased number of mitochondria which enhances their ability to oxidize fats. Muscles containing a predominant amount of slow twitch muscle fibers tend toward stabilizing functions rather than prime movers of muscle tissue. Individuals with a greater number of Type I fibers tend to excel in endurance related activities that last longer than 3 minutes. (Aerobic Oxidation energy system, focus on function and aerobic endurance)
Type IIa Fibers	PINK, Moderately fast twitch	These fibers have traits of both Type I and Type IIb. Individuals with a greater number or more conditioned Type IIa fibers tend to excel in activities lasting between 30 seconds and 2 minutes with a moderate level of strength and aerobic capacity capabilities. (Glycolytic energy system, focus on strength endurance, hypertrophy, basic strength and cardiovascular interval work)
Type IIb (Type IIx) Fibers	WHITE, Fast twitch, Anaerobic fibers	These fibers are larger in diameter and well suited for brief, powerful contractions. They have less mitochondria and small capillary beds. These fibers tend to be prime movers of joints. Individuals with a greater number of Type IIb fibers tend to excel in highly explosive activities such as maximal lifts and sprinting or jumping. These are also the fibers that have the greatest potential for hypertrophy. (ATP-CP Energy System, focus on power and speed)

Cardiovascular Training Analysis

Determine RHR, MHR (Maximum Heart Rate) and THR (Target Heart Rate)

MHR = 220-Age

RHR = Heart Rate at rest

Intensity = % level of effort (generally 40-100%)

Select intensity based upon individual ability and conditioning (Levels 1-4)

Questions to be answered first:

What Type/mode of CV exercise? Frequency? Intensity? Duration? Rest?

Karvonen Equation for determining THR

THR = (MHR-RHR) * intensity goal % + RHR ____

Cardiovascular Training Overview

Benefits and risks of various cardiovascular exercise forms:

Treadmill/Running/Walking

Elliptical Trainer

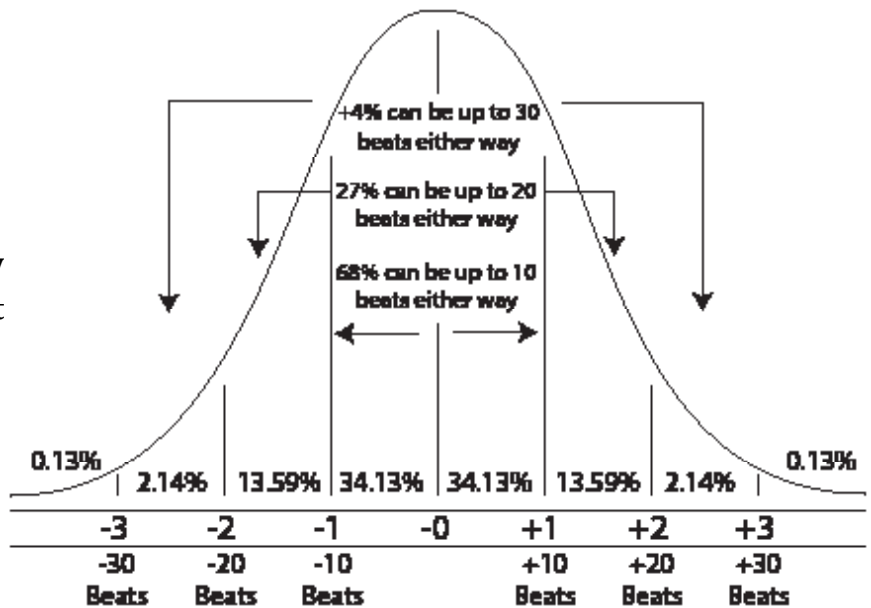
Biking

Swimming

Rowing

Other sports or activities

Which is the “best”? There is none from a CV standpoint, but walking or running is best from movement efficiency standpoint.



Cardiovascular training zones are guidelines. These guidelines are not set in stone once you set such guidelines for your clients. A trainer should never say “get your heart rate up” or “your heart rate is too low”. In the perfect case, your client would have a high energy output, performing intervals or long duration activities at a strong pace while also maintaining a “low” heart rate. This is what you would find with a well-conditioned athlete who is given the proper intensity of work and appropriate recovery. Performance, not heart rate, is the goal. The heart rate, along with RPE (rate of perceived exertion) should be used as a measure of both subjective and objective intensity during activity and to assess rate of recovery. Keep in mind also that a good day might have your client moving at a high pace with a low heart rate, and that same client might have a poor performance the next day with a much higher heart rate. This is not the goal and is an indication that not enough rest/recovery has been given, nutrition or fluid intake is poor, and/or the intensity is too high.

Cardiovascular Training Overview

Find the anaerobic threshold of the client

Talk Test (subjective)

Submax VO₂ testing (objective)

Polar OwnIndex (objective and practical)

Progressions should be applied using the FITTTR principles based on current levels of client conditioning, capabilities, and predetermined goals. As a general rule CV progression in one of the FITTTR principles should increase as much as 10% every week.

Training Level	Training Calendar	Frequency	Recovery Intensity (40-60%)	Light Intensity (60-70%)	Moderate Intensity (70-80%)	High Intensity	(80-90%) Competitive Athlete (90-100%) (Optional)	Time per Session	Type/Mode of Exercise
Aerobic Base/ Recovery (Beginner)	Weeks 1-8 Months 1-2	3-5 total sessions/ week	1-3 sessions/ week	1-3 sessions/ week	0-1 sessions/ week	N/A	N/A	12-30 minutes	Continuous Activity
Aerobic Endurance	Weeks 9-17 Months 3-4	4-6 total sessions/ week	1-2 sessions/ week	2-3 sessions/ week	1-2 sessions/ week	N/A	N/A	20-60 minutes	Continuous Activity
Anaerobic Threshold Training	Weeks 18-30 Months 5-7	4-6 total sessions/ week	0-2 sessions/ week	1-2 sessions/ week	1-2 sessions/ week	1-2 sessions/ week	N/A	20-90 minutes	Continuous Activity or Interval Training
Anaerobic Power (Athlete)	Weeks 31-47 Months 8-11	4-7 sessions/ week	0-2 sessions/ week	1-2 sessions/ week	2-3 sessions/ week	1-2 sessions/ week	0-2 sessions/ week	20-120 minutes	Continuous Activity or Interval Training

The Core

Bones and Joints

The Spine

Cervical

7 Vertebrae

C1 = Atlas, C2 = Axis

Thoracic

12 Vertebrae

Lumbar

5 Vertebrae

Sacrum

Coccyx

The Pelvis

Spinal Motions

Flexion

Extension

Lateral Flexion

Rotation

Pelvic Tilting

- Anterior
- Posterior



Intervertebral Discs

Two main parts

Annulus: Outer concentric rings of cartilage, like a radial tire.

Nucleus: Jelly-like pulp inside annulus which dries as we get older, 88% water when born.

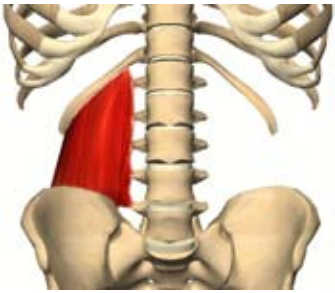
1. Link two adjacent vertebrae to which they are firmly attached.
2. Function to distribute force and shock throughout the spine.
3. Bigger and thicker in lumbar area.
4. Movement affects position of nucleus

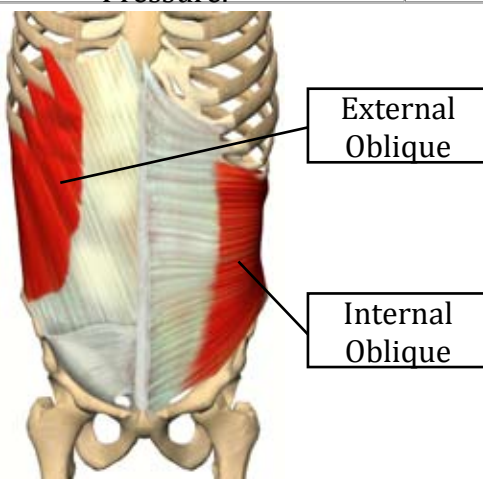
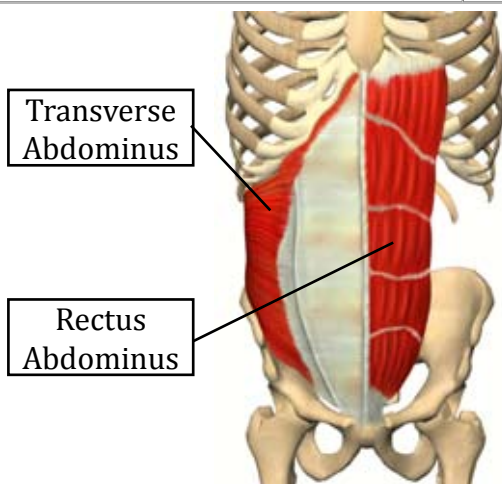
Receives nutrition by imbibition (the absorption of liquid via pressure application and release)

Most vulnerable in the flexed position - producing disproportionate anterior compression (especially when loaded)

The Core

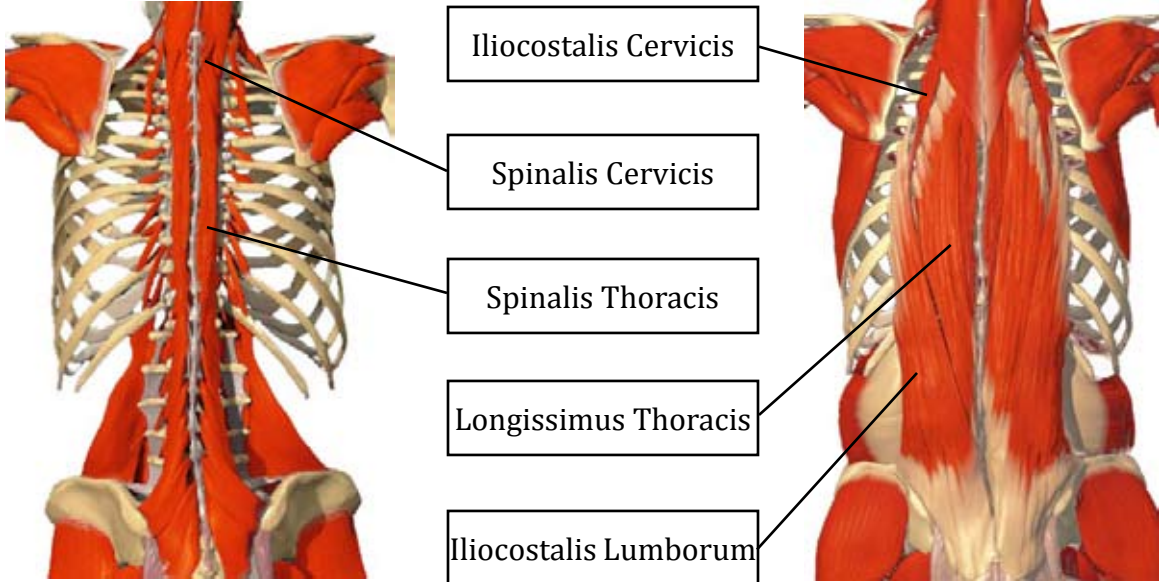
Muscles of the Vertebral Column (Deep to Superficial)

<p>Transverse Abdominus Forced Expiration and Increased Intra-abdominal Pressure (stiffens the trunk to prevent the spine from buckling under compressive loads)</p>	<p>Internal Oblique Flexion, Ipsilateral Spinal Rotation and Increased Intra-abdominal Pressure</p>	<p>Quadratus Lumborum Lateral Flexion of the Vertebral Column and Laterally Tilts Pelvis</p> 
<p>Rectus Abdominus: Flexion, Posteriorly Tilts Pelvis and Increases Intra-abdominal Pressure. Although the rectus abdominus is responsible for flexing the "spine," it does not actually attach to the vertebrae. The rectus abdominus attaches to the pubis and sternum.</p>	<p>Fun Fact: <i>Direction of Oblique Fibres</i> <i>External - Think of hands in pockets (i.e. down and in).</i> <i>Internal - run down and out.</i></p> <p>External Oblique: Flexion, Contralateral Spinal Rotation, Tilts Pelvis Posteriorly and Increased Intra-abdominal Pressure.</p>	



Fun Fact:
****There is a quick way to remember your abdominal muscles. If you have too much fat around your waist, you have a "spare TIRE." Deep to superficial: Transverse Abdominus, Internal Oblique, Rectus Abdominus, External Oblique.****

Muscles of the Vertebral Column (Posterior Muscles)

Iliocostalis Lumborum, Thoracis, Cervicis Extend the vertebral column and bend it laterally.	Longissimus Capitus, Thoracis, Cervicis Extend the vertebral column and head, rotate head.	Spinalis Thoracis and Cervicis Extend the vertebral column.
		

Core Exercise Recommendations

- 1) Supine Bridge
- 2) Prone Cobra/Superman
- 3) Hyperextension Bench
- 4) Russian Twist
- 5) Reverse/Forward Crunch
- 6) Plank/Side Plank
- 7) Crawling/Mobility Activities
- 8) Chops/Lifts
- 9) Medicine Ball Throws
- 10) Bird Dogs/Down Dog/Cat-Dog

The Lumbo-Pelvic Hip Complex

Pelvis

Sacroiliac Joints

Pelvic Tilt

- Anterior Pelvic Tilt (erector spinae and hip flexors) created by lumbar extension and hip flexion.
- Posterior Pelvic Tilt (rectus abdominus and gluteus maximus) created by lumbar flexion and hip extension.

Common Postural Imbalances

The Hip Complex

The hip joint is the most mobile joint in the lower limbs and one of the most mobile in the body. It is capable of: flexion and extension, abduction and adduction, medial and lateral rotation and all of these in a circular motion - circumduction

The hip joint is a ball and socket synovial joint



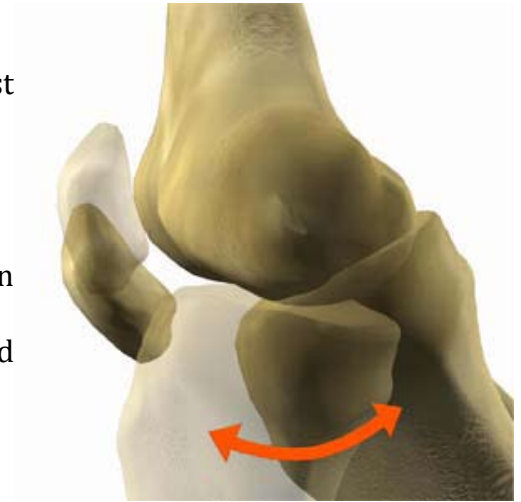
The Knee Complex

The knee is the largest synovial joint in the body and the most complicated in structure.

It consists of six articulating surfaces:

- the two condyles of the femur (CF)
- the two condyles of the tibia (CT)
- the posterior surface of the patella (P) and a patellar surface on the anterior surface of the femur.

The knee joint is essentially a hinge joint capable of flexion and extension



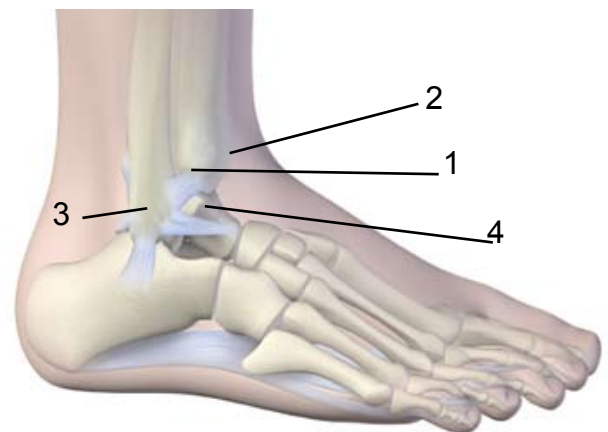
The Ankle-Foot Complex

The ankle joint

This is a joint between: the lower end (1) and medial malleolus (2) of the tibia and the lateral malleolus (3) of the fibula and the trochlear surface of the talus (4) (In this illustration the talus is displaced.)

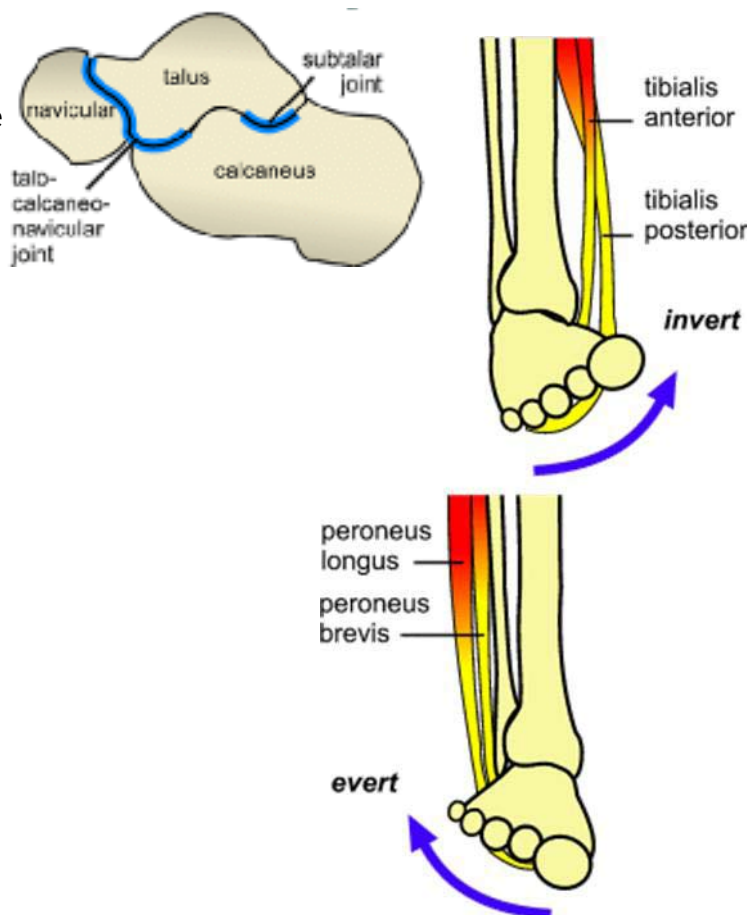
Stability

- The joint resembles a mortise and tenon joint as used in carpentry. The tibia and fibula must be bound together for the mortice to be stable.
- The ankle joint is a synovial hinge joint permitting two movements:
- Plantarflexion (=flexion), in which the foot is pointed downwards
- Dorsiflexion (=extension), in which the foot is raised
- Dorsiflexion is a more limited movement (normal range: 10-30°) than plantarflexion (45° or more).



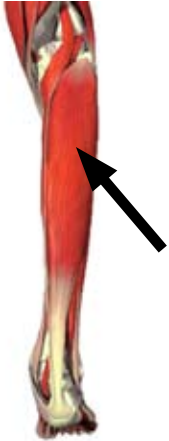



Joints of Inversion and Eversion

Inversion and eversion are movements where the sole of the foot faces either inward or outward respectively.



Lower Body

Muscles of the Lower Leg

<p style="text-align: center;">Soleus Plantarflexion</p> 	<p style="text-align: center;">Gastrocnemius Plantarflexion and Knee Flexion</p> 	<p style="text-align: center;">Peroneus Longus Plantarflexion and Eversion</p> 	<p style="text-align: center;">Anterior Tibialis Dorsiflexion and Inversion</p> 
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Think about it...

While the location of muscles is important in determining their action, remember that muscles that work in opposite movements don't have to be located opposite of each other. For example, the peroneus longus and anterior tibialis are antagonists (they work in opposite movements), but their muscle bellies are both located on the lateral aspect of the lower leg.

Fun Fact:

The two heads of the gastrocnemius and the single head of the soleus come together to form the "triceps surae complex." Make sure you differentiate this from the "triceps brachii" muscle in your arm!



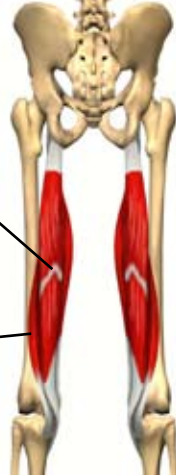
Muscles of the Thigh (Quadriceps)

Rectus Femoris Knee Extension, Hip Flexion	Vastus Intermedius (Deep to Rectus Femoris) Knee Extension	Vastus Lateralis Knee Extension	Vastus Medialis Knee Extension and Medial Glide of Patella
			

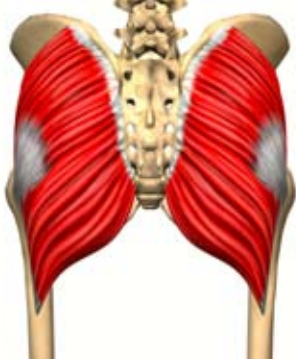


Think about it...

Although muscle groups such as the quadriceps and hamstrings work together to complete the same movement, they also have different actions independent of each other. While the vastus medialis primarily works to extend the knee, it also has an important role in stabilizing the patella on the medial side where it attaches. This is why origins and insertions of muscles are important, in addition to their actions.

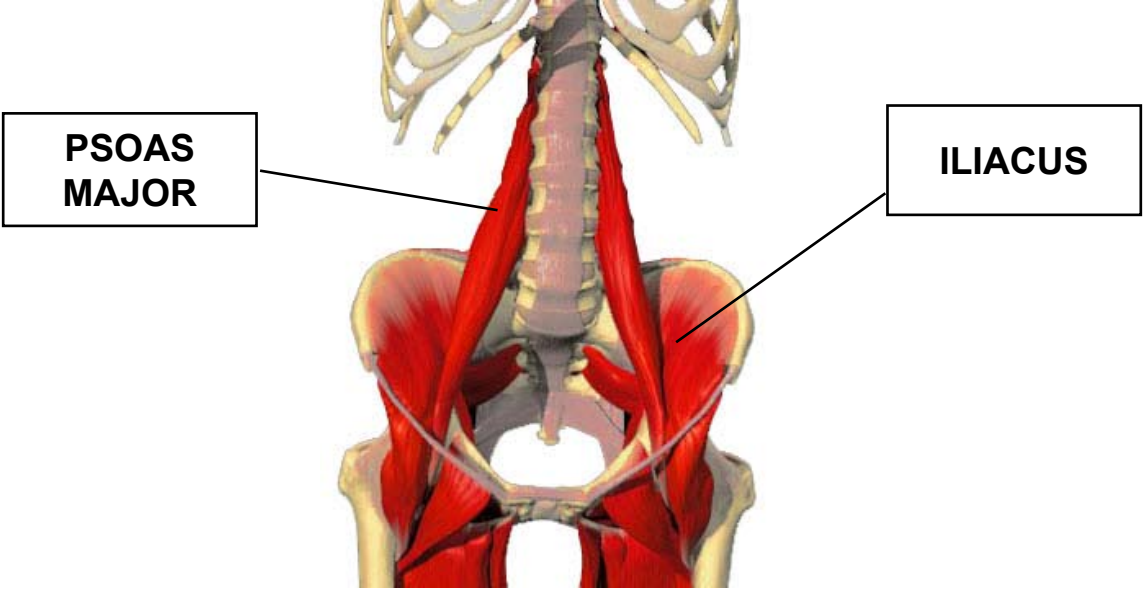
Muscles of the Thigh (Hamstrings)

Biceps Femoris Knee Flexion, Hip Extension and External Rotation	Semitendinosus Knee Flexion, Hip Extension and Internal Rotation	Semimembranosus Knee Flexion, Hip Extension and Internal Rotation
		




Muscles of the Hip (Gluteal Muscles)

<p style="text-align: center;">Gluteus Maximus</p> <p>External Rotation, Hip Extension Upper-half - Hip Abduction Lower-half - Hip Adduction</p> 	<p style="text-align: center;">Gluteus Medius</p> <p>Abduction and Assists in Hip Flexion Anterior Fibers - Internal Rotation Posterior Fibers - External Rotation</p> 	<p style="text-align: center;">Gluteus Minimus</p> <p>Abduction, Internal Rotation and Assists in Hip Flexion</p> 
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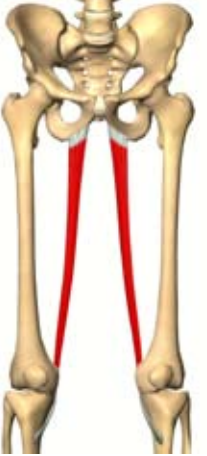


Muscles of the Hip (Hip Flexors)

<p>Psoas Major: Hip Flexion, Lumbar Flexion, External Rotation and Slight Hip Abduction</p>	<p>Iliacus: Hip Flexion, Lumbar Flexion and External Rotation</p>
	
<p>When combined, the Iliacus and Psoas Major are also known as the Illiopsoas.</p>	

Muscles of the Hip (Adductor Group)

<p style="text-align: center;">Adductor Brevis Adduction and Hip Flexion</p> 	<p style="text-align: center;">Adductor Longus Adduction and Hip Flexion</p> 	<p style="text-align: center;">Adductor Magnus Adduction (Some Fibers Contribute to Both Internal and External Rotation as well as Hip Flexion and Extension)</p> 
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Muscles of the Hip

<p style="text-align: center;">Gracilis Hip Adduction, Internal Rotation and Knee Flexion</p> 	<p style="text-align: center;">Tensor Fascia Latae Hip Flexion, Abduction, Internal Rotation</p> 	<p style="text-align: center;">Sartorius Hip Flexion, Abduction, External Rotation. Knee Flexion and Internal Rotation</p> 
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Fun Fact:

The sartorius is the longest muscle in the human body. It is also known as the “tailor’s muscle,” for the crossed leg position that a tailor often sits in.

Lower Body Ex. Recommendations

- 1) Supine Bridge
- 2) Wall Sit
- 3) Stability Ball Supported BW Squat
- 4) Leg (Knee) Extension
- 5) BW/Loaded Squat/Deadlift
- 6) BW/Loaded Stationary Lunge/Split Squat
- 7) BW/Loaded Calf Raise
- 8) Leg Press
- 9) Reverse/Forward/Side/Clock Walking Lunge
- 10) Romanian/Suitcase Deadlifts
- 11) Step-Ups/Downs
- 12) BW Jumps
- 13) BW Bounds
- 14) BW Hops/Skips

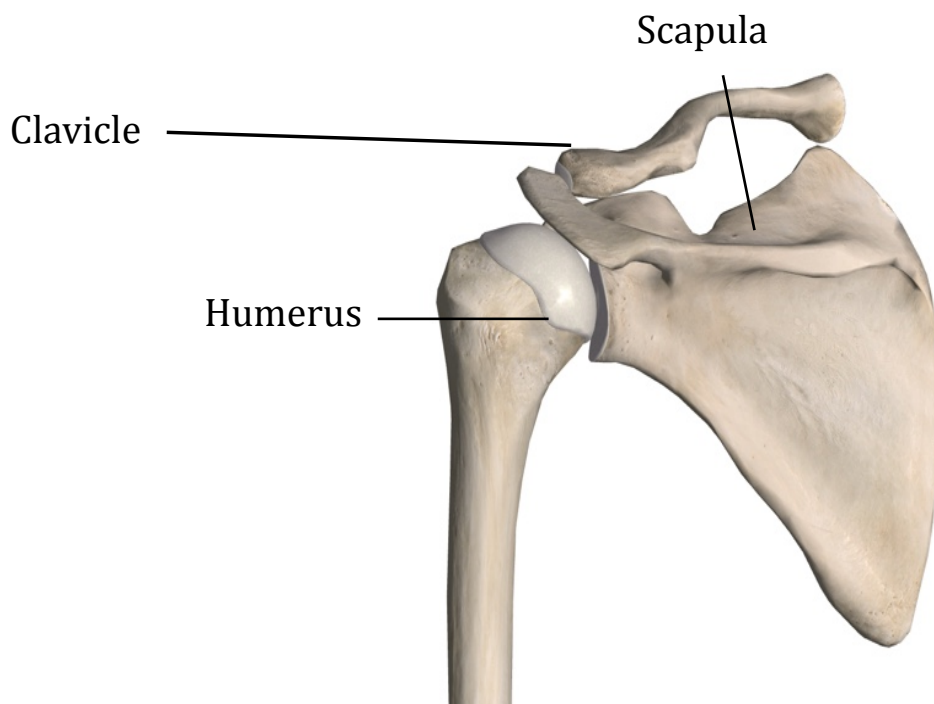
The Shoulder Complex

Bones

Scapula
Clavicle
Humerus

Joints of the Shoulder Complex

Scapulothoracic Joint
Sternoclavicular Joint
Acromioclavicular Joint
Glenohumeral Joint



Scapulohumeral Rhythm

- Distributes the motion between two joints which allows for greater ROM with less compromise of joint integrity or stability than would occur if the same range occurred at one joint.
- Maintain the glenoid fossa in an optimal position to receive the head of the humerus. This increases joint congruency while decreasing shearing forces (i.e. IMPROVED DISTRIBUTION OF FORCES).
- Permit GH muscles to maintain a near optimal length-tension relationship, minimizing or preventing active insufficiency.

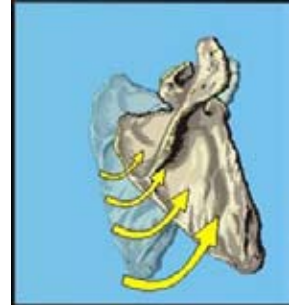
Scapular Motions

Downward rotation:

returning the inferior angle toward spinal column (medially) and glenoid fossa to normal position

Upward rotation:

turning the glenoid fossa upward and moving the inferior angle superiorly and laterally away from spinal column.

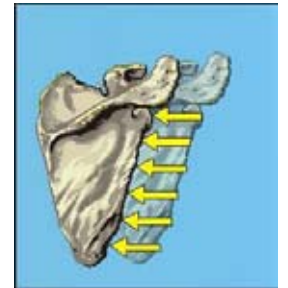
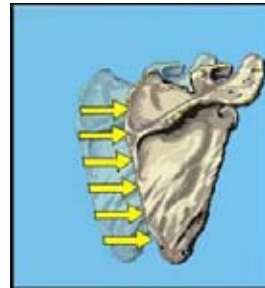


Abduction (a.k.a. Protraction):

movement of the scapula laterally away from spine

Adduction (a.k.a. Retraction):

movement of the scapula medially toward the spine

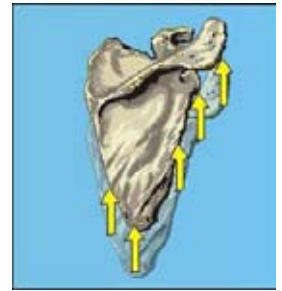
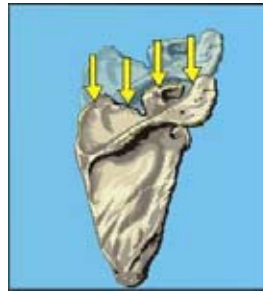


Depression:

Downward or inferior movement of the scapula

Elevation:

Upward or superior movement (shrugging shoulders)



The Elbow Complex

Bones

Humerus

Radius

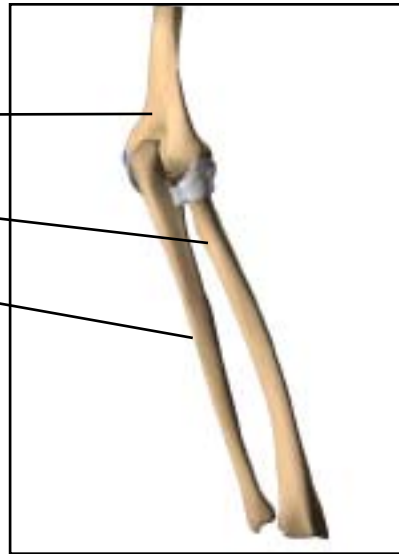
Ulna

Elbow Joint - a true hinge

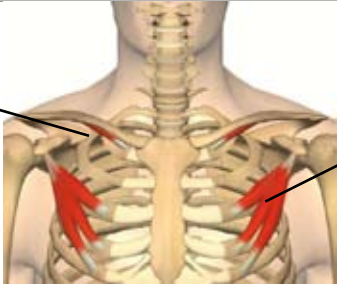



Humeroulnar

Humeroradial

Radioulnar Joint - supination and pronation




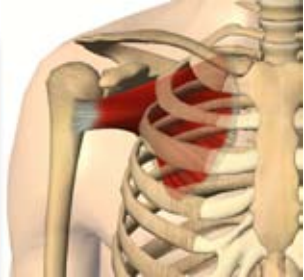


Upper Body



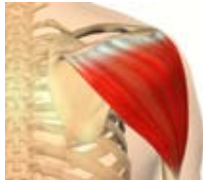
<p>Subclavius Stabilizes and depresses the shoulder girdle</p>		<p>Pectoralis Minor Depresses the scapula and pulls it anteriorly</p>
<p>Latissimus Dorsi Extends, adducts, and internally rotates the humerus</p> 	<p>Teres Major Extends, adducts, and internally rotates the humerus</p> 	<p>Coracobrachialis Flexes and adducts the humerus</p> 

Muscles of the Rotator Cuff

-Together work to maintain integrity and alignment of the gleno-humeral joint

<p>Supraspinatus Stability of the shoulder joint during swimming and throwing movements. Some Abduction and External Rotation.</p> 	<p>Infraspinatus External rotation of the humerus. In extension, helps move the humerus posteriorly.</p> 
<p>Teres Minor External rotation of the humerus. In extension, it helps move the humerus posteriorly.</p> 	<p>Subscapularis Internal rotation of the humerus. In extension it helps move the humerus posteriorly. In adduction, it helps move the arm toward the body.</p> 

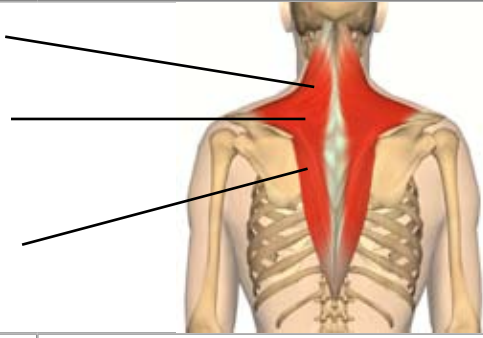
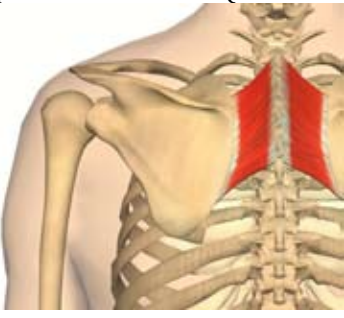


Fun Fact:
***There is a quick way to remember your rotator cuff muscles. They are your "SITS" muscles: **S**upraspinatus, **I**nfraspinatus, **T**eres minor and **S**ubscapularis.*

DELTOID	<p>Anterior Fibers Flexion and internal rotation of the humerus. Horizontal adduction.</p>	
	<p>Lateral Fibers Abduction</p>	
	<p>Posterior Fibers Extension and external rotation of the humerus. Horizontal abduction.</p>	
<p>Pectoralis Major Flexion, internal rotation, horizontal adduction of the shoulder.</p>		






Think about it...
 The word deltoid comes from “delta,” which means triangle. This can help you remember that the deltoid muscle has three parts. There is also a deltoid ligament located on the medial ankle. This ligament also has three parts, positioned in a triangular shape.






TRAPEZIUS	<p>Upper Fibers Scapular Elevation</p>				
	<p>Middle Fibers Scapular Retraction</p>				
	<p>Lower Fibers Scapular Depression</p>				
<p>Rhomboid Major and Minor Scapular Retraction (Adduction)</p>	<p>Levator Scapulae Downward or Medial Rotation of the Scapula and Scapular Retraction</p>	<p>Serratus Anterior Protraction and Upward Rotation of the Scapula</p>			
					

Muscles of the Upper Arm

<p>Biceps Brachii Elbow flexion and supination of the forearm.</p> 	<p>Brachialis Elbow flexion.</p> 	<p>Triceps Brachii Extension of the elbow. Long head extends the shoulder.</p> 
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Muscles of the Forearm

<p>Brachioradialis Elbow flexion</p> 	<p>Supinator Forearm (radioulnar joint) supination</p> 	<p>Pronator Teres Pronation of radioulnar joint, slight elbow flexion</p>  <p>Pronator Quadratus Pronation of radioulnar joint</p>
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Think about it...

The names of muscles are developed from different word roots. For example, the “Bi” in biceps brachii means two, and the biceps muscle has two parts. The “Tri” in triceps means three, and the triceps muscle has three heads.

Chest Exercise Recommendations

- 1) Machine Press
- 2) Plank with Arms Extended
- 3) Prone Hand Touches
- 4) Push-ups
- 5) Cable Press
- 6) Bench Press
- 7) Bench Flys
- 8) Medicine Ball Press
- 9) Explosive Push-ups

Biceps Exercise Recommendations

- 1) Seated Cable Curl
- 2) Standing DB Curl
- 3) Standing BB Curl
- 4) Preacher (Arm Supported) DB or BB Curl

Back Exercise Recommendations

- 1) Machine Low/High Row
- 2) Cable Low/High/Hi-Lo Row
- 3) Machine Pulldown
- 4) Cable Pulldown
- 5) Cable Shoulder Extension
- 6) DB Row
- 7) BB Row
- 8) Pull-up/Chin-up
- 9) Medicine Ball Overhead Throws

Triceps Exercise Recommendations

- 1) Kneeling Cable Pushdown
- 2) Standing Cable Pushdown
- 3) Supine Arm Extension
- 4) Standing Cable Arm Extension

Shoulder Exercise Recommendations

- 1) Prone BW Scaption/Ys/Ts
- 2) Prone DB Bench Scaption/Ys/Ts
- 3) Machine Seated Front/Lateral/Posterior Raise
- 4) Cable Front/Lateral/Posterior Raise
- 5) DB Front/Lateral/Posterior Raise
- 6) DB Overhead Press

Keys to your future success in personal training

If you don't BOTH love exercise and love helping people learn to love what exercise brings them then find a new profession.

Live in the gym during the hours you wish to be training so you are present when potential clients can find you.

Be ready to work hard and help others when at the gym/workplace. Find other times to read, research, plan, and talk with friends.

Expect to read, research, and plan a minimum of 60 minutes each day (on both business skills and training science/concepts).

Be alert, well-rested, and focused on your training clients and gaining potential clients at all times at the gym/workplace (yes, it's very tiring).

Always have a plan for each day for you, and a daily exercise plan for each of your clients.

Remind your clients of upcoming appointments and keep in regular contact with short emails, text messages, or phone calls. You must be forever present in their lives if you are both to succeed.

Know how many sessions you will need to have each week, how many clients will be necessary to have, and be realistic about achieving these numbers in order to meet your own personal goals.

If you're not yet as successful as you want to be or feel you should be, figure out which of the above ideas you are not living up to.

Strive to make training fun. Your clients deserve this and so do you.

Your success is not about luck, so get to it.