



Topic
Better Living

Subtopic
Health & Wellness

Physiology and Fitness

Course Guidebook

Dean Hodgkin
University of Portsmouth



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International fitness expert Dean Hodgkin has presented master classes and seminars to fitness instructors in more than 36 countries, including the IDEA convention for the world's largest association of fitness and wellness professionals. Voted Best International Fitness Presenter at the One Body One World awards in New York, he has appeared on numerous television and radio shows worldwide, including appearances in Taiwan, Mumbai, Warsaw, Amsterdam, and New York. He has taught classes all over the world, including in South Africa, Russia, Japan, India, China, Germany, Spain, Italy, France, and Sweden.

His feature articles on fitness and physiology have appeared in the leading newspapers in Great Britain, including *The Times*, *The Sunday Times*, and the *Daily Express*. In addition, Hodgkin writes regularly for the top men's and women's health magazines throughout the world, including *GQ*, *Esquire*, *Men's Health*, *Women's Fitness*, *Health & Fitness*, and *Weight Watchers*.

Hodgkin also publishes in the medical press, including *Nursing Times*, the British dental magazine *Vital*, and the diabetes magazine *Sweet*. A coauthor of *The Men's Maintenance Manual*, which was published internationally, he is now working on an advanced fitness book for women.

Hodgkin was 3 times the World Karate Champion and 2 times the European Karate Champion as well as a member of the British Karate Squad for 10 years. He was also voted the Most Outstanding Competitor at the world championships in Calgary, Canada.

At the 2012 International Fitness Showcase—Europe’s largest group exercise event, attracting over 7000 participants—Hodgkin received a Lifetime Achievement Award for his services to the fitness industry. Among many other accomplishments, he served as the Fitness Coach for Nike Basketball Camps, training prospects for the NBA and 2012 Olympics, and he was named an Ambassador for the Special Olympics in 2010.

His teaching includes training sports and fitness professionals, adults, and children for a wide range of activities, and he has taught tens of thousands of students around the world. Hodgkin has also worked as a consultant to a number of corporate clients, such as The Royal Automobile Club, Remington, and Reebok International, Ltd. Additionally, he consults for the leading U.K. spa, Ragdale Hall, as well as for LeSPORT, voted the world’s best destination spa by *Condé Nast Traveller*.

After receiving a Bachelor of Science honors degree in Mathematics and Management Studies from the University of Portsmouth, Hodgkin continued his education at Leicester College, where he was awarded the Certificate in Exercise and Health Studies by the Physical Education Association of Great Britain and Northern Ireland, the leading qualification in the field at the time.

Fascinated by the human body, Hodgkin continues to educate himself, obtaining numerous certifications in health safety and health club management as well as industry-specific qualifications such as fitness yoga, spinning, FLEXI-BAR, and Zumba, among others. He is renowned for his practical skills in presenting a wide range of themed master classes and workshops—from mind-body wellness to dance and from core strengthening to aquatics—and he even offers juggling seminars that are aimed at improving mental agility and tackling stress. By keeping up with the latest physiological research on cardio and resistance training, Hodgkin tailors workout sessions to maximize the beneficial effects of exercise for your heart, lungs, bones, and mind.

Hodgkin’s mission is to educate people of all ages and all cultures so that they understand the many benefits and experience the many joys of getting and staying fit. ■

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Physiology and Fitness

Scope:

There's a wealth of scientific evidence that shows that appropriate exercise has a positive impact on the health of human beings in many ways. There's a whole industry of gyms, DVDs, articles, TV shows, and books that introduce us to the world of personal trainers, sports scientists, and health promotion workers. We all know that exercise is something that we should be doing if we're able, but within the bombardment of fitness-related information, there's very little insight into how and why changes occur in our bodies during regular physical activity. This course is designed to equip you with a basic understanding of how your body works and to enable you to set and meet your own health and fitness goals—including permanent weight loss, completing a charity run, or simply having more energy to live your day-to-day life with gusto.

Studies have shown that about 60% of adults don't get enough exercise and that 25% of adults don't get any exercise at all. The recommended guidelines are 150 minutes per week, and if you double that, you could reduce your risk of coronary heart disease by 20%. You could extend your life and reduce your risk of heart disease, diabetes, and cancer just by doing 15 minutes or more of exercise each day. Many people don't engage in 15 minutes or more of exercise each day—even though it's clearly beneficial—because of lack of time, energy, motivation, and information. This course is designed to help you tackle and overcome these most common obstacles.

Throughout this course, you'll discover ways to fit exercise into your daily life, and you'll begin to understand what exercise does for your body so that you'll feel more motivated to make a habit of exercising. In addition, you'll learn various tips on how to squeeze exercise into your day—whether you're at work or even in the car.

The journey through many aspects of health and fitness that this course will take you on will teach you how your body is structured and how it functions. You'll learn various principles of exercise with practical examples based on

thoroughly researched facts rather than on fad or fashion. In addition, you'll encounter common health issues that occur through various stages of life so that even though some might not currently relate to you directly, you could become a vital conduit for your family and friends, who may be facing their own specific challenges and opportunities.

In general, there's a split between how people view exercise: There's a group of people who exercise regularly, even fanatically, but don't necessarily understand the science of physiology, and there's another group that reads about the science of physiology, but they don't necessarily apply that knowledge to consistent workouts. These 2 aspects of physiology are rarely interwoven so that scientific knowledge can improve the exercise or so that exercise can improve the understanding of physiology. In other words, you need both knowledge and practice to create a successful and consistent program of exercise for the rest of your life.

You can intensify any of the workouts explained in this course by adding more weight, more repetitions, more sets, or perhaps by combining workouts as you become fitter. You need to work your whole body in a variety of different ways to manage life's demands—from having to reach for a jar on a high shelf, which requires balance and mobility, to preventing injuries, which requires strength and flexibility.

To participate in this course, you can use some very simple tools, such as weights, resistance bands, training balls, medicine balls, benches, and steps. There are also some simple substitutions you can make for these items, which are available from most sports retailers, so that you can do the exercises at home. It is important to know that you don't need fancy equipment to participate—all you need is the will to exercise. ■

Components of Fitness

Lecture 1

The goal of this course is to enable you to set and meet your personal health and fitness goals. In this lecture, you will gain an understanding of precisely what fitness is through the introduction of the concepts of cardiovascular endurance, muscular endurance, strength, flexibility, and body composition. You will discover the way in which various fitness parameters are measured, the expected results range for each, and the health implications of being outside these limits. Furthermore, you will learn about the physiology of fitness and some of the obstacles that can prevent commitment to a healthier lifestyle.

Anatomy, Physiology, and Fitness

- On the simplest level, **anatomy** refers to the bones, muscles, and other components that form the human body. **Physiology**, on the other hand, refers to the interaction of the bones and muscles, along with the nerves, tendons, veins, arteries, heart, lungs, and thousands of complex systems working together to enable you to move and live.
- **Fitness** is a subjective state, and being fit is related specifically to an individual's personal medical history, current health status, socioeconomic situation, and perhaps sporting aspirations. In addition, fitness could be considered in emotional, mental, and even spiritual dimensions.
- In physiological terms, fitness can be broken down into 2 strata: health-related components and skill-related components. Health-related fitness components have the potential to impact one's quality of life.
 - **Cardiovascular endurance** is the capability of your heart, lungs, and circulatory system to take in, absorb, and use oxygen.

- **Muscular endurance** is the capacity of a muscle, or a group of muscles working together, to maintain continued contractions against a low or moderate resistance.
- **Strength** is the force effectiveness of a muscle or a group of muscles.
- **Flexibility** is the mobility of the joints and their associated soft-tissue structures.
- **Body composition** is the proportional segmentation of body weight into lean and fat constituents.
- Skill-related fitness components are desirable for many sporting activities, but a deficiency in these won't negatively impact your health, as with health-related components of fitness.
 - **Agility** is the ability to change direction of the body or parts of the body, incorporating elements of deceleration and acceleration.
 - **Balance** is the ability to maintain both static and dynamic equilibrium of the body parts as well as the whole body.
 - **Coordination** is the ability to perform a range of simple to complex movements with precision, timing, and continuity.
 - **Power** is the ability to achieve optimal force development of the voluntary muscles—but in a minimal time period.
 - **Reaction speed** is the ability to recruit selected neuromuscular responses with a minimal time delay.
- Taking into account the many influences on total fitness, you can see why there are so many different ways of exercising. It's because

a program designed to improve only one of these components won't satisfy the others.

Cardiovascular Endurance

- Cardiovascular endurance—which is also referred to as cardiorespiratory fitness (CV), cardio, stamina, and aerobic fitness—is improved through specific activity that usually involves a number of large muscle groups and is sustained for a certain length of time, such as aerobics, jogging, and cycling.
- The American College of Sports Medicine recommends about 30 minutes of exercise at medium intensity for 5 days per week or 20 minutes at high intensity for 3 days per week. While these are minimum thresholds for maintaining health and reducing risk of disease, greater gains and specific goals such as weight loss will be more readily achieved with 60 minutes of exercise at a time. However, even 15 minutes can have a significant impact, so you can build up time as your body strengthens.



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You can improve your cardiovascular endurance by running.

- The inspiration of oxygen is the beginning of the process of exercise. In response to the increased demands of exercise, the lungs don't actually become larger; instead, the body learns to absorb more oxygen so that more can be taken in with each breath. Over a period of time, the diaphragm, intercostal muscles, and pectoralis minor that control respiration all become more efficient and able to work longer at higher intensities.

- Oxygen is transported in the blood as we breathe. A key response to exercise is that there's an increase in both the total blood volume and the concentration of red cells, which are the carriers of the oxygen. Over time, your body grows more capillaries to deliver more oxygen faster and more efficiently. The blood takes the oxygen to the heart through the pulmonary veins, and then it is pumped around the whole body.
- Working out leads to the heart being able to hold more blood. The wall of the heart becomes stronger, so an increased amount of blood is ejected with each beat. The body is then able to accommodate higher intensities of exercise. A by-product is that the stronger heart will not have to work as hard when resting, so your resting pulse will drop.
- Within the muscle cells, mitochondria break down food for fuel, and they use the oxygen delivered by the blood to do their work. As a response to exercise, the number and size of these mitochondria increase so that the muscles are able to use more oxygen and sustain greater effort for longer periods of time.
- Exercise also causes a change in the way fats are transported in the blood by increasing the ratio of **high-density lipoproteins (HDL)**, the “good” cholesterol, to **low-density lipoproteins (LDL)**, the “bad” cholesterol. Low-density lipoproteins are associated with the accumulation of fatty deposits on the walls of the blood vessels, which leads to the condition called atherosclerosis.
- Research reveals a simple shift from low cardiovascular fitness to moderate cardiovascular fitness can reduce death due to cardiovascular disease by as much as 66% in men and 50% in women.
- To benefit from cardiovascular exercise, always begin with a warm-up that involves gentle and flowing movements of the major limbs, begins small and gradually

increases in amplitude and effort, and works through all the joints.

- The workout phase features continuous, rhythmic movement that maintains an intensity of between 55% and 90% of your maximum heart rate—which can be estimated by subtracting your age from 220—for between 20 and 60 minutes, depending on your current fitness level.
- The final phase is a cooldown that involves incrementally lowering the intensity of your workout. A sudden stop may cause fainting due to the blood pooling in your muscles and to the reduction in the amount of oxygen that is reaching your brain. The cooldown can be followed by some stretching for the major muscle groups.

Muscular Endurance and Strength

- Muscular endurance and strength are different health-related fitness components, but they functionally complement each other; there is a continuum that ranges from strength at one end to endurance at the other end. The Centers for Disease Control and Prevention (CDC) recommends endurance and strength training twice weekly.
- Muscular endurance is fueled by what's known as the lactate system; one of the drawbacks with this route to supplying energy is the gradual buildup of lactic acid in the muscle. To prevent this, with regular exercise, your body improves the supply of oxygen so that you're able to perform for a longer amount of time before lactic acid builds up.
- Muscular strength training leads to microscopic tears to the tissues at the cellular level. Ingesting sufficient protein and resting will encourage the adaptive process known as super-compensation, which leads to an increase in the cross-sectional muscle size and a corresponding increase in strength.
- The degree to which muscles grow is dependent upon testosterone levels, which explains the different responses between men

and women with this type of training. In general, men who lift weights increase muscle size, but women improve their tone and appear leaner.

- Muscular endurance and strength training have been proven to increase bone density, which reduces the risk of osteoporosis; increases metabolic rate, assisting in weight management; reduces blood pressure; decreases LDL; and raises HDL. Muscular endurance and strength training also improve posture, thereby reducing the risk of lower back malady and the risk of injury from events such as falls.



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- To improve muscular endurance and strength, warm up by performing basic resistance training movements but with no resistance. You ideally want a minimum frequency of 2 times per week and 1 to 3 sets of between 5 strength and 25 endurance repetitions—resting for 30 to 60 seconds between sets and allowing 30 to 45 minutes for each session. Cool down with some stretches for the muscle groups worked in the session.

You can intensify any workout by adding more weight, more repetitions, or more sets.

Flexibility

- Flexibility may be the most undervalued of the components of fitness, even though absence of it can affect health status. Flexibility is highly site specific, so a flexible upper body may not necessarily be connected to a flexible lower half.
- Flexibility is divided into static and dynamic classifications, and a good score in one doesn't necessarily imply the same in the other.

Static flexibility involves slowly lengthening a muscle, either by natural movement or by adding external pressure at the end point and then holding the position.

- Dynamic flexibility, however, refers to the range that can be achieved through movement, in which the muscle is continuously lengthened and shortened but is not held at an end point. Movement must be controlled because dynamic flexibility carries an injury risk if it causes an overstretching of the muscle's capability.
- There are a number of factors that contribute to varied levels of flexibility. In general, it appears that females are more flexible than males. Although appropriate training can improve flexibility at any age, the rate of improvement is greater at a younger age. There's also a clear link between levels of physical activity and flexibility. Furthermore, the time of day can actually affect your level of flexibility.
- Improvements in flexibility are achieved through a developmental stretch, which is a static stretch that's carefully applied and aims to lengthen the elastic muscle beyond its original length. The American College of Sports Medicine recommends including flexibility training 3 times per week.

Body Composition

- Body composition allows us to assess the percentage of our body weight that's attributed to fat. The medical community universally agrees that excess body fat can lead to increased risk of diabetes, cardiovascular disease, joint problems, respiratory issues, and high blood pressure.
- Lean body weight—muscles and bones—are more dense than fat. This explains why someone who is in great shape might weigh more than someone who physically looks heavier.
- The National Institutes of Health target guidelines are 20–21% body fat for women, with 30% or more being considered obese.

The healthy ranges for men are between 13% and 17%, with 25% or more being considered obese.

- We need a certain degree of body fat, known as **essential fat**, which is found in the bone marrow and the organs. The additional fat that we store beneath the skin, called **subcutaneous fat**, presents a risk factor. The distribution of fat also influences the degree of risk, with abdominal accumulation being considered more dangerous than fat around the hips and thighs.
- Improving your body composition is ideally achieved by reducing calorie intake, which is achieved through suitable cardiovascular exercise, and by increasing lean body mass, which is achieved through muscular endurance and strength training.

Important Terms

agility: The ability to change direction of the body or parts of the body, incorporating elements of deceleration and acceleration.

anatomy: The study of the bones, muscles, and other components that form the human body.

balance: The ability to maintain both static and dynamic equilibrium of the body parts as well as the whole body.

body composition: The proportional segmentation of body weight into lean and fat constituents.

cardiovascular endurance: The capability of the heart, lungs, and circulatory system to take in, absorb, and use oxygen.

coordination: The ability to perform a range of simple to complex movements with precision, timing, and continuity.

essential fat: The amount of fat that is needed and is found in the bone marrow and the organs.

fitness: A subjective state that is related specifically to an individual's personal medical history, current health status, socioeconomic situation, and perhaps sporting aspirations. In addition, fitness could be considered in emotional, mental, and even spiritual dimensions.

flexibility: The mobility of the joints and their associated soft-tissue structures.

high-density lipoprotein (HDL): The “good” cholesterol.

low-density lipoprotein (LDL): The “bad” cholesterol.

muscular endurance: The capacity of a muscle, or a group of muscles working together, to maintain continued contractions against a low or moderate resistance.

physiology: The study of the interaction of the bones and muscles, along with the nerves, tendons, veins, arteries, heart, lungs, and thousands of complex systems working together to enable human beings to move and live.

power: The ability to achieve optimal force development of the voluntary muscles—but in a minimal time period.

reaction speed: The ability to recruit selected neuromuscular responses with a minimal time delay.

strength: The force effectiveness of a muscle or a group of muscles.

subcutaneous fat: The unnecessary amount of fat that presents a risk factor and is stored beneath the skin.

How Fit Are You?

Lecture 2

In this lecture, you'll learn how to measure the various health-related fitness components that affect your well-being. In addition, you'll learn how you can use the information you obtain to help you achieve your goals and to ensure that your body functions optimally at work, at rest, and at play. Dietary and exercise advice can be more precisely prescribed once certain benchmark values are established. You'll also learn a number of tests that you can do at home, which will allow you to check whether your exercise regime is moving you closer to your goals.

Measuring Cardiovascular Fitness

- In the United States, heart disease is the primary cause of death and disability. Heart disease can result from a number of contributory factors, which can be split into 2 groups: those proven to be closely associated with an increased risk and those that are just loosely linked.
- The major risk factors for heart disease include family history, high blood pressure, high cholesterol level, smoking, sedentary lifestyle, and diabetes. Other risk factors are suspected to be contributory factors, but their impact isn't as strongly suspected, and these include sex, age, obesity, diet, stress, and alcohol abuse.
- Blood pressure is a critical measure of cardiac health. Your resting blood pressure is a measure of the force exerted on the walls of the arteries, which is dependent upon the amount of blood pumped and the resistance within the blood vessels. Readings outside the published normal ranges can be indicative of a higher risk of cardiovascular disease.
- Your blood pressure reading is made up of 2 components. The first is known as the **systolic pressure**, which is the pressure inside your arteries as your heart is pumping. The second is the **diastolic**

pressure, which measures the pressure inside your arteries when your heart is between beats—during the relaxed phase of the cardiac cycle.

- Blood pressure is measured in millimeters of mercury (mm Hg) and is recorded with the systolic number first, followed by the diastolic number. An average reading will be around 120 for systolic pressure and 80 for diastolic pressure. Readings above 140 and 90 are referred to as being moderately hypertensive and carry some degree of risk; readings above 160 and 95 indicate a high degree of risk and suggest that remedial action is required.
- While blood pressure gives an indication of the heart's function at rest, measuring cardiovascular fitness will indicate the ability to perform dynamic movements using several muscle groups at a set intensity for a period of time. This can provide a good indication of risk of heart disease.
- To measure cardiovascular fitness, the key value is the **maximal oxygen uptake**, which is your body's ability to take in oxygen and transport it to the working muscles. It reflects the working capacity of both the heart and the lungs, but it also relies on the circulation of the blood.
- In the laboratory, maximal oxygen uptake would be measured using a graded exercise test on a treadmill, whereby the intensity—in terms of speed or incline—gradually increases until you can't continue. A breathing apparatus called a Douglas bag is used to analyze the gases you breathe in and out. While this might be the most accurate way of measuring maximal oxygen uptake, it requires costly equipment and professionals to ensure the protocols are strictly adhered to and then to make sense of the results.
- In gyms, instead of having a person exercise to complete fatigue, the process is to test performance at a sub-maximal level and then to extrapolate the results to estimate your capability. There are a

number of ways to do this, but a cycle test is the most common method, and it involves the incremental increase of extra load or resistance through the application of pressure onto the wheel as you cycle.

- Sports teams use the bleep test, in which a person runs between usually 2 cones placed 20 meters apart. The idea is to time your runs with prerecorded bleeps: As the test progresses, the time between bleeps decreases, and the point at which you fail to keep up with the pace is measured.

The Cardiovascular Fitness Test

- To measure your cardiovascular fitness, you need a step of 12 inches in height, and you need to complete 24 steps per minute for 3 minutes. You can use a metronome set at 96 beats to help control your pace. After 3 minutes, sit down, locate your pulse, and measure it for 60 seconds. The following chart establishes pulse values for males and females at varying levels of cardiovascular fitness.

Figure 2.1

	Males	Females
Excellent	< 112	< 109
Above Average	113–119	110–117
Average	120–130	118–134
Below Average	131–135	135–137
Poor	> 136	> 137

Measuring Muscular Endurance and Strength

- Muscular endurance and strength are vital indicators of our ability to perform everyday activities without fatigue and, therefore, imply the degree of independence we might retain in our later years. Also, good muscular fitness has been shown to decrease the risk of developing a number of conditions, such as lower back problems and osteoporosis.
- Muscular endurance is the ability of a specific muscle, or perhaps a group of muscles, to repeatedly perform an exercise. Muscular endurance is essential in the deep postural muscles to enable us to maintain good postural alignment when carrying out daily tasks.
- The 2 most common tests for quantifying muscular endurance that are used in the lab and on the sports field can both be tried at home because they are based on effort in 2 basic exercises: the press-up and the sit-up.
- The press-up test measures how many standard press-ups you can do in 1 minute, and this will give an indication of your endurance capability in the chest, shoulders, and arms.

The Press-Up Test

- Assume a face-down position on the floor with your hands about shoulder-width apart, with a gentle curve in the lower spine and a natural curve in the back of the neck. The aim of the exercise is to raise yourself up—extending your arms and holding—and then lower yourself down to the point where the upper arm is parallel to the floor. For men, full press-up position is recommended, but women can start on their knees with their feet lifted. Measure how many press-ups you can do consecutively in 60 seconds.

Figure 2.2 Males

Age	Excellent	Good	Average	Fair	Poor
20–29	>54	45–54	35–44	20–34	<20
30–39	>44	35–44	25–34	15–24	<15
40–49	>39	30–39	20–29	12–19	<12
50–59	>34	25–34	15–24	8–14	<8
60+	>29	20–29	10–19	5–9	<5

Figure 2.3 Females

Age	Excellent	Good	Average	Fair	Poor
20–29	>48	34–38	17–33	6–16	<6
30–39	>39	25–39	12–24	4–11	<4
40–49	>34	20–34	8–19	3–7	<3
50–59	>29	15–29	6–14	2–5	<2
60+	>19	5–19	3–4	1–2	<1

The Sit-Up Test

- The sit-up test measures how many full sit-ups you can perform in 60 seconds, giving an indication of the endurance strength in the abdominal muscles and also in the hips. Begin by assuming a face-up position on the floor with your arms crossed at your chest and your feet about 12 inches away from your backside—hip-width apart so that your knees are bent—while maintaining a comfortable spine position. Bring your body up to the top of your knees, letting your elbows touch your knees, and then lower yourself down, making sure that your shoulders touch the floor.

Figure 2.4 Males

Age	18–25	26–35	36–45	46–55	56–65	65+
Excellent	>49	>45	>41	>35	>31	>28
Good	44–49	40–45	35–41	29–35	25–31	22–28
Above Average	39–43	35–39	30–34	25–28	21–24	19–21
Average	35–38	31–34	27–29	22–24	17–20	15–18
Below Average	31–34	29–30	23–26	18–21	13–16	11–14
Poor	25–30	22–28	17–22	13–17	9–12	7–10
Very Poor	<25	<22	<17	<13	<9	<7

Figure 2.5 Females

Age	18–25	26–35	36–45	46–55	56–65	65+
Excellent	>43	>39	>33	>27	>24	>23
Good	37–43	33–39	27–33	22–27	18–24	17–23
Above Average	33–36	29–32	23–26	18–21	13–17	14–16
Average	29–32	25–28	19–22	14–17	10–12	11–13
Below Average	25–28	21–24	15–18	10–13	7–9	5–10
Poor	18–24	13–20	7–14	5–9	3–6	2–4
Very Poor	<18	<13	<7	<5	<3	<2

- In contrast to endurance, strength refers to the maximal force that can be exerted by a muscle, or a group of muscles, and isn't related to a time period—it's instantaneous. In the laboratory, specific instruments known as dynamometers are used with a detailed procedure involving measurement at different joint angles. Strength can vary in the movement through a joint.
- A more common method is used in the gym, where the aim is to assess your **1-repetition maximum**—the maximum amount of resistance you can lift just once—for a number of exercises. Usually, the bench press or the leg press is used.

Measuring Flexibility

- Flexibility is the ability to move a joint through its full range of movement. Not only is flexibility of value in sports performance, but it is also important in carrying out everyday activities, particularly because reduced flexibility can lead to decreased

functional capability and possibly to bad posture, which is a precursor of chronic muscular skeletal injury.

- Flexibility is specific to each joint, which makes the art of measuring it, called **goniometry**, a difficult process. While no single test is sufficient to measure flexibility, the sit-and-reach test is the most common procedure because it measures flexibility in the hamstrings and the lower back.

The Sit-and-Reach Test

- Gently warm up prior to the test, practicing a few preparatory stretches and movements for the lower back and the hamstrings. Sit on the floor, placing your feet flat against a sit-and-reach box or other large, heavy box that is not too high. Extend your legs until your knees are sort of straight, and then lean forward as far as you can, with your hands overlapped. To help perform the test, take a deep breath beforehand and then exhale as you bend forward. Place some measuring tape on the floor to assess how far short of (a negative score) or beyond (a positive score) the line of the heels you go.

Figure 2.6

	Males (centimeters)	Females (centimeters)
Excellent	> 8	> 11
Above Average	2 to 8	7 to 10
Average	-3 to 1	3 to 6
Below Average	-10 to -4	-3 to 2
Poor	< -10	< -3

Measuring Body Composition

- Body composition is an important indicator of general health because the risks associated with being overweight are numerous. They include an increased risk of developing coronary heart disease, hypertension, type 2 diabetes, osteoarthritis, and possibly even certain cancers.
- In the clinical environment, measuring procedures are fairly involved but offer a good degree of accuracy. For example, **hydrostatic weighing** works on the basis that fat—being less dense than lean body tissue such as muscle and bone—is more buoyant, allowing a comparison of dry land and underwater weights to be used in calculating fairly accurate percentages for each.
- A second method is **dual-energy X-ray absorptiometry**, which is a very accurate method of measuring body composition that involves passing 2 types of X-rays through the body and uses a special scanner that is able to differentiate between fat, bone, and muscle tissue.
- Another method is **near-infrared interactance**, which uses a device that shines an infrared beam on the front of the arm, and the amount of light that bounces back from the bone is measured as an indication of the amount of fat present. This method is fairly inexpensive and easy to use, but it's not as accurate as the other 2 methods.



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In the fitness industry, skinfold calipers are used to determine body composition.

- In the gym, you're more likely to encounter different methods of body composition evaluation. **Skinfold calipers** are often used to take measurements at the waist, the back, and the front and rear of the upper arm. Readings from the 4 sites are added together, and tables give an equivalent body fat percentage for these sums. In the fitness industry, this method is used to generate surprisingly accurate and repetitive results.
- A second method is **bioelectrical impedance analysis**, which estimates body fat and involves passing a small electric current through the body and measuring the resistance to its flow. Lean tissue conducts electricity better than fat, so resistance to the flow of current can be used to predict the level of body fat.

The Waist-to-Hip Ratio Test

- To measure your waist-to-hip ratio, start by measuring the circumference around your abdomen, which is the waist measurement, by placing a tape measure around your body in line with your belly button. Then, find the widest point on your hips, which is the hip measurement, making sure the tape measure is straight. To calculate the score, divide the waist measurement by the hip measurement. Scores of greater than 0.94 for men and 0.82 for women are indicative of a significantly increased risk of health issues.

Important Terms

1-repetition maximum: The maximum amount of resistance that a person can lift just once.

bioelectrical impedance analysis: A method of measuring body composition that involves passing a small electric current through the body and measuring the resistance to its flow to determine body fat.

diastolic pressure: The pressure inside the arteries when the heart is between beats—during the relaxed phase of the cardiac cycle.

dual-energy X-ray absorptiometry: A very accurate method of measuring body composition that involves passing 2 types of X-rays through the body and uses a special scanner that is able to differentiate between fat, bone, and muscle tissue.

goniometry: The art of measuring flexibility.

hydrostatic weighing: A method of measuring body composition that is based on the premise that fat—being less dense than lean body tissue such as muscle and bone—is more buoyant, allowing a comparison of dry land and underwater weights to be used in calculating fairly accurate percentages for each.

maximal oxygen uptake: The body's ability to take in oxygen and transport it to the working muscles.

near-infrared interactance: A method of measuring body composition that uses a device that shines an infrared beam on the front of the arm, and the amount of light that bounces back from the bone is measured as an indication of the amount of fat present.

skinfold caliper: A device used to take measurements at the waist, the back, and the front and rear of the upper arm to determine body composition. Readings from the four sites are added together, and tables give an equivalent body fat percentage for these sums.

systolic pressure: The pressure inside the arteries as the heart is pumping.

Overcome the Barriers to Exercise

Lecture 3

One method of successfully overcoming obstacles to exercise is to motivate people by helping them understand the many benefits of exercise and then balancing the benefits against the negatives so that the value of adopting a healthy lifestyle becomes apparent. Once the advantages of change are recognized, people are able to develop a realistic plan of action that will remove those barriers. This lecture will establish some basic facts regarding attitudes to exercise, the thought process that leads to action, and tips to help you make the decision to pursue a more active lifestyle.

Barriers to Exercise

- The biggest barrier to exercise is time. People simply don't have time to exercise because of work or having young children to look after.
- In addition, there are emotional factors that involve people believing that they are not sporty and might get injured if they exercise.
- There is also little motivation to exercise because people feel like they need to rest in their spare time and don't have the energy to exercise.
- Another point is access. People may think that they don't have anyone to exercise with or that local exercise facilities are expensive or unsuitable. Furthermore, some people might feel like they don't have the right clothes or equipment.
- Finally, physical injury or disability might prevent some people that feel as though they are too fat or too old to participate.
- Men and women rate barriers differently. For example, injury problems tend to affect men more than women and older people

more than younger people. One tactic is to move away from high-intensity sports to more moderate options, still maintaining a competitive outlet but reducing the taxing effects of wear and tear on the body.

Joining a Gym

- The idea of joining a gym presents specific concerns and worries for some people, but these can be countered. For example, if you are worried that an instructor's exercises will be too complicated, you could request your instructor to design a workout using the most basic movements to start with.
- If you are worried about having to engage in unusual activities, it makes sense to do what you're comfortable with in the beginning because there will be plenty of time to get more adventurous later.
- An instructor should guide you when it comes to the dangers of doing too much too soon, but you can help by taking responsibility for yourself, ensuring you begin at a comfortable speed or resistance and allowing for gradual progression.



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When choosing a gym, you should shop around because easy access to and feeling comfortable in a gym is important.

- Furthermore, technical equipment at gyms can be a barrier. Most cardio stations include a quick start option, which can be an easy way to begin your exercise. In addition, the instructors are there to help you, so don't be afraid to ask questions.
- Being able to monitor your pulse can sometimes be tricky—especially when moving on cardio machines—but it is often required to do some workouts at the right intensity, so try an alternative method of judging your workout. The rate of perceived exertion is one such method that your instructor can explain to you.

Enhancing Self-Image

- Studies have shown that not just regular exercise, but even a single exercise session can lead to improved feelings of well-being—including improved self-esteem, increased productivity at work, enhanced self-image, and better confidence.
- Despite the evolutionary improvements in technology and as an indirect result of a general increase in our standards of living, mental illness has grown and continues to grow. While stress management techniques, psychotherapy, and drugs are common prescriptions, exercise has been shown to be a strong solution.
- Exercise stimulates positive thoughts and feelings that balance negative moods and leads to improved self-esteem, which in turn affects people's performance at work and with relationships.
- Mastering new skills leads to improved confidence, and physical activity gives many opportunities for this, helping to promote a more positive outlook.
- It is possible that exercise itself might not be the treatment, but it acts as a distraction from the causes of anxiety, acting in the same way as meditation.

- Shared pleasure is known to boost mood state, and physical activity can be a route to forming new friendships that result in more positive feelings about life in general.

The Process of Change

- Regardless of the precise mechanism behind the link between exercise and good mental health, the key is the shift toward changing behavior and then making efforts to maintain those changes. The difficulty is that behavior change very rarely arises from a momentary decision; instead, it's often a process of different stages.
- First, precontemplation is the idea of considering starting an exercise program, for example, during the next 6 months. Then, contemplation is the notion of seriously considering starting exercise within 6 months. Preparation involves the plan of beginning to exercise within the next 60 days, and this hopefully then leads to action—the first 6 months of following an exercise program. Then, maintenance entails sustaining the exercise program for longer than 6 months. Relapse is a return to the previous stage, but it shouldn't stop you from moving forward. Finally, hopefully, you arrive at termination, which is a successful consolidation of the behavior into your regular lifestyle.
- Moving through the early stages is very much a thought process, but making progress in the latter stages relies on action. The thought process may be stimulated by reading an article about the risk of heart disease being associated with lack of exercise or perhaps by struggling to play with your children without sitting down, but there is usually a trigger.
- To move through the stages, a decision has to be made based on comparing pros and cons or on the desire to move away from pain and closer to pleasure. Therefore, if a person is struggling to make the move to the next level, external encouragement could be all that is required to tip the scale and avoid the risk of relapse.

- In order to help you to achieve the results you desire, you should use the SMART system. A **SMART goal** needs to be specific, measurable, achievable, realistic, and timed.
- The choice of goal is vitally important because it becomes a motivating force—the difference between success and failure. On the top of the list of common goals for both men and women is to feel in good shape physically. Lower down on the list is the sense of achievement.
- If thinking about beginning a new exercise regime, or if you've taken the plunge recently, plan for the inevitability of relapse so that it doesn't grow into a major collapse. There's always the chance that illness, work deadlines, family commitments, and holidays may throw your program off target. Accept that these things happen and reflect upon the positive notion that you've already made changes—and then move on.
- Perhaps the most vital concept to grasp on this topic is self-responsibility. A fitness instructor can design the perfect routine, but nobody can exercise for you. This is why it's so valuable to have your goals written down and clearly defined. When you feel enthusiasm beginning to drain, read your goals again and try to imagine how you will feel when you achieve those goals.

Incorporating Exercise into Your Daily Life

- Perhaps one of the easiest routes to building a healthy lifestyle is to try to find ways to introduce exercise into your daily routine because this helps to overcome nearly all of the previously mentioned barriers.
- **Non-exercise activity thermogenesis (NEAT)** was shown in a 2005 study to amount to an energy expenditure of about 350 calories per day, which is similar to what you would expect from most moderate-intensity exercise classes. NEAT includes any kind of activity, such as mopping the floor, washing the car, and even fidgeting.

- To incorporate exercise into your daily life, try walking briskly around a shopping mall, ensuring you cover the whole mall prior to stopping to take a look in any shop windows or making any purchase. In addition, always take the stairs instead of the elevator.
- Try to wash your car yourself instead of taking it to an automatic car wash, or take your dog for more frequent walks, aiming to gradually increase the distance you cover in the same period of time.
- If you are confined to a desk all day, you can still give your waistline a good workout. For example, if you sit on the edge of your chair and hold onto the sides, then simply lifting both of your knees up toward your chest is an effective way of working your abdominals.
- Furthermore, try to find new ways to play actively with your children. From football to hopscotch, you can make a serious difference to both your energy levels and your relationship with your children by investing a little bit of quality time.
- If you spend a lot of time on hold during phone calls, you could potentially be doing some squats or perhaps some leg lifts to the side, working the hips, thighs, and perhaps the buttocks.
- Dance is a great way to get fit. Try taking dance lessons with a friend or simply making room to dance in your home or office. Try leaving your car at home when you could walk to do an errand instead. Gardening is also a good workout.
- If you're office bound, perhaps you can talk face to face with your coworkers instead of relying on phone and e-mail communication. Additionally, if you have to do any photocopying, a great exercise you can do is to simply move your feet a little farther away from the copier, put your hands on the side of the machine, and do a couple of press-ups to tone the chest, shoulders, and arms.
- You can even engage in supermarket aerobics, in which you go up and down every aisle—even if you don't need anything in those

particular sections. Furthermore, you can pack your own bags and carry them to the car yourself.

- Try taking your children to a museum. They tend to be large, and the children learn while you lose a few pounds in covering the distance.
- There are always going to be advertising breaks when you're watching television, so try to use them wisely. Jog in place or hit the floor and do some crunches to keep your metabolic rate elevated.

Adhering to Exercise

- One of the primary motivators for exercise is the concept of future aspiration, which is the desire to be independent in later years or to remain distanced from ill health. This needs to be supported by consistent messages regarding the efficacy of exercise as a route to achieving these goals, combined with support from important family members and friends.
- Once there is the belief that exercise will make a difference—and the self-confidence that it can be done—a specific plan of action will move a person from thought to reality.
- Success is a vital commodity because the feeling of proficiency at exercise is key, so exercises should always be achievable. In other words, never do too much too soon.
- Feeling healthier and improvements in your quality of life are significant factors but can take a while to manifest, so regular assessments of some form are valuable in providing confirmation that workout endeavors are creating change.
- An instructor or personal trainer who provides knowledge and who helps to set goals is also a vital tool. In addition, a social element can make a big difference, so exercise classes and small group personal training are advised. Easy access to and feeling comfortable in suitable facilities is also important.

- Having direction has been shown to be very useful, so any attempt to embark upon an exercise regime should begin with devoting some time to setting small goals.

Important Terms

non-exercise activity thermogenesis (NEAT): The act of finding ways to introduce exercise into your daily routine.

SMART goal: An exercise-related goal that is specific, measurable, achievable, realistic, and timed.

Your Heart in Action

Lecture 4

In this lecture, you will learn how your heart works, how it responds to demands placed upon it, and—most importantly—how to exercise in order to improve its ability to keep you healthy and on the move. You will also encounter a range of exercise modes that will help you maximize the health and efficiency of your heart. Exercising—between 20 and 30 minutes per session 3 to 5 times per week—will not just help you look better, but it will actually make you feel better from the inside out.

The Human Heart

- The average human heart weighs around 11 ounces and beats around 100,000 times each day, resulting in approximately 2000 gallons of blood being moved through 60,000 miles of blood vessels that reach almost 75 trillion cells.
- Considering it performs such a key role in sustaining life, the heart has quite a simple design. It pumps blood around the body and sits beneath the breastbone. It's a little larger than the size of a tennis ball, and it's enclosed in a double-lined sheath called the **pericardium**.
- The heart muscle, the **myocardium**, is divided into chambers separated by a smooth membrane. These chambers are stacked on top of each other so that gravity can assist in blood flowing from the upper to the lower chambers. The upper chambers are known as **atria**, which receive blood and pass it to the lower chambers. These lower chambers are called **ventricles**, and they are larger than the atria and are cone shaped to help the blood flow out from the bottom.
- Blood first enters into the right atrium from 3 key veins: namely, the superior and inferior vena cava—which bring blood from the

upper and lower body, respectively—and the coronary sinus, which brings blood that is used by the heart muscle to do its work.

- Because all of this is blood that is returning from the body, it has already given up its oxygen for various cells to be used as energy in a large number of metabolic processes, so it's low in oxygen concentration but high in carbon dioxide—the waste product that has to be removed from the tissues. Blood drains down to the right ventricle, from where it is pumped to the lungs through the pulmonary artery, which divides into 2 legs to serve each of the lungs.
- Having made its journey to the lungs, the oxygenated blood returns to the heart by entering the left atrium, from where it is shifted to the left ventricle. Then, it's ready to be pumped through the aorta to the rest of the body. The ventricles essentially serve as muscular pumps that circulate blood to all the tissues.
- The right ventricle pumps blood only a short distance to the lungs whereas the left ventricle needs to generate enough pressure to ensure that blood flow reaches all the extremities. For this reason, the left ventricle is larger and the muscle walls tend to be thicker when compared to the right ventricle.
- A temporary break in blood flow could be potentially catastrophic, so the heart valves ensure that blood is always moving and, most importantly, always moving in the right direction. This is a strict 1-way system with blood flowing from the right atrium to the right ventricle below it by the tricuspid valve. On the left side, blood moves from the upper to the lower chamber through the mitral valve.
- When blood flows into the atria, the valves are loose and open, but when the heart muscle contracts to pump blood out through the ventricles, the valves are pushed upward, effectively closing off the atria and preventing the blood from flowing backward.

- In addition, there are semilunar valves at the exits of the 2 ventricles to both the pulmonary artery and the aorta. These remain closed while the ventricles fill up, preventing backflow from the arteries. They then open, upon contraction of the heart muscle, simultaneously with the tricuspid and mitral valves closing. In fact, it is this opening and closing of the valves that creates the sound of the heartbeat that's picked up by a stethoscope.

The Cardiac Cycle

- The duration of 1 heartbeat combined with the rest period that immediately follows it is referred to as 1 **cardiac cycle**, which can be listed in distinct stages.
- First, when the heart muscle is at rest, pressure builds in the atria as blood flows into them. As the pressure increases, the valves open to the ventricles and blood shifts to them. The ventricles are relaxed and their semilunar valves are closed due to the pressure from blood within the arteries being greater than in the ventricles. This is the relaxed stage of the cycle; the pressure in the blood vessels is at its lowest. This stage is known as the **diastole**.
- Then, an electrical message stimulates the heart muscle to contract in the atria. This pushes blood into the ventricles that are still relaxed at this stage. The signal to contract reaches the ventricle heart muscles, and so they contract, which causes the pressures in the chambers to increase. When this pressure is high enough—higher than those in the pulmonary artery and the aorta—blood is ejected with some force. This stage is known as the **systole**.
- Once the ventricles are empty, the heart muscle relaxes, and the tricuspid and mitral valves close. Simultaneously, the blood begins to flow into the atria, and the cycle begins all over again. Incredibly, all of this takes place in about 0.8 seconds.
- When we take our pulse, usually at the radial or carotid arteries, we're actually measuring the number of cycles in a set period. Although 72 beats per minute is generally accepted as the average,

fitter individuals tend to have pulses around 60, and in some cases, elite athletes have had pulses as low as 30.

- The heart becomes stronger with regular exercise because the heart becomes able to pump more blood with each contraction, and this quantity of blood is known as the stroke volume. More blood with each beat, therefore, means that the number of beats can be lower, so the heart doesn't need to work quite as hard and, therefore, is likely to last longer than a heart that's constantly under stress.
- The heart muscle, as with every other muscle in the body, requires oxygen to function, and this is supplied by the coronary arteries. If these arteries become blocked—even just partially—the heart muscle will be deprived of blood, which brings the vital fuel. A partial disruption in blood flow to the heart is called a **myocardial ischemia**, and a complete blockage is called a **myocardial infarction**, or a heart attack.
- Because the key is the supply of oxygen to the heart muscle, a lower concentration of it in the blood supply will also be an issue, as in cases of hemoglobin deficiencies caused by smoking or lack of iron in the diet.

The Essential Transport System

- Blood is ejected from the heart into the arteries with force, so they have to have a fairly elastic structure. Their walls need to be able to stretch, and it is the recoil after they have expanded that causes a squeezing effect that moves blood through the network.
- The primary artery is the aorta that leaves the heart and divides up into many sections—one of the most important being the coronary arteries. The aorta then heads upward in the thoracic cavity just a few centimeters before taking a swift U-turn and dropping down behind the heart. At the top of the arch is where the carotid arteries branch off and head toward the brain.

- When the arteries reach the parts of the body they serve, they split into smaller vessels with thinner walls called arterioles. Then, they split again into even smaller capillaries. Being so small allows the vessels to get as close as possible to the tissues they serve and allows them to deliver oxygen as well as remove carbon dioxide. This happens through the process of diffusion through the capillary walls.
- Once the vessels have deposited the oxygen and picked up the carbon dioxide, they begin their return journey. They start to enlarge, forming venules, and then enlarge again to become veins—carrying carbon dioxide back to the heart, from where it can be shifted to the lungs, and then it can be exhaled.

- The transporting of blood back to the heart for reoxygenation is referred to as venous return. It's assisted by the skeletal muscles contracting and effectively squeezing the veins. This is why you should never abruptly stop exercising but, instead, have a gradual cooldown to allow the muscles to help move the blood on its journey and avoid light-headedness.



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Cardiovascular machines, such as stationary bicycles, usually incorporate a fartlek option that is often called the random mode.

Exercise and the Heart

- **Cardiac output** is a term that quantifies the workload of the heart and is calculated as the sum of the stroke volume multiplied

by the pulse rate. An average value at rest is around 5 liters per minute.

- Cardiac output is not evenly shared but is directed specifically to where it's needed, and this is achieved through a combination of **vasodilation** and **vasoconstriction**, in which the blood vessels will increase or decrease in diameter, respectively, together with the selective opening and closing of the capillary beds within the tissues.
- At rest, about 20% of the blood supply is sent to the skeletal muscle, but things change significantly during exercise—with cardiac input increasing to about 20 liters per minute and around 70% of that going to the working muscles.
- There are many exercise routes that we can take to produce improvements in the cardiovascular system. The first technique is called **continuous training**, which is based on working out at a constant intensity for a specific duration of time. The advantages of this type of training include being simple to use and, for the not-so-regular exerciser, not having sudden spikes in intensity that could cause discomfort. It also allows you to easily monitor your progress.
- Continuous training is usually split into 2 strata: less than 60 minutes or greater than 60 minutes. The shorter durations are usually conducted at a moderate intensity, and the focus is on burning calories—plus the general positive health gains that will result. Workouts longer than 60 minutes are known as long, slow distance workouts. Because it involves a lot of repetition, care should be taken with this type of workout because it can lead to overuse injury.
- Another type of training is called **fartlek training**, which comes from a word of Swedish origin meaning speed play, allows for the development of different energy systems and different muscle fibers by introducing short, fast bursts between periods of average

exercise. Unfortunately, this method doesn't allow you to measure your progress because no 2 workouts should be the same.

- **Interval training**—which features spells of exercise interspersed with low-intensity periods to allow for recovery before the next period—is a great way to improve cardiovascular fitness. Interval training allows you to do a considerable amount of high-intensity exercise, which accelerates your results.
- **Cross-training** refers to the practice of using different cardio workout modes either on different days or even within the same workout. Options might include the treadmill, rower, and stationary cycle if you're in a gym or jogging, cycling, and swimming if you're not. This approach helps to reduce the risk of overuse injuries that are associated with repetitive movement patterns.
- A 2005 study published in *The American Journal of Cardiology* established that both continuous and interval formats produced statistically similar results in terms of improvements in aerobic capacity, blood pressure, and heart muscle efficiency. However, the interval options led to significantly greater times until exhaustion in a treadmill test.

Important Terms

atrium: One of the 2 upper chambers of the heart.

cardiac cycle: A cycle that includes the duration of one heartbeat and the rest period that immediately follows it.

cardiac output: A term that quantifies the workload of the heart that is calculated as the sum of the stroke volume multiplied by the pulse rate.

continuous training: Training that is based on working out at a constant intensity for a specific duration of time.

cross-training: Training that involves using different cardio workout modes either on different days or even within the same workout.

diastole: The stage of the cardiac cycle in which the pressure on the heart walls is at its lowest.

fartlek training: Training that introduces short, fast bursts between periods of average exercise.

interval training: Training that features spells of exercise interspersed with low-intensity periods to allow for recovery before the next period.

myocardial infarction: A complete blockage of the blood flow to the heart—a heart attack.

myocardial ischemia: A partial disruption in blood flow to the heart.

myocardium: The heart muscle, or cardiac muscle.

pericardium: The double-lined sheath in which the heart muscle is enclosed.

systole: The stage of the cardiac cycle in which the pressure on the heart walls is at its peak.

vasoconstriction: The process in which blood vessels decrease in diameter.

vasodilation: The process in which blood vessels increase in diameter.

ventricle: One of the 2 lower chambers of the heart.

The Fitness of Breathing

Lecture 5

Like many other bodily functions, breathing is usually a subconscious process, even when you exercise and the rate of inspiration increases. Breathing patterns can influence your energy levels, your ability to concentrate, the performance of your internal organs—and, ultimately, your health. In this lecture, you'll learn about the mechanics of breathing, gaining an understanding of how several body parts and functions work together in perfect harmony to sustain life. You're also going to learn a number of adapted breathing techniques that you can use to your advantage in a variety of everyday situations.

The Breathing Process

- Upon inhaling, the diaphragm contracts and moves downward. Simultaneously, the small **intercostal muscles** pull the ribs up and out, which together results in an increase in volume in the thoracic cavity. This in turn causes a decrease in the pressure within the chest, and due to the pressure gradient, air naturally flows from the area of higher pressure to the area of lower pressure in the chest.
- Air is drawn in through the nostrils and mouth, travels down the **larynx** (or voice box) and the **trachea** (or windpipe), which divides into 2 bronchial tubes that in turn subdivide to feed the lobes of the lungs—which is where the air eventually ends up.
- As we exhale, the whole process is reversed, beginning with the diaphragm and the intercostal muscles relaxing. That leads to the rib cage returning to its original size, which increases the pressure within and, therefore, forces the air out.
- The **sinuses**, the cavities in the bones of the skull that are connected to the nose and cilia (or nasal hairs), help to regulate temperature. By warming the air and making it more palatable, the sinuses ensure we are able to continue breathing even in the coldest climates. The

cilia, which are covered in sticky mucus, play a very important role in acting as a filter to trap germs and foreign particles as they enter within the inhaled air. The saliva performs the same role when we breathe through the mouth.

- The lungs are slightly lopsided, with the right one comprised of 3 balloon-like lobes and the left made up of only 2 lobes. The bronchial tubes split further, into bronchioles, and at the end of these are tiny air sacs known as alveoli. Blood enters the lungs through the pulmonary arteries, which split into smaller arterioles and then into the capillaries that form a network around the alveoli.
- In the alveoli, oxygen is taken up by the red blood cells and carbon dioxide is released into the air to be expelled. Exercise depletes oxygen in the venous blood and enhances oxygen exchange at the alveoli. Therefore, blood flow through the lungs is fairly sluggish when we're at rest but may triple during exercise.
- When we breathe out, water is removed along with carbon dioxide, which is a waste product that results from your body breaking down glucose to generate energy. The oxygenated blood then flows out of the alveolar capillaries, through the venules, and back to the heart through the pulmonary veins. Then, the heart pumps the oxygen-rich blood through the arteries to deliver this vital fuel throughout the body.
- When we exercise, carbon dioxide builds up, so the body's response is to elevate the rate and increase the depth of breathing in order to remove it. Otherwise, the blood could become more acidic, which creates an environment that will inhibit the chemical reactions that produce energy. Upon ceasing exercise, the cadence slows in line with the decreasing levels of carbon dioxide until breathing returns to normal.
- In fact, it's the need to remove carbon dioxide that drives the breathing mechanism—rather than the need to take in oxygen. This is a wholly automatic function, with the brain sending messages

through the thoracic nerves to activate the respiratory muscles. However, when it comes to voluntary efforts to change breathing—perhaps to sing, for example—the cerebral cortex of the brain takes over.

- When feeling stress, the sympathetic nervous system is stimulated, which can lead to tightness in the respiratory muscles. As a result, chest expansion is restricted, and shallow breathing becomes more apparent and a little more rapid. This is referred to as hyperventilation, or chest breathing, and it's inefficient because it results in losing too much carbon dioxide. That's why we're told to take deep breaths when we're stressed—to breathe deeper down into the lungs, where we get a better exchange of gases.

Pulmonary Disorders

- **Asthma** is a condition whereby the tubes that carry air to the lungs become irritated, which sometimes narrows and perhaps produces more mucus than normal, restricting the ability to breathe. We don't know exactly what causes it, but we do know that allergies can exacerbate it. Asthma can't be cured, but it can be controlled with appropriate medication.



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- **Chronic obstructive pulmonary disease (COPD)** is an umbrella term covering a number of conditions, such as emphysema—where the alveoli lose their elasticity and, therefore, their ability to take in oxygen—and bronchitis, which involves a buildup of phlegm that causes coughing. The most

Asthma is a respiratory condition that cannot be cured, but it can be controlled with the help of an inhaler.

common cause of these is smoking, but occupational pollution, such as dust from industrial processes, can also be a contributor.

- **Lung cancer** develops when cells change shape and grow, linking with other damaged cells to form a tumor that can then grow and spread to other parts of the lung and beyond—usually very slowly. Smoking is the key issue in this case.
- **Pneumonia** is an infection that's transmitted by breathing in germs, which causes the alveoli to become filled with fluid and then inflamed, restricting the ability to transfer oxygen into the bloodstream.
- Several studies have found that measures of lung function are the best predictors of life span. Maximal oxygen uptake, or **aerobic capacity**, declines with age in both men and women—except for those involved in endurance training—but research has shown that much of this decline can be attributed to loss of muscle mass rather than to age. Exercise enhances cardiorespiratory function by improving the body's ability to move oxygen into the bloodstream and transport it to the working muscles, where it can be used in metabolic processes.
- Regular exercise can be of benefit to all maladies of the lungs. When you exercise regularly, your body creates less lactic acid. As a result, there is less demand on the lungs to provide oxygen to help remove it and nothing to agitate the symptoms of any lung condition you may already have.
- The American Lung Association suggests that people with pulmonary disorders begin their exercise by coughing—to help clear the airways of mucus. It's important to practice deep breaths, inhaling for 2 counts and exhaling for 4 counts.
- In addition, if you're exercising and feel fatigue or breathless, slow down. Don't aim for too high an intensity of exercise. Walking is

the ideal option, and you should commit to 2 short sessions each day, if you can, rather than one long session.

- Always consult your medical practitioner before beginning a new exercise regime and, certainly, if you experience any difficulty once you get started.

Breathing Exercises

- Even if you don't have a lung disorder, breathing exercises can contribute to your health and well-being. From the world of martial arts to sports psychology and from remedial therapy to yoga, there is a collection of exercises you can try that can be applied to everyday situations. You can practice the following breathing exercises at home, and you can do most of them anywhere and in any position.
- The purpose of a cleansing breath is to expel carbon dioxide, which is a toxin, and to release tension in the sinuses. Start with your mouth gently closed. Inhale deeply, being sure that your stomach is rising. Then, exhale quickly, causing a quick contraction through the diaphragm—forcefully driving the air out through your nose. Through this technique, your breath in will be much longer than your breath out. You should be sitting up straight and tall, dropping your shoulders down.
- The second technique is a great exercise for energizing yourself; it's a great exercise to do first thing in the morning. Start by sitting in a comfortable position with a long spine. If you're sitting in a chair, you'll want to sit toward the end of the chair. Keep your mouth closed, breathing in and out through your nose only. Breathe quickly—at a rate of about 2 to 3 breaths per second. You may feel a little bit of stress in terms of muscular effort at the base of the neck, in the chest, or maybe even in the abdomen, but that's good because you're taxing the respiratory muscles, and over time, they'll strengthen. However, avoid the risk of hyperventilating by doing this for only about 5 seconds.

- Next is an exercise that should give you strength and courage and that can improve the endurance and efficiency of your nervous and digestive systems. If you have attended a yoga class, you may be familiar with the technique called an Ujjayi breath. Start with your mouth closed. Inhale slowly through your nose, but then close the glottis by lifting the back of your tongue to the roof of your mouth. When you exhale, again through your nose, you'll find that there's a little vibration, and the key is to focus on the vibration and the noise.
- The great thing about your breath is that you can use it when you're working out by exhaling on the effort, which will give extra dynamism to your movement and allow you to perform better—and, therefore, achieve better results. With any type of exercise that involves resistance, the exertion, which is the hardest part of the exercise—when you're lifting a weight or lifting your body against gravity—is when you should breathe out intensely.
- If you train your lungs to perform better and your body to deliver and utilize oxygen more efficiently, then you'll be better at sports, and you can do this using timing variations. If you're running, you can try counting a 2:2 ratio, which includes 2 breaths in for 2 strides and 2 breaths out for the next 2 strides. You can build this up to 3:3 and maybe to 4:4. You can also use this technique for swimming and cycling, too.
- De-stress breathing relaxes both the mind and body. This technique probably works better if you're lying on the floor, but you can also do it sitting in a chair, making sure that you sit back in the chair and let yourself feel heavy. Close your eyes and breathe in and out through your nose. Take long, slow breaths and try to fully inflate your lungs. Focus on listening to your inward breath and on feeling the warmth of your nasal breath being pushed down into your center and your body temperature gently increasing from the inside to the outside.

- The final technique is a technique for pain relief. Sit in a comfortable but upright position, taking a deep breath in through your nose. Hold that breath for a count of 7 and then gently exhale through your mouth for a count of 8. Try to expel all the air as you breathe out, and notice how it engages your deeper abdominal muscles and draws your ribs down toward your hips. The goal is to block any thoughts coming into your head and focus simply on the count, as you inflate and fully empty your lungs.
- As with any exercise, breathing exercises improve with practice. There exists an abundance of research on breathing exercises, and it's clear that mastering them can enhance the parasympathetic nervous system, improve cardiac function, decrease the effects of stress, and improve both mental and physical health. Try to incorporate these techniques into your day-to-day routine.

Important Terms

aerobic capacity: Maximal oxygen uptake.

asthma: A condition whereby the tubes that carry air to the lungs become irritated, which sometimes narrows and perhaps produces more mucus than normal, restricting the ability to breathe.

chronic obstructive pulmonary disease (COPD): An umbrella term covering a number of conditions, such as emphysema—where the alveoli lose their elasticity and, therefore, their ability to take in oxygen—and bronchitis, which involves a buildup of phlegm that causes coughing.

intercostal muscles: The small muscles that are located between the ribs and aid in breathing.

larynx: The voice box.

lung cancer: A type of cancer that develops when cells change shape and grow, linking with other damaged cells to form a tumor that can then grow and spread to other parts of the lung and beyond—usually very slowly.

pneumonia: An infection that's transmitted by breathing in germs, which causes the alveoli to become filled with fluid and then inflamed, restricting the ability to transfer oxygen into the blood stream.

sinus: A cavity in the bone of the skull that is connected to the nose and nasal hairs.

trachea: The windpipe.

You Can Reduce Stress

Lecture 6

According to the American Psychological Association, about 75% of Americans experience stress symptoms every month, and about 1/3 report feeling that they are living with extreme stress. The goal of this lecture is to describe stress in a way that will help you understand the many possible root causes and alert you to the various symptoms that can arise. More importantly, you'll discover the role that carefully prescribed exercise can play in reducing your risk of suffering stress, and you'll learn several specific self-help tactics that can help you reduce stress in your everyday life.

What Is Stress?

- The American Institute of Stress suggests that stress is difficult to define because it affects people in so many different ways and, therefore, can elicit varying symptoms.
- At the basis of understanding stress is the fact that it is a primitive reflex that takes the form of the set of changes in body chemistry that make you ready to fight or run away, and this is why nervousness and anxiety often show in a fast pulse, rapid breathing, and sweating. The extent of the reaction will vary, depending on whether the threat seems imminent or farther away.
- The vagaries of life in the 21st century imply that many of us lead lives in which stress is inherent in far too much of our normal daily routine, and our bodies are constantly in this state of heightened activity. If this goes on for an extended period of time, it can lead to a number of unpleasant consequences—from feelings of anxiety and depression through various aches and pains to serious illnesses.
- Some of the first indicators of stress domination can include headaches, neck pain, digestive problems, frequent colds, and an irregular heartbeat. You could also develop irrational behavior

patterns, such as eating or drinking too much, gambling, and making impulsive purchases. Your moods may fluctuate from moments of absolute joy to angry outbursts—or even to periods of withdrawal.

- In most circumstances, stress carries a negative connotation. However, a completely stress-free existence may also have drawbacks. We could lose the ability to react to the different challenges life throws at us. As counterintuitive as it sounds, a degree of stress is essential for optimal health—but we need to be able to control it. High stress levels can directly affect your weight but can be combated by exercise.

Relaxation and Meditation

- To supplement their physical exercise programs, many people turn to the world of relaxation and meditation techniques for help. Practicing relaxation techniques can bring many benefits, but—like stress—the experience varies between individuals. Despite this variance, the medical community recognizes relaxation as a treatment for a number of stress-related ailments, such as hypertension, insomnia, asthma, chronic pain, cardiac arrhythmia, and phobic anxiety. The physiological effects include a lower heart rate, lower blood pressure, and lower blood cortisone levels.
- All of these changes are consistent with a generalized decrease in activity of the sympathetic nervous system, and they are distinctly different from the physiological changes observed when sleeping. You might find watching television or reading a book relaxing, but true relaxation needs to be learned in order to effectively release tension from the muscles and to slow the breathing.
- For people who regularly practice relaxation techniques, they can benefit from a heightened sense of self-awareness, clarity of the mind, anger control, and even a strengthened immune system.
- **Relaxation** is primarily aimed at and also benefits the body whereas **meditation** is a form of mental exercise that is based on the belief that the mind determines the quality of life. The 2 are

linked: Relaxation is often the route to accessing meditation and could be a secondary effect of meditative practice.

- The essence of meditation is in paying attention. It can be described as being a deep form of rest—as relaxation with a neurological awareness—and it's characterized by moments of stillness that balance a life of activity. Meditation allows us to practice detachment, being able to take ourselves outside of our everyday thoughts, and it also gives an insight to the nature of subjective thought.
- Meditation is not an exclusively Eastern, esoteric, mystical, or religious exercise; it's actually similar to physical exercise. Meditation can be included as an essential part of a fitness routine, and even sitting for just 1 minute at the end of a workout can make a difference.
- The aim of meditation is to focus inward and, to a large extent, to forget about the body and allow the physical body to become completely relaxed. While fully concentrated in meditation, it's possible to lose awareness of any pain or discomfort in the body—or to notice it and not even care. The more time spent in meditation, the more time the body remains relaxed. Some people find that meditating even reduces their need for sleep.



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It can take years to understand the nature of meditation, but it can become an important part of your fitness routine.

- Although there are different types of meditation techniques, there are 2 main categories of meditation: concentration and contemplation.
- The first technique is a concentrative technique. In order to aid concentration, choose an object for your attention, including observing or counting breaths, using a repetitive sound (such as chanting a mantra), or focusing on an image (such as a candle flame). When you notice your attention beginning to wander, simply try to bring your attention back to the object of meditation—without judging yourself or worrying about it.
- The contemplative technique, or mindfulness, is based on the underlying principle that most meditative techniques provide an individual with the means to gain firsthand insight into the way their mind works. Contemplative meditation normally builds upon the concentrative technique. Once the mind is calm, the object of concentration is put aside, and the flow of mental images and sensations is observed as they naturally arise.
- In the area of relaxation and meditation, techniques that work for one person may leave another confused or uncomfortable, so you should treat the practice as a journey of self-discovery. Ideally, then, you should endeavor to evolve in this area by exposing yourself to learning a broad spectrum of practices.

Techniques to Try

- The stress-fighting endorphins released during exercise can also be unleashed by laughter, and surprisingly, your body can't distinguish whether laughter is real or fake. Laughter therapy is a recognized technique that works in both group and individual situations and starts with a warm-up, followed by a range of activities designed to make you laugh.
- Experts suggest that the rhythm of music produces a calming effect. It's believed that there is a link to when we were in our mother's womb and were influenced by her relaxing heartbeat. There is no

single music genre that works for everyone, so personal preference is key. You'll want to sit or lie in a comfortable position, allowing the music to rinse away the stresses of your day.

- Learning to juggle real objects can actually help you cope better with common stressors such as work pressures, family commitments, and money. By improving concentration skills and providing a link between the left and right sides of the brain, improving mental agility and problem-solving functions, you can take your conscious and subconscious mind away from issues that cause you mental malaise.
- If writing comes naturally to you, then take a blank piece of paper and write down your thoughts and feelings. This can really help you clear your mind, and it can be particularly useful before going to sleep or when you first wake up. Seeing things written down on paper can generally give you a fresh perspective.
- Stretching your muscles can release tension. First, you can try a stretch for your neck, shoulders, and back. If you're sitting in a chair, you'll need to sit up comfortably. Then, take one hand and press it down along your side, bringing your ear to your shoulder. Hold the position for about 15 seconds and repeat on the other side. Then, bring your hands up in front of you to about chest level and clasp them together, pressing forward and bending the elbows slightly. The opposite of this is to take both hands behind you, place them on the lower back, and squeeze your elbows toward each other.
- You can also try a basic breathing exercise. Start by placing the palms of your hands on either side of your rib cage, spreading your fingers. As you take deep breaths in and out, feel your rib cage expanding. Apply a little pressure with your hands so that as you inhale, you have to work a little bit harder through the respiratory muscles to expand the rib cage—and then relax. This will help you relax through your whole upper body, but it also calms the mind. Yoga classes are a great way to learn more breathing techniques.

- Another great technique is effectively a concentrative meditation technique that was developed by Dr. Herbert Benson, a Harvard Medical School professor and a pioneer in the field of alternative medicine. In order to aid concentration, choose an object for your attention. For example, think of a word that helps you to relax, such as “peace” or “calm.” Each time you take a breath in, think of the word, say it to yourself slowly, and make it last the length of the breath out. If your attention begins to wander, don’t try to block out the incoming thoughts; let them come, but then let them go, and return to focusing on your word.
- Finally, try a method attributed to Laura Mitchell, a renowned London physiotherapist who discovered that relaxation in the muscles could be initiated by certain mindful movements. Each movement command is followed by a stop, which ensures that you cease moving that particular body part and prepare for the next joint action. This technique is best done lying down, but it can also be adapted for a sitting position.
- To begin, pull your shoulders down, away from your ears, and stop. Your neck feels longer, and the tension through the muscles in the neck and shoulders has been released.
- Roll your elbows out and open, and stop. Be aware of feeling the upper arms moved away from the rib cage, and the weight of both arms should be resting on the floor.
- Gently extend your fingers and thumbs, and stop. Be aware of feeling your fingers slightly stretched, separated, and gently touching the floor.
- Turn your hips out, and stop. Feel that the thighs have rolled and that the kneecaps are facing slightly outward.
- Gently bend and extend the knees to find a comfortable position, and stop. Be aware of the comfort through the knees.

- Push your toes away from you, and stop. Release, and feel the heaviness of the feet.
- Push your torso into the floor, and stop. Be aware of your contact and the support of your body.
- Push your head into the floor, and stop. Feel the contact of the head with the floor.
- Pull your jaw down, and stop. Feel that your teeth have separated. Your jaw feels heavy, and your lips are barely touching.
- Press your tongue downward in the mouth, and stop. Feel how that releases the tension through the throat. The tongue should feel loose.
- Close your eyes. Screw the eyes up tightly, and stop. Let the eyelids gently rest over the eyes. Take a moment to enjoy the darkness.
- Beginning at the eyebrows, imagine—don't move—that you're slowly smoothing your fingertips up the forehead, into the hairline, over the hair, and down the back of the neck, and stop.
- Take a few moments to focus on your breath. Try to be aware of taking deeper, slower breaths.
- When you're ready, open your eyes and get used to the amount of light in the room and slowly begin to return your mind to the present. In your own time, sit up and carry on with your day.

Important Terms

meditation: A form of mental exercise that is based on the belief that the mind determines the quality of life.

relaxation: A practice that is primarily aimed at and also benefits the body.

Fitness and Pregnancy

Lecture 7

Exercise is of great value both before and after giving birth, helping moms-to-be reduce pregnancy symptoms, control weight gain, and ease labor. In addition to assisting the new parent in toning the stretched pelvic floor and abdominal muscles, exercise can also help to realign her posture. The goal of this lecture is to help you make the right decisions regarding whether exercise will be beneficial and if so, what type and how much to do. In order to draw the right conclusions, you'll learn about the changes a woman's body goes through during pregnancy and how exercise affects such changes.

Pregnancy, the Body, and Exercise

- The pelvis is made up of the 2 hip bones and the sacrum between, conveniently forming a basin for the growing baby to sit in. The female pelvis differs from the male pelvis in that the **symphysis pubis**—the point at which the 2 pubic bones meet at the bottom—is wider to allow for the passage of the baby during childbirth.
- The abdominal muscles, in order to accommodate the growing baby, are forced to stretch, which leads to the **linea alba**—the tendinous line in the middle of the abs—separating. Care needs to be taken not to put undue stress on this area, particularly because the muscles will be weakened. Therefore, exercises that require strong contractions, such as sit-ups, are not advised because this could exacerbate the separation, or **diastasis**, and lead to doming.
- Static abdominal contractions, however, are favored because maintaining some tone in the abdominal muscles will help the healing process after birth, reducing the risk of the separation.
- The spine is affected by the posture change due to the weight of the baby at the front, causing a backward lean, which exaggerates the lumbar and causes the pelvis to tilt.

- The pelvic floor muscles are in layers and, like other muscles, have an elastic property. During pregnancy, these become stretched due to supporting the weight of the baby and can cause a partial reduction in their functional ability.
- To allow the pelvis to expand during pregnancy, the body produces a hormone called **relaxin** that has the effect of loosening the ligaments, particularly in the **sacroiliac joints**, where the 3 pelvic bones meet at the rear. The ligaments around the symphysis pubis at the front also relax, and these 2 combined actions, leading to a degree of instability in the pelvis, can be a concern.
- The changes that occur to the cardiovascular system include an increase of about 30% in blood volume, but this is mostly plasma, so the concentration of red blood cells is actually reduced, sometimes leading to feelings of fatigue. As a response, the heart increases its workload to ensure enough oxygen is transported around the body.
- In the third trimester, the respiratory system is also affected due to the size of the baby pushing up on the diaphragm, reducing the chest volume. However, because breathing changes are automatic in the mother-to-be, specific breathing exercises at this time are of little benefit.
- A key consideration for exercise is the risk of **supine hypotensive syndrome**, which is when lying on the back can result in the weight of the baby resting on the main blood vessels, causing them to pinch, which could temporarily restrict the blood supply flowing back up to the heart and, in turn, the supply to the mother and baby as a whole.
- The arguments for specific exercise during pregnancy include gaining relief from typical pregnancy symptoms, reducing the risk of varicose veins, controlling excess weight gain, helping to ease the actual birth, and ensuring a speedier postnatal recovery.

- Exercise during pregnancy needs to be modified as a result of the many body changes. Your target should be to exercise 2 to 3 times per week. If you're not already a regular exerciser, then you should stick to low-intensity activities. Drink plenty of water. Movements should always be smooth and never jerking. Avoid exercises that involve lying down after you are 20 weeks pregnant, and focus on constant relaxed breathing. It's also important, because of the effect of relaxin, to limit your range of motion.

Stages of Pregnancy

- Pregnancy is recognized as being comprised of 3 periods, or **trimesters**, which each lasts 3 months and are characterized by the changes that occur to the body at these times. Specific exercise advice varies for these 3 periods.
- Fatigue and nausea are common symptoms in the first trimester, and emotions may swing from joy to excitement to even apprehension. It's likely that the mother will be comfortable and able to continue her regular level of exercise, but it's important to listen to the body and rest if necessary—particularly because miscarriage is most common toward the end of this first trimester.
- During the second trimester, the blood volume, weight, and relaxin levels begin to increase, and the first signs of the stomach expanding can be seen. Often, the sick feeling subsides and is replaced by renewed energy—although, not for everyone. Occasionally, sickness can continue throughout the full term.
- In the third trimester, symptoms are perhaps breathlessness, posture and balance issues, and joint instability caused by the higher levels of relaxin. Individual variations are manifested by weight gain—being between 15 and 30 pounds—and also whether the baby is carried high or low in the abdomen.

Exercising while Pregnant

- When starting a warm-up, a pregnant woman's heart rate is elevated due to the extra load on the cardiovascular system caused by the

increased blood volume, so exercise should begin very gently and remain at a low intensity, which will also help to reduce risks associated with joint stability.

- The center of gravity change makes speed of movement and direction changes more difficult, so a gradual buildup is required. Generally, body temperature will already be raised, so the warm-up can usually be shorter than normal.
- Furthermore, cardio needs to be simple because **proprioception**, which is the body's ability to know where it is in space, can be reduced. Therefore, agility challenges should be avoided, particularly later in the pregnancy. Because the heart rate is already higher than usual, the workload will need to be lower than a normal workout to achieve a training effect.
- The workout also needs to remain below the **anaerobic threshold**, which is where lactic acid builds up when we start to fatigue, because this can be an issue for the growing baby.



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The endorphin release from exercise can help ease pain and lift the mood of pregnant women.

- Restricting to low-impact exercise from the second trimester onward will reduce stress on the pelvic floor and the unstable joints between the pelvis. Exercising pulse shouldn't exceed 70% of your maximum working heart rate, and a maximum of 20 minutes of exercise is the recommended limit in the early postnatal period. Cardio is valuable to help reduce weight, but it should be very gentle and low impact.
- Muscle toning exercises need to incorporate a focus on correct posture due to potential instability. Isometric options, where there is no movement (such as holding a particular position), should be avoided because this can lead to blood pressure increases.
- Due to supine hypotensive syndrome, exercises that require the mother to lie flat on her back are not recommended from around 20 weeks onward. Once the baby starts to show in the stomach, usual abdominal exercises are not ideal because they put stress on the muscles that are already being stretched and weakened.
- The presence of high relaxin levels implies that extra care will need to be taken with flexibility workouts. If you push any stretches too far during pregnancy or early in the postpartum period, the ligaments may be caused to slacken, and this could remain after the birth, leading to unstable joints. Some stretches can be hindered by developing babies and the increased body fat, so experimenting with different positions to find comfortable options is required.
- Psychological benefits commonly affected by pregnancy can include anxiety, forgetfulness, and feelings of isolation. Therefore, doing crossword puzzles and engaging in adult learning are great ways to occupy the mind, create a positive distraction, and help improve mental fitness.

Amending Exercise Techniques

- When pregnant, squats may need to be restricted so that your heels always remain in contact with the floor. Stability is important, so

you should evenly spread your weight rather than favor one leg because this can cause stress to the sacroiliac joint.

- To protect the lower back, side bends should be supported. Put your hand on the top of your thigh, lift your other hand up, and bend sideways.
- Lifting your leg should be done with a focus on keeping the pelvis centered. Try to avoid side-to-side shifts because this can cause problems for the symphysis pubis.
- Standing and sitting exercises should be done with bent knees because straight legs can cause the hamstrings to pull the pelvis into a tilt that stretches the lumbar spine.
- Abdominal exercises should include just pelvic tilts—lying on your back, tilting the pelvis upward and back down. You can also roll onto your side, supporting your weight with your elbows and knees in what is called a **hip hitch**, lifting the hip away from the floor and back down. Try not to twist.
- The platform of all exercise is the concept of overload, which involves stressing the body systems more than they're used to dealing with. Rather than seeking to greatly improve fitness levels, pregnant women should apply gentle overload.
- In terms of frequency, some mothers-to-be will feel they can manage exercise every day while others may struggle to meet the minimum requirement of 2 times per week. A sensible target is to aim to exercise every alternate day.
- Intensity is usually measured by your heart rate, but this can be already elevated to begin with, so it's best to listen to your body. A rough guide to heart rate level is when breathing rate increases, but it's still possible to talk.

- Duration of exercise varies among individuals and with different energy levels on different days. The mode of exercise is also a matter of personal preference, but as the weight of the baby increases, exercising in water becomes more appealing because the water's buoyancy takes stress away from the pelvic floor and joints while the resistance from the water provides a toning effect on the muscles.
- Reversibility—the fact that fitness levels decline, muscles weaken, and joints stiffen if we don't do regular exercise—is a strong reason for continuing to exercise throughout the full pregnancy term.

Postnatal Exercise

- Exercise shouldn't begin until after the customary 6-week postnatal examination, when many of the changes that occurred have already begun to revert back to prepregnancy status. However, it will take months for many changes to occur.
- Following the baby's departure, the mother's center of gravity will begin to shift back toward the norm. Often, weight loss will occur naturally, taking anywhere between 3 and 12 months, and cardio is vital to encourage this process. At this stage, engage in low-impact exercise.
- Because the abdominal wall can be stretched as much as a staggering 8 inches in length and an even more incredibly 20 inches in width, it's important to begin toning your abs as soon as possible. Isometric, or static, contractions are the starting point.
- The pelvic floor muscles have been stretched and need some time to heal, so with abdominals, static toning exercises should be gradually introduced after the 6-week period.
- In general, postnatal exercise should begin gently. Don't push stretch positions too far, and only hold them for 15 seconds. Try to schedule exercise for times after feeding rather than before. Aim for

3 to 4 sessions per week, building incrementally up to 20 minutes if you can.

Important Terms

anaerobic threshold: The point at which lactic acid builds up in the body when a person starts to fatigue.

diastasis: The separation of parts that are normally joined together.

hip hitch: The act of lifting the hip away from the floor and back down.

linea alba: The tendinous line in the middle of the abdominals.

proprioception: The body's ability to know where it is in space.

relaxin: A hormone that has the effect of loosening the ligaments.

sacroiliac joints: The point at which the 3 pelvis bones meet.

supine hypotensive syndrome: A condition in which lying on the back can result in the weight of the baby resting on the main blood vessels, causing them to pinch, which could temporarily restrict the blood supply flowing back up to the heart and, in turn, the supply to the mother and baby as a whole.

symphysis pubis: The point at which the 2 pubic bones meet.

trimester: A period of time that lasts 3 months and is used to divide a woman's pregnancy into 3 stages.

Refuel, Recover, and Reenergize

Lecture 8

The key to achieving your weight loss and fitness goals might not be your workouts but, rather, what you do between them. Adequate recovery will not only enable you to derive optimum benefit from your exercise regime, but it will also reduce your risk of injury and promote a general feeling of well-being that will help to keep you in a positive mindset as you progress along your fitness journey. Although there's no proven consensus on a one-size-fits-all strategy for recovery, monitoring your exercise performance and adjusting your workouts accordingly is an essential ingredient.

Recovery and Fatigue

- In its most basic form, **recovery** is the ability of our bodies to meet the demands of future activity. In physiological terms, it's a multifaceted concept that includes the lowering of the blood pressure, the return to normal of the cardiac cycle, the replenishment of blood glucose and muscle glycogen energy stores, and the replacement of key cellular enzymes that govern the use of fuel sources.
- Recovery actually begins during exercise, which is known as **immediate recovery**. There are 2 other major types of recovery: **Short-term recovery** is the recovery that occurs between sets of exercises or between intervals in a session, and **training recovery** is the recovery that occurs between workouts, races, or matches.
- Failure to recover properly will lead to **fatigue**, which can be defined as an exercise-induced reduction in the ability to generate force or maintain an exercise intensity.
- Fatigue can take 2 forms. **Central fatigue** refers to the effect of messages in motor pathways from the brain and spinal cord to the muscles that leads to a reduction in effort or complete cessation of

activity. This response is thought to be a self-protective reaction to the possibility of injury from excessive physical exertion.

- **Peripheral fatigue** describes the point at which the protein filaments in the muscle fibers that are responsible for contraction cease to respond to neural stimulation. This is then combined with the depletion of glycogen stores in the muscle, so no fuel is available to prolong the exercise efforts.
- Fatigue can manifest itself in a number of different ways, including drop in performance, loss of appetite, interrupted sleep patterns, gastrointestinal issues, muscle soreness, and increased risk of infection. All of these will adversely affect your exercise program and slow your progress toward your weight loss, fitness, or sporting goals.

Accelerating Your Results

- In general, the more stressful your workout is, the more muscle groups will be recruited, which leads to greater damage to the muscle fibers, so you should rest longer between workouts.
- The most important aspect of recovery is refueling. Exercise will not only deplete your energy stores, but it will also cause your muscles to break down at a cellular level, so you need to consume both carbohydrates and protein. Your body stores energy in the form of glycogen in both the muscles and the liver, and the energy is provided by the carbohydrates in your diet.
- You should begin replacing fuels—by consuming high glycemic index carbohydrates such as pretzels or energy drinks—within 30 minutes after exercise. You need to quickly replace the glycogen because it is essential for building adequate glycogen stores for your next workout.
- Easily digestible proteins should also be taken within 30 minutes after your workout. Examples are egg whites and protein shakes, both of which are easily digested. Your refueling efforts should

continue with a meal around 2 hours later that consists of low glycemic index carbohydrates (such as whole wheat pasta or vegetables) combined with lean protein (such as turkey or chicken) and some fatty acids (such as omega-3, which can be found in oily fish and nuts).

- Carbohydrate requirements for moderate activity levels are around 5 to 7 grams per kilogram of your body weight per day. Protein intake, however, should be about 1.2 to 1.4 grams per kilogram of your body weight per day.
- Dehydration during or just after exercise can cause your blood pressure to drop, making you feel sick and possibly increasing the chance of developing exercise-related health conditions. It is vital to drink lots of fluids before, during, and particularly after exercise because replacing lost fluid promotes the removal of toxins and waste products from your muscles, speeding up the recovery period.



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It is important to drink water, or other types of fluids, during exercise to replace what you sweat out.

- The American College of Sports Medicine recommends that you drink 2 to 3 cups of water 2 to 3 hours before your workout. Recent studies have shown that beginning your workout properly hydrated improves performance and recovery.
- During your workout, drink 0.5 to 1 cup every 15 to 20 minutes—or more if you sweat excessively. After your workout, drink around 2 to 3 cups for every pound of weight you lost during the workout.
- After long workouts or endurance events, sports drinks can speed recovery more effectively than water alone. Sports drinks can be classified under 3 headings due to their varying concentrations of carbohydrates and electrolytes.
- **Isotonic drinks** have a similar concentration of carbohydrates to body fluids, so they are quickly absorbed and are useful for tackling thirst during a workout or sports participation. **Hypertonic drinks** contain a higher percentage of carbohydrates, so they are useful for recovery after a long workout or an endurance event. **Hypotonic drinks** have a low carbohydrate concentration, so they are useful for sports participants to rehydrate when lots of energy is not required—perhaps for activities that involve more skill than physical exertion.
- The need to take additional nutritional supplements depends on the intensity of your exercise program in addition to the quality of your diet. Supplements can be categorized as performance enhancing, or ergogenic—such as caffeine and creatine—or they can be used for general health, such as omega-3 fish oils.
- In the case of exercise recovery, L-carnitine and magnesium are recommended. Some antioxidants, such as vitamins C and E, are reported to help reduce muscle damage and, therefore, enhance the speed of recovery.

- In the right conditions, supplements can be of benefit, but they should never be relied upon as a substitute for good nutrition and should always be used under a physician's guidance.
- Taking a plunge in an ice bath is now a common practice among elite athletes in a wide number of different sporting disciplines to help them recover faster and reduce muscle soreness following intense training or competition. It serves to reduce the swelling and the degree of tissue breakdown. Additionally, when you get out of the ice bath and your core body temperature begins to increase again, this leads to an increased blood flow, which assists the healing process.
- Another approach involves alternating between bathing in hot and cold water to speed up the recovery process. This works by alternately constricting and dilating the blood vessels, which helps to flush away the toxic waste products, such as lactic acid, in the tissues. Research has also found that this contrast water therapy can help to reduce the muscle soreness that is usually felt in the 24- to 48-hour period following an intense workout.
- Adequate, good quality sleep is essential for the regular exerciser because it is the time during which your body produces growth hormones, which play a significant role in tissue growth and repair.
- Studies have shown that sleep can be split into 1.5-hour cycles and that you will feel more refreshed if you awake at the end of a cycle rather than midway through—for example, if you awake after 6, 7.5, or 9 hours. Evidence also suggests that a 20- to 30-minute nap during the day can bring positive benefits.

Stretching to Prevent Injury

- Research shows that it's better to warm up before workouts and to do active stretching after a workout. Before your workout, you should carry out a few dynamic, mobilizing movements that begin with small movements around each of your major joints and then gradually become larger as your body temperature increases.

- The goal of warming up is to get synovial fluid, which acts as lubrication, into the joints. In addition, you are trying to increase your heart rate and body temperature.
- Start by tilting your head to the side and bringing it back up, working through your range of movement. Don't let any of the movements become jerky. Then, make circles with your shoulders in a backward motion, working through a comfortable range of motion. Start incorporating your elbows, increasing the range of motion. At your own pace, involve your full arm, keeping your abs in tight. Then, make circles with your shoulders in a forward motion, slowly incorporating your elbows and then your full arms.
- Next, work through the trunk of your body. Begin by doing a little twist, and lift your foot onto your toe so that you can twist without any torque through the knee. Let your arms hang at your sides. You should begin to feel your body temperature rising a little. Then, hunch over, curving your spine in and then relaxing it, which will work through the joints in the lower spine.
- Then, do some small squats that aren't too low, pressing into your heels. Your abs should be in tight, and you should be working through your knee and hip joints—working your glutei and the muscles in the front and back of your thigh.
- Next, move your feet out a little bit wider, and point your knees and toes out slightly. Shift your weight side to side with a little dip in the middle. Bring your arm across your chest, and then over the top of your head. Then, add both arms, reaching up. Your breathing rate should be increasing slightly. Then, begin curling each heel up to your backside. Next, lift your knees toward your chest.
- Then, begin to march, using your arms and lifting your legs. Slowly work up to a jog, and then build the intensity to jumping jacks. Your heart rate should be increasing, and you should feel a little warmer—ready for your workout.

Postexercise Activity

- After exercising, you should perform static stretches to allow your muscles to relax and return to their resting length. Breathe out as you ease into each stretch—to the point where you feel mild tension in the target muscle. Hold that position for about 30 seconds, and then gently release.
- Your body operates most efficiently when its many systems are functioning in harmony—a concept referred to as **homeostasis**—and optimal recovery is the point at which the body has returned to the same state as before exercise.
- Your muscles are surrounded by a soft layer of connective tissue. Just like the muscles themselves, this **fascia** can become tight, perhaps due to lack of stretching or to not being regularly moved through its full range of motion. This can lead to it becoming stuck to the muscles it encases, forming adhesions, which are often described as a knot in your muscles that may reduce your movement and cause soreness.
- Using a foam roller can help to relieve the tension in the fascia. This technique is referred to as myofascial release and involves applying gentle pressure to the soft tissues while generating traction to stretch it. As a result, the fascia softens and lengthens, which helps to break down any adhesions.
- A foam roller is relatively inexpensive to purchase and easy to use. Place the foam roller on the floor, and then place the body part you wish to target on top of it. Slowly roll backward and forward along the length of the muscle for about a minute. If you find a knot or a particularly stiff area, hold that position and apply a little extra pressure, rocking very slightly forward and backward until it begins to ease.
- Postexercise massage reduces the intensity of muscle soreness. Manual pressure increases blood flow and leads to an increase in muscle temperature, thereby increasing flexibility. In addition, it's

likely that the psychological benefits of massage can help boost your physical functioning, speeding up your recovery.

Important Terms

central fatigue: The effect of messages in motor pathways from the brain and spinal cord to the muscles that leads to a reduction in effort or complete cessation of activity.

fascia: The soft layer of connective tissue that surrounds muscles.

fatigue: An exercise-induced reduction in the ability to generate force or maintain an exercise intensity.

homeostasis: When the body's many systems function in harmony, causing the body to operate most efficiently.

hypertonic drink: A beverage that contains a higher percentage of carbohydrates; it is useful for recovery after a long workout or an endurance event.

hypotonic drink: A beverage that has a low carbohydrate concentration; it is useful for sports participants to rehydrate when lots of energy is not required.

immediate recovery: The type of recovery that begins during exercise.

isotonic drink: A beverage that has a similar concentration of carbohydrates to body fluids, so it is quickly absorbed; it is useful for tackling thirst during a workout or sports participation.

peripheral fatigue: The point at which the protein filaments in the muscle fibers that are responsible for contraction cease to respond to neural stimulation. This is then combined with the depletion of glycogen stores in the muscle, so no fuel is available to prolong the exercise efforts.

recovery: The ability of the human body to meet the demands of future activity. In physiological terms, it's a multifaceted concept that includes the

lowering of the blood pressure, the return to normal of the cardiac cycle, the replenishment of blood glucose and muscle glycogen energy stores, and the replacement of key cellular enzymes that govern the use of fuel sources.

short-term recovery: The type of recovery that occurs between sets of exercises or between intervals in a session.

training recovery: The type of recovery that occurs between workouts, races, or matches.

Thinking—The Brain-Body Connection

Lecture 9

Although the precise program design for exercise to impact mental health is not certain, there is no question that physical activity has a positive influence on brain function. Regular exercise taps into your ability to handle the multitude of challenges that life can throw at you. Exercise enables you to feel more alert and, therefore, more aware and more able to savor every second of the day by being present in the moment. Mental fitness is a journey—not a destination—so keep working at it and enjoying the gains you will undoubtedly make along the way.

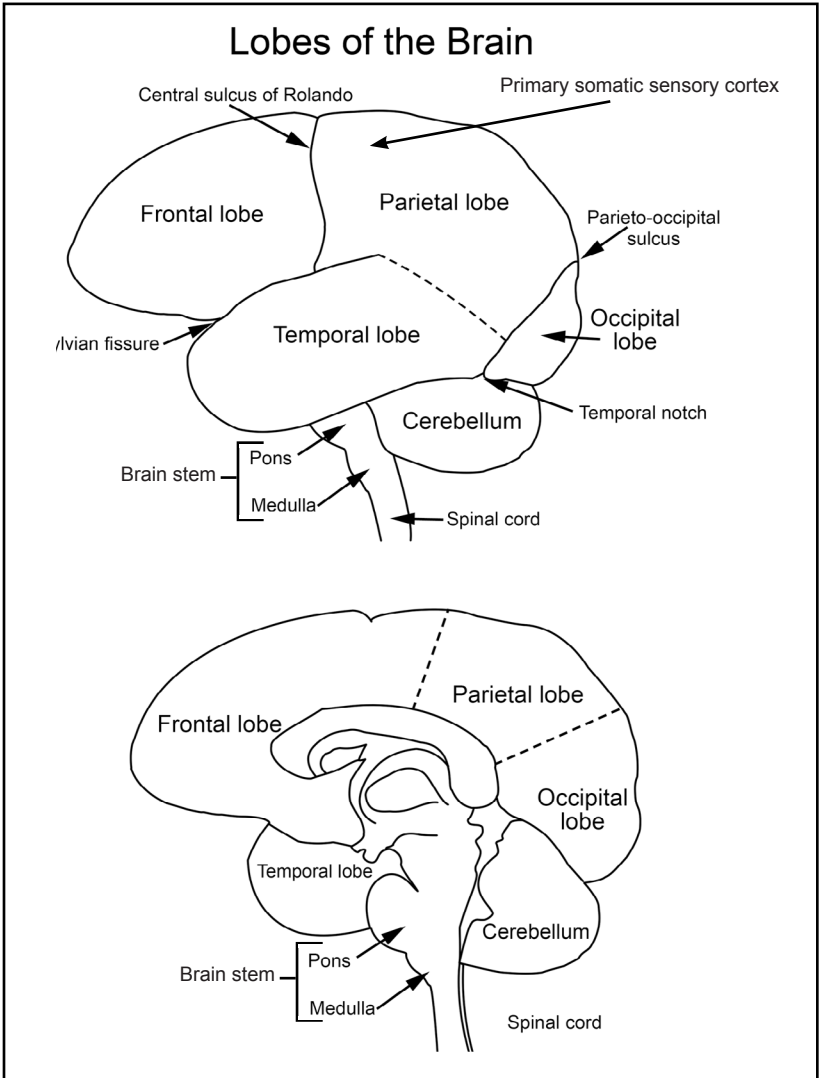
Mental Health and the Brain

- Mental health is one of the platforms for good quality of life. It involves how we feel about ourselves and others—as well as how we think. It reflects our ability to build and maintain relationships with others and how we accommodate change in our lives.
- The medical community faces significant numbers of patients with mental disorders. Fortunately, exercise has the potential to make a difference by directly treating and preventing the more common mental disorders and improving both health and quality of life for sufferers.
- While a single exercise bout can tackle a temporary or acute negative mood state, more ingrained chronic conditions will take weeks or even months for exercise to have an uplifting effect.
- The average brain weighs around 3 pounds, is made up mostly of water, contains about 100,000 blood vessels, has approximately 100 billion neurons, and uses about 20% of your oxygen supply.
- **Neurons** are the cells that combine to form the nervous system and transmit information through both electrical and chemical means and are responsible for the estimated 70,000 thoughts we have

each day. We can continue to grow neurons throughout our life if we constantly challenge ourselves to learn new facts, activities, and skills.

- The lower part of your brain, the **brain stem** that connects to the spinal cord, is responsible for your heartbeat, breathing, digestion, and circulation of the blood around your body—but also for keeping you awake and alert. The **cerebellum** is the bottom rear portion and governs movement by controlling balance and muscle contractions.
- The **frontal lobe**, the top front portion of the brain, determines emotions and is the logical part involved in solving problems, planning, and organizing.
- In the back region, the **occipital lobe** is where we process visual information; it is where our brain makes sense of the shapes and colors we see.
- At the top, the **parietal lobe** is split into 2 sections, the right and left, and is concerned with spatial awareness on the right side and with language on the left side. This is also where the **primary sensory cortex** that controls the sense of touch is located.
- Like the parietal lobe, there are 2 **temporal lobes**, one on each side, and they're at about the level of the ears. The right lobe is involved with visual memory while the left lobe is concerned with verbal memory.
- It appears that exercise mostly affects the areas of the brain associated with memory, organization, performing more than one task, and handling doubt or uncertainty. These are the areas that are known to significantly decline with age, so the value of exercise in maintaining mental agility in later years is evident.
- Experts suggest that a combination of cardiovascular, strength, and flexibility training is probably the most effective recipe for inducing positive change. These are also the components of a healthy body.

Figure 9.1



The location of the four lobes of the cerebral cortex on the lateral and medial surfaces of the brain.

It is the mix of these 3 different exercise modes that is thought to encourage a wide spectrum of neural and chemical changes, including the growth of new nerve cells that has been shown to improve brain function.

- Furthermore, exercise results in an increase in the number of **neurotransmitters**, which are the chemicals responsible for conveying nerve impulses between neurons in the brain. Additionally, cardiovascular exercise can lead to the formation of new blood vessels, improving the supply of oxygen to the brain and thereby enhancing its capability.

Exercise as Treatment

- Exercise can be a useful mode of intervention, resulting in positive physical changes in the brain's chemistry. Studies suggest that exercise could be a useful component in the treatment matrix, particularly because—unlike some medications—there are no associated side effects. Work with your doctor to see if you can supplement your treatment with an exercise regimen.
- Exercise has been shown to reduce levels of anxiety and stress by helping to dampen the physiological responses to stressful situations. Importantly, it can provide a healthier alternative coping mechanism than alcohol or smoking, which are often used when anxious.
- A number of studies have documented that subjective well-being is higher in regular exercisers. In addition, self-esteem, generally accepted as the most valid single indicator of mental health, is encouragingly susceptible to upward shift as a result of regular exercise and is an established target outcome of exercise programs in addressing low-level mental disorders, such as lack of self-worth.
- Cognitive function in elderly adults has been linked to fitness levels through the testing of reaction times. This is of great importance because those with greater mental alertness are less prone to falls.

- According to the National Sleep Foundation, approximately 1/3 of adult Americans suffer sleep problems, with 1/2 of these reporting them as chronic disorders. Exercising, especially in bright light, has been shown to improve length and quality of sleep for both insomniacs and nonsufferers.
- Just as mental illness can present different symptoms in different people, the response to exercise is also individual. Unfortunately, it's not possible to define what method of exercise and mix of variables will produce the optimum results for everyone.
- An exercise regime might need to be adapted as an individual progresses through the course of treatment—something that's impossible to quantify. A certain degree of trial and error needs to be applied to discover plans that suit individual preferences and that will lead to adherence, which is vital in the long term.
- Workouts need to be challenging but noncompetitive. Try to include a focus on mastering new skills. Look for activities that involve social interaction. If exercise is used as part of a treatment package, it can be as effective as psychotherapy and medication.
- Exercise has fewer negative side effects than medication—typically using selective serotonin inhibitors—and actually has several positive side effects, including reduced risk of heart disease, obesity, osteoporosis, and stroke. Through regulation of growth factors and reduction of peripheral and central risk factors, exercise also ensures successful brain function.
- Exercise is a behavior change that is sustainable, becoming a significant part of a healthy lifestyle. Exercise doesn't carry the stigma that is sometimes linked with treatment that involves drugs and psychotherapy. Also, exercise can be applied to patients displaying a mix of mental and even physical conditions.

Exercise and Alzheimer's Disease

- According to the Alzheimer's Association, Alzheimer's disease affects over 5 million Americans, and this is predicted to rise quite considerably—with estimates of over 13 million by 2050.
- In addition to causing distress to family members who see how it affects a loved one, Alzheimer's can also lead to high levels of stress because those same family members often end up having to take on the caregiver's role.
- While we know that our brains, just like our bodies, will change with age, difficulty in retaining newly learned information is a common early sign of Alzheimer's. Symptoms become worse as the condition progresses, leading to confusion, mood swings, and even difficulty accepting help from family and friends.
- One of the biggest issues in treating sufferers is that they don't recognize or accept they have the condition, which is particularly concerning because early diagnosis and treatment can make dramatic improvements in the quality of life.
- Research shows that exercise is one of the treatments that should be considered. Although the exact mechanisms by which exercise affects sufferers is still somewhat vague, exercise should be recommended to counter Alzheimer's symptoms but also to provide preventative care.
- It has also been suggested that physical activity has beneficial effects on the **hippocampus**, which plays a role in memory function. The amount of exercise that seems to make a difference is in line with the American Heart Association's recommended guidelines—30 minutes of exercise 5 times per week.

A Mental Approach to Physical Activity

- **Imagery** is defined as using some or all of your senses to create an experience in your mind. The point of imagery is that the brain

interprets it as a real situation so that you'll be prepared with the appropriate responses if and when the situation actually happens.

- There's an abundance of scientific and academic evidence to support the positive effects of using mental training techniques, but the problem is that they can't really be measured.
- Research shows that using imagery in the moments directly before an event has a distinctly favorable influence on performance. Research also suggests that imagery can be used beyond physical endeavors to enhance confidence, boost motivation, and reduce anxiety.
- To make imagery work for you, start by defining the things that you can aim for on a daily basis, giving you something to focus on. These goals can be as simple as deciding to take the stairs a bit faster every week until you can run up them or doing lunges behind your office door every time you're upset at work.
- Try to identify your negative thoughts, acknowledge them, and then propose a solution. You may still carry the same negative thoughts with you even after you've overcome them, so try to diminish them by focusing on the positive things in your life.
- Concentrate on your goals and keep reminding yourself that you can and will achieve them because the positive reinforcement will serve to drive you to actually hitting the targets you set for yourself each day.
- Imagine how you will feel when you miss your goals on a particular day. The key is to be proud of where you are and to tell yourself that you have the tools to make things better so that you will be able to knock down those goals tomorrow.

Recipe for Happiness

- If you can simply choose to be happy, then you will be happy. There is a strong link between outcomes and outlook: You choose your outlook, and it determines the outcomes of whatever you set out to do.
- The next time somebody asks you how are you, don't reply with a grumble; rather, tell them you feel great and recount the last good thing that happened to you.
- If things start to stress you out during the day, take 1 minute in a quiet place and write a list of the 5 things that are most important to you.
- Making decisions is an empowering process, so think about a recent decision you made that was successful. Remember that you also have the authority and power to decide to have a good day.
- Lead by example. If you want others to love you, love them. If you want to be trusted, trust others. If you want enthusiasm, be enthusiastic.
- Try not to think of work as a chore—something that prevents you from enjoying life. Work allows you to be creative and to show others, not to mention yourself, what you can do when you set your mind to something. When you feel positive about your work, it's amazing how much better you will perform.
- Laughter is the gatekeeper to happiness; you can't laugh and feel down. The best happiness of all is the knowledge that happiness needs no reason.
- Take a few moments to write down a few things that you are grateful for at the end of each day. More importantly, try to read the list when you awake the next day, before setting off to face the new day ahead.

Important Terms

brain stem: The lower part of the brain that connects to the spinal cord and is responsible for the body's heartbeat, breathing, digestion, and circulation of the blood around the body—and for keeping a person awake and alert.

cerebellum: The bottom rear portion of the brain that governs movement by controlling balance and muscle contractions.

frontal lobe: The top front portion of the brain that determines emotions and is the logical part involved in solving problems, planning, and organizing.

hippocampus: The part of the brain that plays a role in memory function.

imagery: The act of using some or all of your senses to create an experience in your mind.

neuron: A cell that combines to form the nervous system and transmit information through both electrical and chemical means and is responsible for the estimated 70,000 thoughts we have each day.

neurotransmitter: A chemical that is responsible for conveying nerve impulses between neurons in the brain.

occipital lobe: The back region of the brain that is responsible for the processing of visual information.

parietal lobe: The top region of the brain that is split into 2 sections, the right and left, and is concerned with spatial awareness on the right side and with language on the left side.

primary sensory cortex: The part of the brain that controls the sense of touch and is located within the parietal lobe.

temporal lobe: The middle region of the brain that is split into 2 sections, the right and left, and is concerned with visual memory on the right side and with verbal memory on the left side.

Healthy Joints for Life

Lecture 10

In this lecture, you will learn about the incredible system of levers that form the joints within the human body. You'll also investigate the different structures and functions of the joints and explore the movement capabilities of the human skeleton. The goal of this lecture is to help you understand all the major joints of the body and why exercise is so important for their health and longevity. Furthermore, you'll be introduced to the most significant joint problems and what you can do to overcome them.

The Skeletal System

- The skeletal system is composed of an interlinked structure of bones, joints, and cartilage. Without this frame, we would be unable to perform exercises but also everyday movements.
- The skeleton allows for movement by providing a series of independent levers that can be moved by shortening the muscles. The skeleton provides a framework that supports the soft tissues and provides attachment sites for the muscles. It also serves as protection for our vital organs, which is essential for survival. Surprisingly, male and female skeletons differ only very slightly.
- Joints occur where bones meet, and they can be split into 3 categories. Immovable joints can be found where bones are joined either by cartilage or dovetailed edges to the bones—for example, the sutures of the skull, where adjacent bones of the skull meet.
- Partially movable joints are joints with ligaments or fibrous cartilage between the bony surfaces—for example, the vertebral column.
- Freely movable joints feature ends of bones that are covered in cartilage and are connected by a fibrous capsule—for example, the hip and shoulder joints. The inner layer of the fibrous capsule is

known as the **synovial membrane**, which is why freely movable joints are also called **synovial joints**.

- Synovial joints are encased by a capsule that encloses the joint cavity and is attached to the **periosteum**, which is the layer of connective tissue that surrounds the bones. The joint capsule provides support to the joint. The inner layer of the synovial membrane secretes **synovial fluid**, which is a vital lubricant that helps reduce friction at the joint but also provides nourishment for the articular cartilage that covers the end of the bone. The purpose of the articular cartilage is to help with shock absorption and to reduce friction.
- Warming up prior to exercise is such an important concept because a vital result of moving the joints through their ranges of motion is to stimulate the synovial membrane to produce lubrication in the form of synovial fluid. This will then reduce friction and enhance the shock absorption of the articular cartilage, directly affecting the smooth performance of joint movement and, therefore, diminishing the risk of injury.
- There are 6 different types of synovial joints. With gliding joints, movement occurs over a flat surfaces—for example, the carpals in the wrist. Hinges allow for movement in one plane only—for example, the elbow. A pivot is purely to provide rotation—for example, the atlas in the neck that enables you to turn your head. A condyloid joint allows movement to occur in 2 planes—for example, in the wrist between the ulna, radius, and carpals. A saddle joint is similar to a condyloid joint, but the bone surfaces are concave and convex—for example, at the base of the thumb. Ball-and-socket joints are highly movable, affording tri-planar capability—for example, the shoulder joint.

Joint Movement

- Joints are positioned to be able to perform a wide array of different movements. Joint movements are labeled from a position of

standing erect with your feet and palms facing forward, known as the anatomical position.

- **Flexion** describes a reduction in the angle at a joint, or bending—for example, bending the leg at the knee.
- **Extension** involves increasing the angle at a joint, or straightening—for example, straightening the arm at the elbow.
- **Hyperextension** refers to the continuation of extension beyond the anatomical position—for example, continuing to move the spine beyond the normal position after standing straight up.
- **Adduction** describes bringing a limb toward or across the center line of the body—for example, crossing your legs.
- **Abduction** defines movement of a limb away from the midline of the body—for example, lifting your arm to the side.
- **Elevation** refers to raising a joint—for example, shrugging your shoulders.
- **Depression** refers to pulling a joint down—for example, dropping your shoulders. Depression is the counter movement to elevation.
- **Lateral flexion** defines sideways bending—for example, tilting your head.
- **Lateral extension** is the return from a sideways position—for example, straightening up after bending to the side through the trunk.
- **Horizontal flexion** describes a forward movement in a horizontal plane—for example, bringing your arms to the center after they've been out to your side.

- **Horizontal extension** is the backward movement in a horizontal plane—for example, swinging your arms behind you.
- **Rotation** can be inward or outward—for example, the movement of the hip joint.
- **Circumduction** involves performing a full circle. Circumduction is unique to the shoulder joint.
- **Pronation** is the inward turning of the palms.
- **Supination** involves turning your palm upward.
- **Plantar flexion** refers to pointing the toes downward, toward the soles.
- **Dorsiflexion** refers to pulling the toes upward, toward the body.
- **Protraction** refers to extending a body part forward—for example, sticking out your chin.
- **Retraction** refers to pulling a body part backward—for example, pulling your shoulders back to stretch your chest.

The Vertebral Column

- The key part of the skeleton is the vertebral column, or backbone, which is made up by the joints of 33 bones. These divide into 7 cervical vertebrae within the neck. The top vertebra is the atlas that supports the skull and then links to the axis, the second vertebra, by a highly flexible pivot joint, which allows for the many necessary movements of the head.
- Twelve thoracic vertebrae form joints with the ribs, creating a rib cage that protects many vital organs found in the trunk area. The 5 lumbar vertebrae are the largest bones of the spine and are also the strongest; they are required to support the rest of the column and to accommodate the force generated by loads that we carry. The 5

bones that make up the sacrum and 4 bones that form the coccyx are 2 sets of fused bones, so they don't allow for any movement.

- The joints between the 24 movable vertebrae form a flexible column that supports the head and trunk but also encases and protects the spinal cord. Sitting neatly between each of the bones of the spine is a fibrous cartilage mass known as the **intervertebral disk**, which acts as a shock absorber.
- Rather than sitting one directly on top of the other, the bones of the spine form 4 gentle curves: the cervical curve, the thoracic curve, the lumbar curve, and the sacral curve. The cervical and lumbar curves are concave, or curve forward, whereas thoracic and sacral curves are convex, or curve backward.
- These curves center the head on top of the body and reduce impact forces traveling along the spine, helping to protect the skull and the pelvis at either end—along with their valuable soft tissue contents. The curves also make it easier for us to stay upright when we're walking.
- There are a number of conditions that can affect the curves of the spine and present problems such as pain, stiffness, and fatigue—in addition to poor posture, which can lead to reduced functional performance of the limbs.
- **Kyphosis** is an exaggerated rounding of the thoracic spine—a hunched position sometimes known as dowager's hump—that can result from growing issues during adolescence, degenerative disease such as arthritis, compression fractures, prolapsed disks, and even lazy posture.
- **Lordosis** is a curvature of the lumbar spine that makes the backside stick out and can be caused by poor posture when lifting and carrying items or development problems as a result of pregnancy issues.

- **Scoliosis** is described as a side-to-side curve in the spinal column that leads to an “S” or “C” shape rather than a straight line when viewing from the rear. It is a spinal deformity that is usually due to a congenital defect but can also be caused by incorrect posture.

Arthritis and Its Effects

- The Centers for Disease Control and Prevention claim that arthritis is the most common cause of disability in the United States, affecting about 50 million adults and usually manifesting itself as pain, stiffness, loss of function, and loss of independence.

- **Arthritis** is an umbrella term for a large number of rheumatic diseases that affect the joints and the soft tissues around them, including conditions such as childhood arthritis, fibromyalgia, and lupus that affect both sexes, all ages, and every ethnic group.



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- **Osteoarthritis** is the most common form of arthritis and is caused by the degeneration of the hyaline cartilage, which is a key shock absorber on the end of bones when they come into contact with one another. This can result in the unprotected bone ends rubbing against each other, which leads to pain, stiffness, and reduced physical capability.
- Osteoarthritis is commonly seen in the hands, knees, and hips of the elderly, although it results from repeated stresses on joints that

Approximately 21 million people report that arthritis restricts their functional capabilities in some way.

are beyond their ability to withstand such stresses. Exercise is a key component in reducing the effects of this condition.

- **Rheumatoid arthritis** is an inflammation of the lining of the joint capsule that spreads to cause erosion of the cartilage and bone, leading to pain and stiffness—often in multiple joints—and often to visible deformity of the joint. In worst cases, rheumatoid arthritis can affect the blood vessels and lead to issues in a number of organs, including the heart and lungs.
- Excess weight has been shown to increase pain in sufferers of arthritis, so weight management programs—usually the combination of a sensible, healthy diet and regular, varied exercise—are vital.
- As a result of inactivity, arthritis sufferers are at greater risk of lifestyle disease than the general population, so both cardiovascular and strength training are strongly recommended for the many measurable benefits they have on a wide range of health components.

Combating Arthritis

- A program to combat arthritis should focus on improving cardiovascular fitness, enhancing strength, and increasing flexibility because these will lead to greater joint mobility and afford a protective factor to the joints.
- Those affected by arthritis are generally less fit than their unaffected counterparts, so programs should begin very gently. Chosen exercise modes need to accommodate the reduced range of motion due to swelling and bone changes. In addition, variety is recommended rather than repetitive movement.
- When considering cardiovascular exercise, the type of activity is crucial. Choose non-weight-bearing modes of exercise and exercises that require engagement of the large muscle groups through whole-body movements. High-impact exercises are not

recommended, with suitable options including swimming, aqua exercise, dance, and brisk walking.

- As with any exercise session, a careful warm-up that incrementally increases in intensity and raises both the heart rate and the core body temperature is essential. In addition, choose supportive, cushioning footwear for weight-bearing activities that will provide shock absorption.
- Strength training will enable the muscles, tendons, and ligaments to better help stabilize the joints, offering better shock-absorbing benefits and reducing the stress that wears down the articular cartilage that covers the ends of the bones.
- The exercises performed will be selected through trial and error, working within your comfortable range of movement. Allow recovery time for the muscles to refuel and repair; strength training should not be done on consecutive days.
- Flexibility training brings a number of positive benefits but clearly is of extra importance for the arthritis sufferer, who faces reduced mobility if no action is taken.

Important Terms

abduction: The movement of a limb away from the midline of the body.

adduction: The movement of a limb toward or across the center line of the body.

arthritis: An umbrella term for a large number of rheumatic diseases that affect the joints and the soft tissues around them, including conditions such as childhood arthritis, fibromyalgia, and lupus.

circumduction: The act of performing a full circle that is unique to the shoulder joint.

depression: The act of pulling a joint down.

dorsiflexion: Pulling the toes upward, toward the body.

elevation: The act of raising a joint.

extension: Increasing the angle at a joint, or straightening.

flexion: A reduction in the angle at a joint, or bending.

horizontal extension: A backward movement in a horizontal plane.

horizontal flexion: A forward movement in a horizontal plane.

hyperextension: The continuation of extension beyond the anatomical position.

intervertebral disk: A fibrous cartilage mass that forms the cushioning between the bones of the spine to allow movement, acting as a shock absorber.

kyphosis: An exaggerated rounding of the thoracic spine—a hunched position sometimes known as dowager’s hump—that can result from growing issues during adolescence, degenerative disease such as arthritis, compression fractures, prolapsed disks, and even lazy posture.

lateral extension: The return from a sideways position.

lateral flexion: Sideways bending.

lordosis: A curvature of the lumbar spine that makes the backside stick out and can be caused by poor posture.

osteoarthritis: The form of arthritis that is caused by the degeneration of the hyaline cartilage, which is a key shock absorber on the end of bones when they come into contact with one another.

periosteum: The layer of connective tissue that coats the outer surface of bone and has a rich supply of blood vessels that provide nutrients for the growth phase and also for repair after injury.

plantar flexion: Pointing the toes downward, toward the soles.

pronation: The inward turning of the palms.

protraction: The act of extending a body part forward.

retraction: The act of pulling a body part backward.

rheumatoid arthritis: An inflammation of the lining of the joint capsule that spreads to cause erosion of the cartilage and bone, leading to pain and stiffness—often in multiple joints—and often to visible deformity of the joint.

rotation: Movement that can be inward or outward.

scoliosis: A side-to-side curve in the spinal column that leads to an “S” or “C” shape rather than a straight line when viewing from the rear and is usually due to a congenital defect but can also be caused by incorrect posture.

supination: The act of turning your palm upward.

synovial fluid: A vital lubricant secreted by the inner layer of the synovial membrane that helps reduce friction at the joint but also provides nourishment for the articular cartilage, which covers the end of the bone.

synovial joint: A freely movable joint.

synovial membrane: The inner layer of the fibrous capsule.

Protecting Yourself from Injury

Lecture 11

The idea of progressive overload is that you need to keep increasing your workload to improve your cardio system and to strengthen your muscles. However, constantly pushing your body to its limits can carry the risk of a number of injuries. To keep your body fully functional, you need preparation, precaution, and prehabilitation—which involves treating injuries before they occur. The goal of this lecture is to establish the greatest injury risks for recreational exercisers, to introduce treatment tactics, and most importantly, to arm you with the knowledge to avoid injury in the first place.

Exercise-Related Injuries

- Although injury can be difficult to precisely diagnose and treat, simple measures such as good flexibility, balanced muscle development, good choice of footwear, and gradual progression of intensity have all been proven to reduce this risk. The earlier help is sought from a medical adviser, the easier it is to treat almost all categories of injury.
- Although muscles are elastic, when a muscle is powerfully contracted or stretched beyond its comfortable range, a strain, or tear, can occur.
- Muscles are attached to the bones with fibrous connective tissues called **tendons**, and they can become inflamed with overuse.
- The **ligaments** are thick cords that connect bones together and give the joints stability, but they can become damaged, causing a sprain if alignment is incorrect and the joint moves in a manner it was not designed to.

- Because bone moves against bone at the joints, there is a need for cushioning, which is the job of the bursas, but these fluid sacs can sometimes become irritated if you attempt to do too much too soon.
- The intervertebral disks of the spine act as shock absorbers and can become damaged over time, particularly as a result of twisting and bending moves when holding weights.
- These mechanical breakdowns explain the pathology of a number of common activity-related injuries. Basketball players, for example, may be familiar with **Achilles tendonitis**, which is characterized by soreness and stiffness at the back of the ankle. This is also common in runners who land on the ball rather than on the heel of the foot. The constant pounding puts stress on the Achilles tendon, causing microscopic tears.
- The solution is to stretch the soleus muscle by performing a normal calf stretch with one leg in front of the other and the rear leg stretched out but bent. It's important to ensure that footwear has good lateral motion control to prevent rotational forces from being transferred to the tendon. If these interventions are combined with a reduction in workload and localized massage, full recovery can be expected.
- For tennis players, a common problem is a piriformis strain. The **piriformis muscle** is deep in the buttock and reaches from the pelvis, or sacrum, to the femur, or upper part of the thigh bone. This muscle can go into spasm, causing an entrapment of the sciatic nerve, leading to a sore hip and pain down the back of the thigh. The problem occurs due to the constant lateral motion that requires repeated, quick changes of weight from one foot to the other.
- The targeted stretch that is useful can be achieved by lying down, lifting your knees up to your chest, and then dropping them to the opposite side from the injured hip and holding for about 30 seconds. To specifically strengthen the piriformis, you can lie face

down with knees bent so that the soles of your shoes are pointing up to the ceiling and squeeze a soft medicine ball between your calves.

- Cyclists are often plagued with **patella tendonitis**, an inflammation below the kneecap that is usually noticed when walking down the stairs. Usually, the problem is the patella not riding correctly in its groove combined with repeated overstretching of the knee through excessive flexion.
- Treatment involves building up strength in the **vastus medialis**, which is the part of the quadriceps that is closer to the center and that helps to pull the kneecap back in line. This can be achieved by focusing on the last 15 degrees of the knee movement on the leg extension machine at the gym or perhaps by performing quarter squats.
- For swimmers, shoulder soreness is a problem, and this can be caused by rotator cuff impingement. The **rotator cuff** is the small group of muscles around the shoulder girdle that connect the upper arm to the shoulder blade. Repeated stress on the tendons of the small muscles that surround and stabilize the shoulder blade when the arm is moving can cause rotator cuff impingement.



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Someone with a leg injury might turn to swimming, instead of doing their usual exercise routine, to stay healthy.

- To help prevent this, bring your arm on the affected side across your chest and use the other hand to stretch it by pulling it in and across, and you'll feel a stretch through the shoulder and the shoulder girdle. You can also hold a resistance band in both hands and then pull your hands out while keeping your elbows glued to your ribs.
- Jogging can sometimes lead to **plantar fasciitis**, a strain of the connective band that maintains the longitudinal arch on the base of the foot, which is stretched basically every time the foot bears weight. This is often caused by running on hard surfaces and manifests itself as a dull ache, usually when you wake up in the morning.
- It will be necessary to reduce your weekly mileage, and you might try some sessions in the shallow end of the pool. It's also wise to choose running shoes with good arch support and even consider using orthotics.
- Competitive runners, as opposed to joggers, need to watch out for **iliotibial band syndrome**, which refers to a friction problem between the thick band of fascia that runs down the outside of the knee and the lateral femoral condyle, or bottom end of the thigh bone. You may notice a clicking and feel sharp pain on the outside of your knee.
- Stretching is essential both in terms of prevention and cure. You can try lying on your side with a foam roller under the affected area and gently rolling up and down so that the roller massages the area and stretches the connective tissue. You'll need to reduce your training load, and it may be necessary to take anti-inflammatory medication.

Stages of Healing

- The first stage of healing is the inflammatory stage, lasting anywhere from 1 to 4 days, in which cells form a clot to seal the affected area. This stops the bleeding, which may be external or internal—as in a contusion, or bruise. Cells known as **phagocytes**

are attracted to the area and absorb the damaged cells that can no longer perform their functions.

- In addition, chemicals are released by the damaged cells that attract white blood cells, which assist in sealing the area, helping to boost oxygenation and bring vital nutrients to aid the healing process. Once the damaged cells have been cleared, the clot that is formed by platelets is then broken down by other cells, known as **fibroblasts**, allowing scar tissue to be laid down.
- Next is the proliferative stage, which usually occurs between 7 and 14 days after the injury. This stage describes the laying down of scar tissue, which is made up of collagen fibers. The process is not very well ordered, so the fibers can be disorganized in their arrangement. As a result, the site may be weak—hence the increased likelihood of a repeat injury. At this time, the original blood clot dissipates, as cells known as **myofibroblasts** work to glue together the torn structures.
- Remodeling occurs anywhere between 14 and 90 days, at which time the scar tissue begins to adopt the function of the surrounding tissues. This stage is influenced by the external stress placed on the area—hence the need for rehabilitation if one is to recover fully from an injury.
- Injuries generally give rise to pain, which is caused by overexcitement of the nerve endings. **Visceral pain** refers to cramping, a deep ache, or a dull throbbing that could be constant or intermittent. It's often a referred pain, so it can be difficult to pinpoint. **Somatic pain** is easier to identify because the injured party can usually point to the exact location, and it can hurt to touch. **Naturopathic pain** relates to damage to the peripheral nerves or even to the central nervous system that manifests itself in contrasting ways—it could be sharp or numbing.

Pain Management

- A significant development in pain management was the realization that preemptive analgesia can block pain before it strikes with a class of painkillers called COX-2 inhibitors. These offer arthritis sufferers the benefits of nonsteroidal anti-inflammatory drugs without the associated negative side effects to the gastrointestinal system and kidneys.
- A pump implanted at a convenient point within the body can deliver small doses of anesthetic every few hours that can inhibit pain without the side effects that higher dosages might elicit.
- Simple tactics such as massage and the application of heat and cold are highly effective.
- Acupuncture is thought to interrupt the flow of pain messages and induces an endorphin release that promotes a healing response.
- Saint John's wort is an herb that is often taken to counter depression and is used to help relieve pain, but research into its effects has not necessarily proven its merit.
- Any activity that stimulates the body to release the natural endorphins can help pain management, so simply watching a funny television show or movie has its value.
- If you are suffering from acute or perhaps chronic injury but don't have easy access to these treatment protocols, use the RICE regime. First, rest: Listen to your body, and take a day off if it's telling you to. Then, ice helps to counter the inflammation caused by injury. Compression will then counter the inevitable swelling following an injury. Finally, elevation will assist your circulatory system as it gradually removes the excess fluid around an injured site.

The Psychology of Injury

- The psychology of injury—in terms of emotional, social, and self-perception dimensions—can be as important as the physiological

implications, such as pain, restricted function, and the rigor of treatment. Psychological state has a direct impact on recovery from injury. Thought patterns can be irrational and lead to cognitive distortion.

- Catastrophizing refers to the exaggeration of the severity of an injury.
- Overgeneralization extends the impact of an injury to areas that are actually unaffected.
- Personalizing relates to the mindset of assuming responsibility for the injury.
- Selective abstraction describes the concept of taking a specific aspect of the injury and blowing it out of proportion.
- Absolute thinking is the idea that your injury is an all-or-nothing situation, leaving you assuming you are no longer of use to your family or team.

Tips to Avoid Injury

- By adequately warming up, you will not only heat your muscles and, therefore, render them more malleable and less likely to tear under stretch, but you will also pump more synovial fluid into your joints, leading to less friction as you move.
- The most common gym injuries are related to poor technique. Be aware of your alignment, ensuring your movement patterns feel natural, and follow the biomechanics of your body.
- Remaining focused will allow you to observe your mental checklist before and during every exercise within your workout, ensuring you are engaging the right muscles at the right time.
- By not giving your body enough time to sufficiently recover—by overtraining—you might head into your next workout before

your stores of adenosine triphosphate and glycogen have been replenished. Without adequate supply of these essential fuels, your regular workouts will be much more stressful.

- Think about tempo. Unless specifically training for power, resistance exercises should be performed slowly to allow you to control momentum and, therefore, range of motion.
- Core stability will lend greater support to your spine during movement, reducing the risk of multidirectional forces causing trauma to the spinal structure.

Important Terms

Achilles tendonitis: A condition characterized by soreness and stiffness at the back of the ankle—in the Achilles tendon.

fibroblast: A type of cell that breaks down the clot that is formed by platelets once the damaged cells in an area of injury have been cleared, allowing scar tissue to be laid down.

iliotibial band syndrome: A friction problem between the thick band of fascia that runs down the outside of the knee and the lateral femoral condyle, or bottom end of the thigh bone.

ligament: A thick cord that connects bones together and gives the joints stability.

myofibroblast: A type of cell that works to glue together the torn structures within an injury.

naturopathic pain: A type of pain that relates to damage to the peripheral nerves or even to the central nervous system that manifests itself in contrasting ways—it could be sharp or numbing.

patella tendonitis: An inflammation below the kneecap that is usually noticed when walking down the stairs.

phagocytes: A type of cell that is attracted to the area of injury and absorbs the damaged cells that can no longer perform their functions.

piriformis muscle: A muscle located deep in the buttock that reaches from the pelvis, or sacrum, to the femur, or upper part of the thigh bone.

plantar fasciitis: A strain of the connective band that maintains the longitudinal arch on the base of the foot, which is stretched basically every time the foot bears weight.

rotator cuff: The small group of muscles around the shoulder girdle that connect the upper arm to the shoulder blade.

somatic pain: A type of pain that is relatively easy to identify because the injured party can usually point to the exact location, and it can hurt to touch.

tendon: A fibrous connective tissue that connects the muscles to the bones.

vastus medialis: The part of the quadriceps that is closer to the center and that helps to pull the kneecap back in line.

visceral pain: A type of pain that is characterized by cramping, a deep ache, or a dull throbbing that could be constant or intermittent. It's often a referred pain, so it can be difficult to pinpoint.

The Amazing Benefits of Balance

Lecture 12

The purpose of this lecture is to investigate balance and to learn exercises that will help you maintain your independence and improve your quality of life. Balance training is not just for the elderly to reduce the risk of falls; it is also an important component of the process of recovering from injury. There are a number of simple preventive exercise measures you can take that can significantly improve your balance. To participate in this lecture, you will need a chair, dumbbells, a fitness ball, and a mat—or similar alternatives.

The Importance of Balance

- Balance is required in nearly every daily activity, but we often take it for granted. Balance is what corrects you if you stumble on uneven ground or if someone bumps into you.
- Balance can be viewed as either a static or dynamic equilibrium. It can also be conscious—when bracing yourself against a stiff wind, for example. It depends on 3 key processes within the body: the visual, vestibular, and somatosensory systems.
- The **visual system** provides information to your brain regarding where the body is in space, how fast it's moving, and details about possible obstacles in the immediate environment by using depth perception and peripheral sight skills.
- The **vestibular system** refers to sensors in the inner ear that respond to the position of your head, causing your brain to send a message to your body to correct itself when you're off center, for example, when you stumble.
- The **somatosensory system** relies upon the sensors in the skin and the muscles to relay information to the brain regarding pressure, touch, and the position of your limbs.

- The combined efforts of these 3 systems is referred to as proprioception, the ability to detect your position in space and to correct it as necessary. Sadly, falls do occur, as we mentioned earlier, particularly in the elderly, and can often lead to a downward spiral.

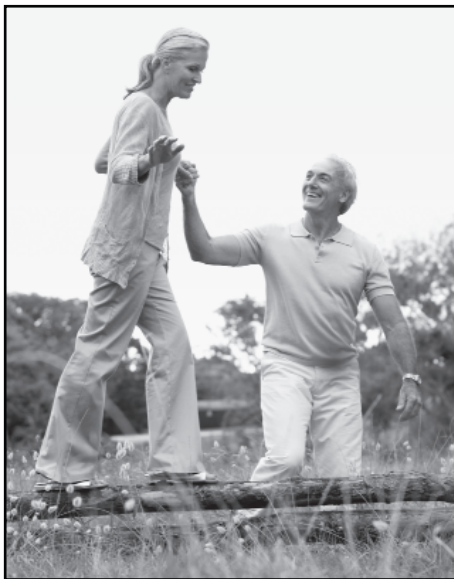
Causes of Falls

- Poor balance is the most important reason that people fall, and it can be caused by the slowing of reflexes due to the aging process. Changes occur within the brain, but weaker muscles and possibly certain conditions—for example, arthritis—can lead to reduced mobility and slower movement.
- In addition, restricted vision is an age-related issue that can result in a diminished appreciation of potential trip hazards. Furthermore, people who have fallen previously are at greater risk of repeat—usually as a result of the fall introducing a fear factor that leads to being less active and, therefore, losing vital movement skills.
- Certain medical conditions may involve dizziness, which leads to an increased risk of falling. In addition, some prescription drugs for a number of conditions are known to carry side effects that include dizziness.
- There are also environment factors: From curbs to rugs or pets in the home, we face many potential hazards every day.
- Falls might not just result in injury, pain, and even disability, but they could also have a psychological impact, including loss of confidence, fear, and perhaps guilt.
- The social consequences of possibly having to be moved into residential care are also associated with financial implications and possible depression of losing contact with friends.
- Exercise can resist or at least soften the influence of fall factors. Practicing movement skills will enable the body and mind to

maintain the complex level of integration required to function optimally. Regular exercise affords an opportunity to repeatedly work on challenging and, therefore, improving balance; nonuse, rather than age, is the biggest culprit.

Measuring Balance

- To measure static balance, use the tightrope stance, which involves putting one foot directly in front of the other and standing still in that position. Hold that position without any swaying of the trunk or shuffling of the feet. If you can't hold that position for at least 10 seconds, it could be indicative of fall risk. Try switching feet and holding again; you may find that one side is associated with better balance.
- Similarly, try standing on one leg—and try it on both sides—for 5 seconds. If you can't hold this position for 5 seconds, that's a small risk factor.
- To measure dynamic balance, use the tightrope walk test, which involves walking through the tightrope stance. Another test is to do a 360-degree spin, which involves standing and turning your body around in a circle. Focus on getting yourself around in as few steps as possible within about 3 seconds.



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It is recommended that the elderly include balance exercises as part of their overall physical activity routine.

Improving Balance

- Your walking pattern can reveal signs of potential balance issues before they arise. Short strides, a slower pace, a wider walking stance, an uneven rhythm, a lowered foot lift, and dragged feet are all signs that your body might be trying to correct your balance.
- Improving balance requires a mix of training techniques in order for an exercise program to be successful. An effective regime needs to incorporate exercises that focus on posture, coordination, reaction speed, strength, and flexibility. Additionally, cardiovascular sessions will have an indirect positive effect by aiding weight management.
- The target outcomes from an exercise regime to reduce the risk of falls includes increasing mobility in the lower back, hip, knee, and ankle; enhancing strength in the deeper postural muscles, calves, quadriceps, hamstrings, glutei, hip abductors, and hip adductors; and improving the ability to change speed and direction with smooth fluidity.

Exercises for Improving Balance

- The following exercises that can help improve your balance offer 3 levels of difficulty for each, so you can choose your appropriate starting point, but you also have the opportunity to progress as you start to find the exercises easy.
- Ideally, you need to warm up before attempting these exercises. You should aim for 12 repetitions of each exercise, but if that's difficult, do as many as you can and commit to increasing the number you complete. Once you can do 12 repetitions with ease, you can move on to the next level of difficulty.
- For these balance exercises, you will need a chair, dumbbells (or a couple cans of beans or bags of sugar), a fitness ball, and a mat (or a towel).
- The first level of the first exercise is a power hop. The aim is to control your side-to-side movement. Start very simply with a

step and touch, taking a step to one side and bringing your other foot to the moved foot and back. Control your lateral movement, which will involve certain elements of deceleration. Sink into the movement a little bit on each side.

- The next level is a hop and touch, which requires you to work a little bit harder to control your lateral movement. Your abdominals should be tight, and you should incorporate a little sink again. Don't jump too high, but continue moving from side to side.
- The third level involves incorporating more of a sink. You're looking to control your momentum with a sink. As soon as you land, bend your knee and soften your ankle to lower yourself into that hop position.
- The next exercise is the lunge. To help with your balance, move your feet hip-width apart. Take one foot back, rest it on the ball of your foot, and lower your body down into the lunge position. Hold your abdominals in tight, keep your head up and your chest lifted, and lower your knee toward the floor and back up. Be careful not to twist your back leg.
- The second level involves lifting your rear foot onto a chair and then lunging down. When you raise yourself from the chair, you'll find that your knee is bent a little less than a 90-degree angle. Make sure you're far enough away from the chair, resting your foot at the back of the chair. In addition, make sure that you're on the ball of your foot and that your hips, chest, and shoulders are facing the same direction.
- For the third level, move the chair out of the way and use the fitness ball. Begin by placing your rear foot on the ball and resting the ball of your planted foot at the back. You might want to bring your hands out to the side as you go down for your lunge position to make this more difficult. If you switch from one side to the other, be aware if one side is weaker and work on that side.

- For the next exercise, you'll need to grab your dumbbells (or any weighted object) in order to do a squat and press. Pick up your weights with your feet about hip-width apart. Keep your abdominals in tight and your shoulders back and down as you bend your knees and sit down into your squat. Go as low as is comfortable for you. Lift up your big toe as you go down, helping you press the weight through the heels, which makes you engage the glutei.
- The second level involves simultaneously squatting and pressing with the dumbbells, bringing the weights above your head as you stand up. Be careful not to lock out your elbows. You'll find that this exercise offers a greater challenge for the abdominals, so you need to pull them in tight as you sit down into your squat.
- For the third level, lose one of the dumbbells and do a single leg squat. Lift one leg and the opposite hand, and as you squat down, press up with the single dumbbell in the lifted hand. You won't be able to squat as low as you did for the previous levels. Keep your abdominals in tight while pressing up.
- The next exercise involves the fitness ball. Start by lowering your body down until your shoulders are on the ball, keeping your hips lifted, and then walk yourself backward so that your midsection is on the ball. The goal is not to wobble; try to keep yourself balanced if you can.
- The second level introduces your abs into the exercise. Start by bringing your elbows back behind your head, and do a sit-up, or crunch, squeezing your ribs toward your hips. Because you're on an unstable surface, you also have the extra challenge of balancing yourself.
- The third level is a difficult exercise. As you're doing your crunches, lift one of your feet off the floor and hold it up.
- The final exercise requires your use of the mat and is slightly different from the previous exercises: Instead of aiming for 12

repetitions, your goal is to increase the amount of time that you can hold a position—challenging your core muscles to maintain good alignment through the spine.

- The first exercise is called a T-stand. Start by lying on one side of your body on the mat. Raise your body up, lifting your body by placing one hand on the mat while your foot on the same side is also in contact with the mat. Your other foot should be resting on top of the foot that is in contact with the mat. You want to maintain a long position—from the top of your head through your tailbone to your heel. Gravity is trying to drop your body onto the mat or to make you twist your body. Your challenge is to stay sideways. Then, lift the arm that is facing the sky.
- The second level involves lifting the foot that is resting on the other foot, which is in contact with the mat. Your arm should still be lifted. The challenge is that your hips are going to want to drop down.
- The third level involves holding the position from the second level but dropping the lifted arm down and then lifting it up repeatedly. The challenge is that you will want to rotate, so you have to try to hold your abs in tight and keep your hips lifted.

Important Terms

somatosensory system: The system that relies upon the sensors in the skin and the muscles to relay information to the brain regarding pressure, touch, and the position of your limbs.

vestibular system: The system that refers to sensors in the inner ear that respond to the position of your head, causing your brain to send a message to your body to correct itself when you're off center, for example, when you stumble.

visual system: The system that provides information to your brain regarding where the body is in space, how fast it's moving, and details about possible obstacles in the immediate environment by using depth perception and peripheral sight skills.

Fueling Fitness

Lecture 13

When your body performs what feels like a basic movement, such as lifting your arms, your body actually performs many steps, and a number of complex processes have to take place. In this lecture, you will learn about human energy and, particularly, about its role in helping you lose weight and maximize your fitness. Furthermore, you're going to discover where energy comes from, the amazing ways in which your body can use it, and how you can optimize its use in exercise.

Essential Fuel for Your Body

- There are 3 essential compounds that your body receives from the food you eat to provide energy for movement. Carbohydrate—found in pasta, bread, and potatoes—is an ideal source of energy because it can be easily converted into **glucose**, the form of sugar that's transported and used by your body for energy. Glucose is stored in both your muscles and liver.
- Fat is vital for your body to function normally and can exist in your body in 2 forms. The kind that is found in places such as your bones, heart, lungs, and kidneys can't be reduced; in fact, your organs wouldn't survive without this fat. Fat is also stored beneath the skin in the adipose tissue, where it serves not only as a fuel source but also as insulation. This is the kind of fat that you can see, and it's also the one you can shed if you want to.
- Protein is vital for growth and repair of your body tissues, but unlike carbohydrate and fat, it's not stored in your body unless there's an excess when leftover protein is converted to fat. Therefore, if you're consuming too much protein, you'll end up putting on extra fat. Protein can be broken down to provide energy—but only during prolonged periods of exertion, such as endurance events.

Energy and Energy Systems

- **Adenosine triphosphate (ATP)** is the chemical in your muscles that breaks down to produce energy and, in turn, relies on the breakdown of carbohydrate, fat, and protein. All biological processes—such as digestion, production of hormones, transmission of nerve impulses, and repair of tissues—demand energy in the form of ATP.
- ATP is composed of adenosine and 3 phosphate groups. Strong bonds exist between the phosphate groups, so breaking 1 of them results in the release of energy. In a muscle cell, the breakdown of ATP results in mechanical work—muscular contraction and heat, which is why you feel warmer when you exercise.
- When ATP loses 1 of its phosphate bonds, energy is produced, and it becomes adenosine diphosphate (ADP). Once this has occurred, ADP is resynthesized back into ATP. This is the ATP cycle, which is important for the constant generation of energy within your body.
- When you first begin to exercise, the demand for energy increases quickly, so your body's store of ATP is used within a couple of seconds. Almost immediately, more fuel is needed to produce more ATP.
- ATP can be resynthesized in 3 different ways. The first 2 systems are **anaerobic**, which means without oxygen, and the third is **aerobic**, which implies that oxygen is present when ATP is being regenerated to keep you on the move.
- The first of these 3 systems is known as the phosphocreatine system, which gets its name from the phosphorous bonds that are required to be broken to produce energy and creatine.
- When you begin exercising, you use your store of ATP in your muscles within a few seconds. However, your body doesn't just shut down after a couple of seconds of exercise because although there's no further store of ATP in your muscles, there is a small amount of **creatine phosphate**, which can't be used directly to

bring about muscle contractions and, therefore, movement—but it can donate a phosphate molecule to ADP, making it ATP in 1 step.

- There's only about 10 seconds worth of creatine phosphate inside the muscle, but there's enough to get you started until more time-consuming processes begin to kick in.
- Although we can get creatine from the meat we eat, it can also be synthesized in our liver, which is great for vegetarian athletes. Your liver puts the creatine into your bloodstream, and then your muscles remove it from the blood according to your needs.
- Blood levels are kept constant, so the more creatine your muscle removes, the more creatine your liver will make. The more you use your creatine phosphate system, the more creatine phosphate you will be able to store inside your muscles, thereby making the job easier for your liver.
- If you're exercising at a very high intensity with repeated bouts, creatine supplementation may be helpful in maintaining creatine levels inside your muscles. This implies that you may be able to perform more intense bouts in a specific amount of time. However, creatine supplementation isn't effective as a performance enhancer under low-intensity circumstances.
- The lactic acid system is the second anaerobic system. In the initial stages of an exercise session, when there's still insufficient oxygen reaching the muscles, glucose is the only fuel source that can be called upon for ATP synthesis.
- Lack of oxygen also occurs whenever you work so hard during your exercise session that you outpace the capacity of your cardiovascular system to deliver to your working muscles all the blood you require. The point when this occurs and your fatigue is dependent upon your fitness level is the anaerobic threshold.

- The breakdown of glucose molecules is very efficient and generates a significant amount of ATP, but the metabolism of glucose ideally needs oxygen. It also needs time because a large number of steps are involved in the process. Fortunately, glucose can travel this pathway without oxygen and produce a little of the ATP we need through a process called **glycolysis**.
- However, this process can deplete your glucose stores quite rapidly, so you can only perform this for a short while. Unless another energy source kicks in, you'll start to fatigue, and you'll have to reduce the intensity of what you're doing.
- Another problem is that glycolysis results in production of a compound called lactic acid, and when lactic acid builds up, it prevents further ATP synthesis and, therefore, further muscular contraction. In these circumstances, you have to decrease the intensity of your workout so that the blood and, therefore, oxygen can get to the muscles.
- In essence, lactic acid prevents permanent damage during extreme exertion because it slows the key systems required to maintain muscle contractions. Accumulated lactic acid is washed out of your muscle cells and taken to other cells and to the liver, which converts it back to glycogen for storage. This energy system allows you to increase your fitness levels by working at a higher rate of intensity.
- The last of the 3 energy systems is known as the aerobic system. Once the blood flow has increased to bring sufficient oxygen to your working muscles, aerobic production of ATP predominantly generates carbon dioxide, which you breathe out, and water, which is why you sweat when you exercise.
- In the presence of oxygen, fat can also be used as a fuel to make ATP because its breakdown shares the same pathway as the aerobic phase of glucose breakdown. This means that limited glucose stores will be conserved for when you really need them—during the more difficult phases of your workout.

Energy Systems in Practice

- At rest, both your aerobic and anaerobic energy systems operate. The relative contribution of each varies among individuals, but the aerobic system often predominates because your cardiovascular system is able to meet the demand for all of the cells in your body that require oxygen at rest.
- As you start exercising, there is an immediate increased demand for energy by your muscles that may not be fully matched by the oxygen delivery, so anaerobic metabolism would dramatically increase while aerobic metabolism would decrease. As a result, the phosphocreatine system would be utilized.
- However, if you warm up carefully and gradually to this intensity, it may be that some aerobic metabolism would take place even from the very beginning. This would gradually increase its contribution as the warm-up proceeds.
- Throughout the warm-up, anaerobic metabolism decreases and aerobic metabolism increases as your heart rate rises until it arrives at its maximum possible contribution—a point referred to as **steady state**, which is the point at which the rate of lactic acid production exactly matches the rate of clearance of it from the cells. The steady state is an intensity that feels comfortable and sustainable for some time.
- As the intensity rises beyond the anaerobic threshold and continues rising, it doesn't mean there's a sudden switch to full anaerobic production of ATP; rather, there would be an increasing shift in the ratio of aerobic to anaerobic metabolism.
- At this point in the workout, the lactic acid is building up rapidly—to the point at which it would stop energy production. The only option is to decrease exercise intensity for about a minute. Once the lactic acid is cleared and your heart rate drops below the anaerobic threshold, a higher workout intensity can be continued.

Training Energy Systems

- The phosphocreatine system increases as a result of doing the sort of training that constantly uses this system, so pushing your body in workouts with short, sharp bursts of high-intensity exercise will result in an increase in your ability to perform such exercise at even greater workloads.
- The lactic acid system, because it's also an anaerobic process, requires the same kind of training as for the phosphocreatine system. When you regularly deplete your glucose stores by doing large amounts of high-intensity training, your muscle cells have to stock up their glucose during rest phases so that your body is ready for the next session. This can only happen if your carbohydrate intake is adequate, and training will result in you being able to increase these stores.
- Leading up to an endurance event, if you train to exhaustion and then consume extra amounts of carbohydrate, you can fill up your stores, resulting in an increased supply that you can use when you need it.



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Sprinters need to generate large amounts of adenosine triphosphate (ATP) in a very short amount of time.

- Adaptations to training your aerobic energy system are far more complex than the anaerobic systems. Appropriate training has 2 main outcomes for this energy system: You want to be able to sustain a steady state at progressively higher intensity levels and progressively increase the proportion of fat compared with carbohydrate that you burn at your steady state.
- The mechanisms by which these adaptations occur are related to how good your cardiovascular system is at pumping oxygenated blood to your working muscles and how efficient your muscles are at removing that oxygen from the blood and using it to generate energy.
- An untrained, unfit individual exceeds his or her steady state at a relatively low intensity level. At a certain point past their threshold, lactic acid builds up inside the muscles to a point where it would inhibit further production of ATP. As a result, muscle contraction will stop—and so will movement.
- The net result is that the balance between aerobic and anaerobic ATP production alters in favor of the aerobic system, and the anaerobic threshold is raised. Because less lactic acid is produced throughout a bigger range of exercise intensities, higher work rates can be sustained for longer amounts of time, leading to more calories being burned for each workout—and a greater percentage of these calories will be fat.
- None of these adaptations can occur unless your anaerobic threshold is regularly exceeded to the point where lactate stops muscular contraction. In other words, you need to overload your present capabilities to improve your future capacity.

Important Terms

adenosine triphosphate (ATP): The chemical in your muscles that breaks down to produce energy and, in turn, relies on the breakdown of carbohydrate, fat, and protein.

aerobic: With oxygen.

anaerobic: Without oxygen.

creatine phosphate: A compound of creatine and phosphoric acid that can donate a phosphate molecule to ADP, making it ATP.

glucose: The form of sugar that's transported and used by your body for energy.

glycolysis: The process through which glucose can produce ATP without oxygen.

steady state: The point at which the rate of lactic acid production exactly matches the rate of clearance of it from the cells. It is an intensity that feels comfortable and sustainable for some time.

Why Everyone Should Exercise in Water

Lecture 14

Exercising in water continues to grow in popularity as the elderly, those carrying injuries, fitness enthusiasts, and even elite athletes begin to appreciate the many ways in which it can help them move closer to their fitness goals. Aquatic exercise allows you to comfortably move your upper and lower limbs through optimal ranges of motion while minimizing the stress on your joints, ensuring you burn calories while toning your muscles and providing the ideal setting for reducing stress and tension.

Exercising in Water

- The Centers for Disease Control and Prevention report that many people enjoy water-based exercise more than exercising on land and that swimmers have about 1/2 the risk of death compared to inactive people.
- For people with arthritis, water-based exercise improves the use of affected joints without worsening symptoms and can decrease pain in some circumstances.
- People with rheumatoid arthritis have more health improvements after participating in hydrotherapy than with other activities. They can also exercise longer in water than on dry land—without increased effort or joint or muscle pain.
- For people with fibromyalgia, exercise therapy in warm water has been shown to decrease anxiety and depression and to improve mood.

Physical Properties of Water

- **Buoyancy** is the degree to which your body floats when it's immersed in water. This has the positive effect of reducing impact on contact with the floor, thereby reducing the stress on the joints. However, it also reduces the body's stability, so you have to engage

the deeper postural muscles to fix your position. Wide-leg stances or movements of the upper body limbs will also help you retain your stability.

- Buoyancy is determined by body composition. Body fat increases flotation whereas highly muscular or lean physiques tend to sink due to muscle and bone being considerably denser than body fat. The distribution of body fat will also affect how the body floats.
- Another factor that determines buoyancy is water depth. The deeper the water is, the greater the flotation effect is due to the decreased activity of gravity. Water cushions movements and, therefore, is ideal as an exercise medium for anyone unable to fully bear their own weight—as would be necessary on dry land.
- In addition to the elderly and those with musculoskeletal injuries, buoyancy in the water guarantees a much more enjoyable exercise experience for obese individuals.
- Resistance provided by the water requires us to exert greater force with our muscles to overcome it, which potentially increases the intensity of a water-based workout. Water is about 800 times denser than air, so water affords a greater opportunity to challenge the muscles and achieve high levels of calorie burn but with less risk of injury to the joints.
- However, the resistance of water also reduces the speed of movement possible and the ability to change direction quickly, so you have to be motivated to put some work in when exercising in the water. The good news is that the resistance you feel is proportional to the speed at which you move.
- **Hydrostatic pressure** refers to the constant pressure exerted by the water equally around the body. This helps improve the circulation of the blood and reduces the risk of the blood pooling in the muscles, which can cause dizziness.

- Fluid dynamics impacts the body through the smooth flow of water molecules known as **lamina flow**, and **turbulent flow**, which is caused by molecules rebounding from an object in all directions. Lamina flow offers the least resistance to the exerciser, and turbulent flow is the white water you see around you and the bubbles you feel against your skin when you move.

Benefits of Aquatic Exercise

- Hydrostatic pressure is the force upon the body when it's immersed in water. The force is greater as you go deeper into the water and is multidirectional. This increased pressure on the body effectively squeezes the blood vessels, increasing the amount of blood returning to the heart—known as an increase in venous return—which has effects on the cardiovascular, respiratory, and renal systems.
- Cardiac output is a measure of the heart's functioning capacity and is quantified as the volume of blood ejected by the heart in a minute. It's calculated by multiplying the stroke volume, which is



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Yoqua, or water yoga, often involves the use of foam noodles to help with stretching.

the volume of blood ejected by the heart with each beat, and the heart rate, or the number of beats per minute.

- The increase in blood returning to the heart stretches the walls, which in turn increases the force of the contraction of the heart muscle. As a result, the stroke volume increases, which leads to an increase in cardiac output. Because the heart rate drops during immersion, the question of whether we can get our heart rates up in an aquatic workout is raised—because this is essential to making our fitness gains.
- Once we start to exercise in water, the heart rate will increase just as on dry land, but straining heart rates will be lower in water. Therefore, rates of perceived exertion, which involve scoring the intensity of a workout from 1 to 10, are often a more suitable measure of the intensity.
- When you're immersed in water, the hydrostatic pressure leads to an increase in the rate of breathing. Breathing mechanics change as a result of hydrostatic pressure acting on the chest and abdomen and also because of the increased venous return, shifting more blood into the thorax from the extremities.
- This leads to a reduction in **tidal volume**, which is the amount of air taken in with each breath. The respiratory muscles are required to work around 60% harder than normal, so the result of getting into water is a strengthening effect on the respiratory muscles, which can help to increase the efficiency of the respiratory system.
- As more blood reenters the heart, the brain is tricked into thinking there is excessive fluid on board, so it switches off the antidiuretic hormone that is produced in the **pituitary gland**, which controls the action of the kidneys.
- A number of studies have shown that shallow-water sessions have the capability to significantly improve maximal oxygen uptake, which is accepted universally as the best measure of fitness. Many

studies have also shown significant improvements in muscular strength and endurance.

- Aquatic exercise provides a valid variation to your existing training regime, and the water keeps you cool, so it's a much more enjoyable exercise experience than sweating on dry land. In addition, engaging in aquatic exercise can help you increase your confidence in water.
- The supportive properties of water make it ideal for specialist populations to participate comfortably. Aquatic exercise also promotes social interaction and provides a whole-body toning effect. Beyond exercise for members of the public, water-based exercise is invaluable for both rehabilitation and elite sports training.
- It's getting harder for those who still think of aquatic exercise as a soft option and only suitable for seniors when there are so many examples of high-performance water workouts. The pool has become a wet gym for all ages and all levels of athletic conditioning—with a wide range of specific equipment designed to improve strength, speed, and stamina.

Tips for Water Workouts

- When engaging in aquatic exercise, the water should be at about chest level, with shallower depths used for participants who are less confident. Walking in chest-level water burns 50% more calories than walking on land, and running in the pool burns 90% more calories.
- As always, adequate time should be allowed for warming up before any main activities. To get a good cardiovascular workout, exercises need to be large and rhythmical.
- During swimming, heat loss from the body is mainly through convection, whereby heat is transferred from the body to the water because there is a reduced role for evaporation of sweat from the skin's surface—the normal cooling mechanism on dry land.

However, there will still be some fluid loss through sweat, so it's still important to have fluid available during an aquatic workout.

- If you have musculoskeletal issues, especially joint problems, make your warm-up more gradual and slightly longer because this can give stiffer joints more opportunity to loosen up and move more freely.
- If you're swimming rather than doing water workouts, pace yourself as you warm up. Pick an easy stroke and do it slowly, gradually picking up the speed. You'll know when you're ready to swim at a higher speed because you'll be feeling warmer in the water.
- Be functional with your aquatic workouts. Consider prioritizing exercises in order to improve your functional ability and support for painful or weakened joints and muscles.
- There are many activities that you can incorporate that mimic movements of daily life. For example, pushing your arms forward, against the water, could replicate the action of pushing a door open. You can always add a float in each hand for extra resistance.
- In the water, your cooldown needs to be more gradual to allow blood flow to return efficiently through the muscles and flush them of waste products, such as lactic acid.
- Speed plays a part because the pace of your aquatic workout session may need to be slightly slower in order to accommodate any range of movement restrictions or stride changes. Furthermore, allow time to transition between exercises in case balance is affected.
- In terms of intensity, for those participants free of impairments, always use the water effectively. Keep your arms under the surface to aid movement through the water and keep your shoulders under the water to maximize resistance of the water, making you work harder.

- Swimming in particular is considered one of the best all-around exercises because it works all the major muscle groups while giving you a good cardio workout, but you won't maximize these benefits if you don't push yourself.
- In the same way that you use all of your muscles in a land workout, try to work all of your muscles in the pool. To get a good all-around workout, swimmers need to vary their strokes to engage all muscles.

Aquatic Exercise Classes

- The best way to sample aquatic exercise is in a class situation, which allows an instructor to take you through a range of different drills and gives you the motivation to push yourself to get the results you desire.
- The great thing about aquatic classes is that there are some great variations on land-based themes that have been adapted for the pool. If you like a particular group exercise class at the gym, try the water version.
- Aqua chi, derived from tai chi, moves and is influenced by flowing, continuous, graceful movements that typify many Eastern philosophical disciplines. The class focuses on enhancing internal energy, referred to as **chi** in Chinese—a healthy flow of which reflects optimum balance in mind, body, and spirit.
- Pilates H₂O is a posture-based class that focuses on promoting strength in the core muscles to help stabilize the spine. Working on aligning the shoulders helps people who carry tension in their shoulders, which can result in an excessive outward curve in the upper back.
- Yoqua takes the principles and movements of yoga and adapts them to the water environment. Yoqua strengthens and tones the body while relieving tensions and renewing energy. Yoqua is also lower impact than traditional yoga, putting less strain on the joints and allowing those who have trouble moving or standing

for long periods of time to get excellent exercise and meditative yoga practice.

- Aqua Attack is one of the sports-specific training programs that has been adapted to an aquatic environment. This class combines the benefits of training in water with boxing, martial arts, self-defense, and mind-body conditioning. Aqua Attack offers an exciting, time-efficient workout that builds on 4 essential ingredients: self-defense, self-awareness, fitness, and fun.

Important Terms

buoyancy: The degree to which your body floats when it's immersed in water.

chi: A healthy flow of this internal energy is believed in Eastern cultures to reflect optimum balance in mind, body, and spirit.

hydrostatic pressure: The constant pressure exerted by the water equally around the body.

lamina flow: The smooth flow of water molecules.

pituitary gland: The gland that controls the action of the kidneys.

tidal volume: The amount of air taken in with each breath.

turbulent flow: The white water you see around you and the bubbles you feel against your skin when you move in the water, caused by molecules rebounding from an object in all directions.

The Secret Life of Muscles

Lecture 15

If you truly wish to achieve any degree of success from your exercise efforts, an understanding of how your muscles work is essential to planning a safe and effective route to a healthier, fitter, and slimmer you. Furthermore, digging deeper into the unique structure of the muscles is a fascinating journey. The very essence of movement itself relies on the coordinated action of groups of muscles, so harmony, balance, and timing are key components in even the simplest movement patterns.

Types of Muscle

- **Voluntary muscle**—also known as skeletal muscle, due to its attachment to the skeleton, and striated muscle, due to its striped appearance—is controlled consciously by the nervous system. The triceps and quadriceps are examples.
- **Involuntary muscle**, also known as visceral muscle, is smooth in appearance and is not contracted intentionally, as skeletal muscle is. These muscles are found in the respiratory system.
- Cardiac muscle, also known as the myocardium, is an involuntary muscle that is specific to the heart.
- The muscles and bones of the skeleton form a series of levers—with the joints acting as a fulcrum and the muscles exerting a pulling force. The force of the muscles is exerted on the skeleton through 3 different contacts: through a tendon at the end of the muscle, directly onto the bone, or through a fibrous sheath known as an aponeurosis.
- The human body conveniently features a balance of muscles at the front and back, enabling a wide range of movement in all directions. These opposing pairs, such as biceps and triceps, have to work in unison so that one relaxes while the other contracts in order

for movement to take place. When analyzing movement, we use the term “group action” to describe the relationship between various muscles as the skeleton moves.

Muscle Construction and Contraction

- Muscles are made up of various components. The **epimysium** is a strong connective tissue that surrounds the whole muscle. Within the epimysium are bundles of muscle fibers, and each of those is covered in connective tissue called the **perimysium**. Each of these bundles is then made up of other bundles of fibers wrapped in another cover called the **endomysium**. Each of these muscle fibers is made up of myofibrils that feature blocks of sarcomere, each of which contain the key proteins actin and myosin arranged alternatively in thin and thick strands.
- When a nerve impulse stimulates the muscle to move, the result is that the actin and myosin elements are attracted to each other, forming a cross bridge that causes the sarcomere to shorten. If one end of the muscle stays fixed, the other end will move.
- The force generated by the muscle is dependent upon the number of muscle fibers brought into play. A **motor unit** is a group of muscle fibers and the nerve that links them to either the central nervous system or the spinal cord. Once a nerve is stimulated, all the fibers it attaches to will kick in.
- Motor units that require precise movements, such as the eye muscles, may have one nerve controlling only a few muscle fibers, but the buttock muscles, for example, may have one nerve that’s serving hundreds of muscle fibers because we don’t need too much dexterity in our movement in that location.
- Muscles are made up of a mix of slow-twitch and fast-twitch fibers. **Slow-twitch fibers** tend to be red in color because they hold myoglobin, which is where oxygen is stored. They also contain a high concentration of mitochondria, which is an enzyme that’s vital for the production of energy in the muscle cells. These muscle fibers

are slow to contract, but also slow to fatigue, so they're ideally suited for activities of a lower intensity and a longer duration.

- **Fast-twitch fibers** are white in color and hold low levels of mitochondria. They contract quickly, but they also tire equally rapidly, so they're suited for activities that are high in intensity but short in duration.
- Muscular contractions can be split into 3 classifications. A **concentric contraction** occurs when the muscle develops tension as it shortens. An **eccentric contraction** occurs when the muscle actively lengthens. An **isometric contraction** occurs when the muscle doesn't shorten or lengthen.

Developing a Resistance Training Program

- Resistance training is the root to bringing about gains in both the strength and endurance of muscles, and many different methods of resistance training have been developed to improve these parameters for health benefits and for sports performers' demands.
- Designing a resistance training program is based on your goals, primarily because your goals will determine the number of repetitions you should perform.
- The relationship between the number of repetitions and the loads that you lift is known as the strength continuum. The drawback with this approach is that it relies on identifying the 1-repetition maximum, which can be a timely process and can present a potential injury risk for anyone who isn't accustomed to regular resistance training.
- Trial and error can help you identify the appropriate amount of weight to work with, and you can use the rule of thumb that if the last couple of repetitions are difficult to complete, then you have the correct amount of load. If you work out regularly, you'll become stronger over time, and therefore, the load will need to be incrementally increased to achieve fatigue on each exercise.

- Exercise selection should address specific individual desires but should ideally follow a whole-body approach that ensures all-around development. This helps to reduce the risk of injury due to muscle imbalances.
- Compound exercises, such as chest presses, that engage a number of muscle groups are favored over isolation exercises because they're more likely to mirror everyday movement patterns.

- For a resistance training program, it is generally advised to attempt the most demanding exercises at the beginning of the workout because then you have more energy. In addition, alternating upper- and lower-body exercises allows you to avoid having to stop due to low core muscular fatigue. Furthermore, rest periods between exercises are important and can vary according to your training program.



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A heavy weight that is demanding for you to lift engages several muscle fibers whereas a light weight only engages a few.

- Strength trainers should allow about 1 to 5 minutes of recovery before the next maximal exertion whereas endurance training features rest bouts no longer than 90 seconds because you want to keep the muscles working as much as possible.
- Recovery between successive workouts is governed by the length of time it takes for the muscles to repair themselves. It's usually around 48 hours—although, for novices, it could be a little longer. If you attempt to exercise before your muscles are ready, they will constantly break down as a result of not being afforded enough time

to absorb the protein they require for repair, and they'll actually become weaker and smaller.

Resistance Training Formats

- A single set is an approach to resistance training that dictates that you only perform 1 set of each exercise to fatigue. The benefit of this approach is that it has been shown to produce results and that it's time efficient. However, overload is not always achieved in just 1 attempt, so practice is required to get the right resistance. Exercise should be performed at a slow to moderate speed.
- The approach of multiset exercises involves performing about 3 to 5 sets of the same exercise before moving on to a different exercise. Although this may be too demanding for those new to exercise and requires a lot of time, it is a simple format, and it encourages a deeper concentration on the working muscles, which can help to accelerate results. A possible disadvantage is that in the gym, you need to sit on one piece of equipment for a while to do this.
- The practice of circuit training describes a number of exercises done in rotation, usually 1 set at each station with a short rest as you move on—possibly completing even more than 1 circuit if you're advanced. Exercises will be varied to allow for a focus on all the major muscle groups, and the target at each station might be a specific number of repetitions or a set time duration. In both cases, the goal is to improve your endurance.
- A sensible approach for circuit training is to alternate upper- and lower-body exercises at stations next to each other. This format is known as **peripheral heart action (PHA) training** because it requires the blood to constantly shift oxygen-carrying blood from one part of the body to the next, leading to a greater calorie burn. This method has the advantages of allowing for a large number of exercises and allowing the exercise to choose how many circuits you complete.

- Pyramid training describes the technique of repeating sets on a given exercise but with different loads and a different number of repetitions for each. This allows for either an ascending set, where you increase from a light to a heavy load, or a descending set, where you decrease from a heavy load to a light load. A full pyramid involves going from light load to a heavy load and back down again.
- Pyramids have the advantage of allowing for development of both strength and endurance in the same workout, but they do need lots of time—especially if you apply the full pyramid to every exercise in your routine. Furthermore, some believe that so many sets will not produce any greater or speedier gains than just 1 or 2. In addition, this a demanding approach, so it's not suited for beginners.
- The notion of supersets refers to 2 different methods of training that both rely on moving directly from one exercise to the next with no rest, and the option is either to target the same muscle group or to work in opposing pairs.
- Due to reduced periods, supersets are time efficient because you're going straight from one exercise to the next, and they allow for muscles to be worked through varying movement planes at a high intensity. This approach is going to produce good results, but it's not ideal for novice exercisers. Additionally, if you're performing supersets at home, you will need a few pieces of equipment, and at the gym, you could run into trouble if other members are using the piece of equipment you need to use.
- A drop set, a type of descending pyramid, is an advanced technique used by those looking specifically to increase muscular size. The intensity is high because the goal is to perform 4 to 6 repetitions to fatigue with a heavy weight and then quickly remove a small amount of the load, known as stripping. Then, you immediately try repeatedly to see how many repetitions you can do until you reach complete fatigue.

- The result of resistance training is muscle growth, but the aim of resistance training is actually to injure the muscles at the cellular level. The goal is to effectively cause more tears in the cell structure as a result of overloading the muscle. The result of this is that satellite cells are drawn to the area to repair the damaged fibers, leading to an increased number of protein strands as an adaptive response. As a result, more dietary protein will be absorbed, and the cross-sectional area of the muscle will increase.
- Resistance training can not only slow the effects of growing older, but in terms of skeletal muscle, it can even reverse it—making you look younger.
- The American College of Sports Medicine recommends that resistance training should be performed at least 2 times per week—one set of 8 to 15 repetitions to fatigue on about 8 to 10 different exercises—and professes this will significantly improve your health status. Research shows that in addition to obvious and potentially huge weight loss and aesthetic benefits, weight training leads to adaptations such as reduced risk factors associated with heart disease, osteoporosis, and diabetes.

Important Terms

concentric contraction: The contraction that occurs when a muscle develops tension as it shortens.

eccentric contraction: The contraction that occurs when a muscle actively lengthens.

endomysium: The connective tissue that covers the bundles of muscle fibers that are found within the perimysium.

epimysium: A strong connective tissue that surrounds the whole muscle.

fast-twitch fibers: Muscle fibers that are white in color and hold low levels of mitochondria. They contract quickly, but they also tire equally rapidly, so they're suited for activities that are high in intensity but short in duration.

involuntary muscle: The type of muscle that is smooth in appearance and is not contracted intentionally—also known as visceral muscle.

isometric contraction: The contraction that occurs when a muscle doesn't shorten or lengthen.

motor unit: A group of muscle fibers and the nerve that links them to either the central nervous system or the spinal cord.

perimysium: The connective tissue that covers the bundles of muscle fibers that are found within the epimysium.

peripheral heart action (PHA) training: An approach to circuit training that involves alternating upper- and lower-body exercises at stations next to each other. This format requires the blood to constantly shift oxygen-carrying blood from one part of the body to the next, leading to a greater calorie burn.

slow-twitch fibers: Muscle fibers that are red in color and contain a high concentration of mitochondria. These muscles fibers are slow to contract, but also slow to fatigue, so they're ideally suited for activities of a lower intensity and a longer duration.

voluntary muscle: The type of muscle that is controlled consciously by the nervous system and is also known as skeletal muscle, due to its attachment to the skeleton, and striated muscle, due to its striped appearance.

Strong to the Bone

Lecture 16

The goal of this lecture is to equip you with the knowledge you need to help you reduce the risk of becoming subjected to osteoporosis. Specifically, you'll learn how bone is constructed and how exercise affects bone health. There are plenty of options for building and maintaining strong bones, and it's never too late to get started. If you follow some simple guidelines, you could delay the process of deterioration in bone health—and possibly even reverse it.

Our Skeleton and Bones

- **Osteoporosis** is defined by the World Health Organization as a skeletal disease characterized by low bone mass and microscopic deterioration leading to increased susceptibility to fractures.
- Our 206 bones enable us to carry out a wide range of everyday tasks that we may take for granted, including one of the most basic but essential functions—movement.
- Contrary to common belief, the skeleton is a living and ever-changing structure that needs care and attention. It's a dynamic tissue that, in addition to enabling movement, is also responsible for support, protection, storage, and production.
- The skeleton provides a framework that supports the soft tissues and provides attachment sites for the muscles.
- In terms of protection, it's essential for survival that our vital organs are protected.
- Minerals, such as calcium and phosphorous, are stored in bone tissue to be released into the bloodstream when they're required. In addition, as we age, some of our red bone marrow becomes yellow

bone marrow, which contains more adipose, or fat, cells that we can use as energy.

- Furthermore, bone also plays a role in production. Red bone marrow is the source of production of new blood cells and platelets, the clotting cells that help stop blood flow in cases of injury.
- Lesser important functions of bone include conducting sound to the inner ear through the bones of the skull. Bone conduction also allows us to hear under water.
- Rather than having a solid structure, bone is comprised of 2 distinct sections. **Cortical bone**, also known as compact bone, is the exterior of bone that is dense and strong. It gives the smooth, pale appearance and accounts for about 80% of the bone mass in adults.
- **Trabecular bone**, or cancellous bone, is located on the inside and is spongy. It has a honeycomb structure in appearance and is where the red bone marrow that produces blood cells can be found.
- Coating the outer surface of the bone is the periosteum, which is a fibrous membrane that has a rich supply of blood vessels that provide nutrients for the growth phase and also for repair after injury. In addition, the ends of most bones are covered in **hyaline cartilage**, which acts to both assist shock absorption and reduce friction between articulating bones.
- Bone has a good compressive strength, so it is resistant to direct pushing forces, but it has much lower tensile strength, so it is prone to injury from pulling or shearing forces. The bones of the skeleton are divided into different categories based on their size, shape, and location.
- Long bones consist of a central shaft that is slightly curved for extra strength and 2 wider ends. Long bones tend to be made up mostly of cortical bone. Examples include the femur, tibia, fibula, humerus, and radius.

- Short bones are usually almost as wide as they are long. They only have a thin outer cortical bone and are made up mostly of the spongy trabecular bone. Short bones are found in the key fulcrums of the wrist and ankle.
- Flat bones are relatively thin and are made up of 2 layers of cortical bone separated by a layer of trabecular. They offer much-needed protection in addition to hosting muscle attachments. Examples of these are the cranium, sternum, and scapulae, or shoulder blades.
- Irregular bones have much more complex shapes, such as the hip, vertebrae, and bones within the structure of the face.
- **Sesamoid bones** are housed within tendons at points of high physical stress and tension. Examples include the patella in the kneecap, which is actually in between the muscle fibers, and the pisiform in the wrist.

Bone Growth and Osteoporosis

- Bone growth begins very early in the fetal stage. Bones can be formed either from a collection of collagen fibers—as with the skull, jaw, and collar bone—or following the formation of cartilage, as with the long bones. In both cases, development results from the buildup of calcium and magnesium salts that is deposited at a particular location, a process referred to as **ossification**.
- A process of remodeling continues throughout life, with **osteoblast cells** depositing mineral salts to promote new bone growth and old bone being broken down and absorbed by **osteoclast cells**, which allow calcium, potassium, and phosphate compounds to be released from the bone into the bloodstream. In addition to maintaining calcium levels, remodeling also involves making any necessary repairs to bone tissue.
- As a child, formation outpaces reabsorption and results in increased length and width of the bones, but the reverse is true in later years.

We achieve a peak bone mass around 25 years of age, although there is some individual variance.

- **Calcitriol** governs the flow of calcium into and out of the bone tissue. Calcitriol is formed in the kidneys, with vitamin D—which we absorb from the sunlight—being a key ingredient. The parathyroid gland controls the kidney secretions, so if calcium levels in the blood fall below a certain point, more will automatically be released. This balancing act is assisted by the presence of estrogen.
- There are 2 classifications of osteoporosis. Primary (type 1) osteoporosis occurs in women soon after menopause, due to the drop in estrogen level that occurs. Secondary (type 2) osteoporosis is age related and affects both sexes. However, it's usually more pronounced in women, due to their smaller bone mass and tendency to live longer than men.
- Unfortunately, there are no obvious, outward signs for bone health, so the first you may know of it is when you suffer a fracture following perhaps a relatively minor trauma. The most common fracture sites are the wrist, hip, and vertebra.
- However, it is possible to measure bone density and, therefore, predict risk of fracture by using such technology as single-energy X-ray absorptiometry, quantitative computed tomography, and dual-energy X-ray absorptiometry.
- The risk factors for osteoporosis can be split into 2 categories: intrinsic factors, which cannot be manipulated and account for about 70% to 85% of the difference in bone mass density, and extrinsic factors, which can be manipulated and are responsible for the remaining 15% to 30% of the difference. Intrinsic factors include gender, ethnicity, age, and medical history. Extrinsic factors include diet and whether you drink alcohol or smoke.

Exercise and Bone Health

- Exercise has been shown to improve bone density at any age, although results can be affected by a number of factors, such as nutrition and choice of exercise. Exercise can be seen as a 2-pronged attack on reducing the risk of osteoporosis-related fracture by giving greater muscle strength and dynamic stability to remove the risk of fall but also by giving greater resilience should you fall.
- The key to the increase in bone density and, therefore, lowered osteoporosis risk through resistance training is the skeleton's natural inclination to adapt to forces applied to it. If demands fall above a certain threshold, then cellular activity will change to bring about an increase in strength of the bone. This occurs through a phenomenon known as the piezoelectric effect, whereby the mechanical stress exerted by the tendon of a muscle on the bone that it attaches to will generate a voltage.
- The piezoelectric effect dictates that the stress applied will result in a charge within the collagen fibers, which attracts the oppositely charged osteoblasts that deposit minerals at the site. The result is a localized increase in bone density. This principle was first observed in 1892 by Dr. Julius Wolff and, therefore, is referred to as Wolff's law.
- Lack of physical activity will lead to a reduction in bone density and an increase in your associated risk, but regular exercise will reverse this decline. This is why osteoporosis—along with many other conditions we often associate with being elderly—has nothing to do with age but is linked to disuse. Committing to a regular exercise program at a young age will ensure that bone density starts at a higher level, thereby mitigating the effects in later life.

Workout Guidelines for Prevention

- To be effective as prevention for osteoporosis, exercise must achieve the bone-loading effect, which involves weight-bearing exercises to achieve the gains resulting from gravitational force

and strength exercises to take advantage of the influence of muscle loading.

- Walking, jogging, and jumping combined with strength training will provide a stimulus to benefit bone health. In addition, there appears to be a bonus in varying the training environment from land to water and in deploying differing speeds of movement, including explosive exercises.



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Weight lifting is essential to maintaining muscle mass and functionality in your later years.

- The bone loading effect is site specific, so you need a wide selection of resistance or strength training modes in order to ensure the whole body achieves these gains. There should be a bias toward exercises that target the key fracture areas, such as the femur, hip, and wrist.
- Strength training options can include resistance bands, which provide for a wide range of strengthening exercises and are one of the most cost-effective and space-saving pieces of workout equipment. Bands are available in different thicknesses, giving you different resistance levels that you can progress through.
- Even the most basic exercises transferred from dry land into the water will attract a loading effect that will promote bone density gains. Furthermore, research shows that water exercise can at least slow bone loss while also promoting fitness.
- Fixed resistance machines usually feature a stack of weighted plates on a central vertical rod with the option to select the number of plates lifted using a pin. These have the advantage of being

relatively safe to use in addition to enabling you to isolate specific body parts to be exercised.

- Free weights include barbells, dumbbells, medicine balls, power bands, and body bars. This mode can be practiced in gyms and has the great benefit of being functional, but you need to get the technique right. In addition, wrist and ankle weights can be used to increase bone density.
- Body weight training requires no equipment, so is the perfect mode for home workouts. Squats, press-ups, and sit-ups are all exercises that use your body weight moving against gravity as the resistive stimulus and are of great value.
- Vibration machines are designed to improve bone density by tricking your skeleton into thinking it's carrying more load—up to 6 times your actual weight—which leads to the osteoblasts being excited and forming new bone tissue.
- In order to maintain or increase bone density, it's vital that an exercise program is progressive, or always challenging the skeletal system, either through increased weights or different exercises.
- An ideal plan will be periodized, with a rotation of various workout modes. Staying with the same workout for longer than 12 weeks will not result in bone density gains, and you'll also hit a fitness plateau.
- Your minimum target is 20 minutes of exercise 3 times per week, although an optimum target is 2 bouts of 10 minutes of exercise 5 times per week. It's better to work harder than longer, and weight-training routines are ideal. You must aim to increase the volume of exercise in workouts over time.

Important Terms

calcitriol: A hormone that governs the flow of calcium into and out of the bone tissue.

cortical bone: The type of bone that is the exterior of bone that is dense and strong—also known as compact bone.

hyaline cartilage: The material that covers the ends of most bones and acts to both assist shock absorption and reduce friction between articulating bones.

ossification: The buildup of calcium and magnesium salts that is deposited at a particular location, resulting in bone growth.

osteoblast cell: A cell that deposits mineral salts to promote new bone growth.

osteoclast cell: A cell that breaks down and absorbs old bone, allowing calcium, potassium, and phosphate compounds to be released from the bone into the bloodstream.

osteoporosis: A skeletal disease characterized by low bone mass and microscopic deterioration leading to increased susceptibility to fractures.

sesamoid bone: A bone that is housed within tendons at points of high physical stress and tension.

trabecular bone: The type of spongy bone that is located on the inside and is where the red bone marrow that produces blood cells can be found—also known as cancellous bone.

Getting Your Back on Track

Lecture 17

Lower back pain is the second most common neurological malady, and it can range from being mildly uncomfortable to severely debilitating. As in most fields of medicine, prevention is better—and cheaper—than cure. Therefore, this lecture is designed to help you understand the basic anatomy of your spine, to alert you to some of the problems that may arise, and to arm you with a plan of action to reduce the risk of becoming a sufferer of back pain. Fortunately, a specific exercise regime can significantly increase the health of your lower spine and keep you active for life.

The Structure of the Spine

- The spine consists of 24 movable vertebrae, which are divided into several major sections: 7 cervical vertebrae, 12 thoracic vertebrae, and 5 lumbar vertebrae—plus 9 fused vertebrae that make up the sacrum and coccyx. The job of the vertebrae is to protect and support the spinal cord in addition to bearing most of the weight of your body.
- Like all bones, vertebrae have a hard, strong outer shell called cortical bone and a soft, spongy inside called cancellous bone. Groups of ligaments hold the vertebrae together, and tendons attach muscles to the vertebrae.
- The intervertebral disks form the cushioning between the bones of the spine to allow movement, and they act as the shock absorbers for your body. The disks have a strong outer ring called the annulus, and each disk has a soft fibrogelatinous center that helps with cushioning.
- The top 2 vertebrae—also known as the atlas and the axis, respectively—have great degrees of freedom and, therefore, allow the many movements of the head and neck.

- The base of the movable spine is the **sacrum**, which connects the spine to the pelvis through the 2 sacroiliac joints—the point at which your upper body meets your lower body. At this point, there is cartilage to absorb shock, but the sacroiliac joints are not very movable. They have a unique locking device that is essential to maintain stability in the pelvis when you're walking, allowing for weight to be transferred from one leg to the other.
- There is a thoracic rounding of the upper body that is referred to as the primary curve because it forms in the embryonic stage. The cervical and lumbar curves are known as secondary curves because they develop after birth—when the baby first learns to lift its head and when it first stands, respectively. The curves allow for upper-body loading to be dissipated through the muscles, protecting the vertebrae that are down low in the column.
- Each vertebra consists of a main body to the front and a central aperture. There are 2 transverse processes and a spinous process to the rear, which is what you can feel when you run your hand down your back.
- The vertebrae stack to allow the holes to line up, providing a protected canal down which the spinal cord runs. This mass of nerves branches off into 31 pairs of nerve roots that feed out throughout the neural foramen, or gaps, in the sides of the bony structure and reach out to all parts of the body, allowing for messages and information to constantly transfer between the brain and the outer extremities.
- An ingenious feat of engineering, the spine is capable of movement in many directions, including extension, flexion, lateral flexion, and rotation. Our everyday activities require a combination of these movements.
- The muscles that attach to the spine can be split into 2 groups: those nearer the surface that are primarily linked to movement of the arms and the deeper muscles that move the vertebral column itself.

- The surface back muscles include the **trapezius**, which runs from the base of the skull and vertebra C1 down to T12—cervical 1 down to thoracic 12—inserting into the clavicle, acromion, and scapula at the back. The trapezius can lift and lower to retract the shoulder blade.
- The **levator scapula** reaches from vertebra C1 to C3, sometimes to C4, and onto the upper part of the shoulder blade. In addition to assisting the trapezius in lifting, it tilts your head to the side.
- The **rhomboids**—major and minor—begin at vertebra C7, go down to T5, and attach to the inner border of the shoulder blade. From this position, the rhomboids can only do one thing: retract your shoulder blade.
- The **serratus anterior**, which has the opposite function of the rhomboids, is situated on the front surface of the scapula, and links to the 8th and 9th ribs. The serratus anterior draws the shoulder blades forward.
- Starting at the iliac crest of the hip, the **latissimus dorsi** comes up, connects through the vertebra T7 up to L5—lumbar 5—passes across the lower ribs, and eventually inserts into the upper arm. It's predominantly responsible for bringing your arm back down to your side, but it's also responsible for inwardly rotating the arm.
- The deep muscles of the back are the **splenius muscles**, which attach from cervical to thoracic vertebrae and are responsible for lifting your head when it's down.
- The **erector spinae** is a group of muscles—including the iliocostalis, longissimus, and spinalis muscles—that are of varying lengths and run down both sides of the spine, from the cervical all the way down to the lumbar regions. The erector spinae produce movements including lifting you from a bent position, bending the trunk to the side, and rotating your upper body.

- The **transversospinalis muscles**—the semispinalis, multifidus, and rotator muscles—lie deeper than and are generally shorter than the erector spinae, but they perform almost an identical function in extending, lateral flexing, and rotating the spine.
- The **segmental muscles** are the deepest, and they only link from one vertebra to the next rather than connecting several. The interspinalis assists in extending the spine, and the intertransversarii assist in bending to the side—although all the muscles in these groups have a very limited amount of force.

The Spine and Posture

- Good posture refers to a balanced body position that allows for movement with minimum effort and should be a proactive state from which the body can accommodate external forces and respond with strength, mobility, and stability—or a combination of these. Poor posture decreases the body’s ability to handle gravitational stress and compromises functional ability, leading to possible physical issues.
- Aligning the body correctly allows structural stability and creates harmonious movement patterns. A proactive posture will result in both lumbopelvic and scapulathoracic integration combined with optimized unilateral and bilateral relationships.
- In a neutral placement, the normal curve of the spine is slightly anteriorly convex—the most stable and optimal shock-absorbing position. While breathing and engaging the abdominals in this position, no strain should be felt through the spinal extensors in the lumbar area. If muscular tension does occur in this location, you need to veer the pelvis toward a slight posterior tilt and a slight lumbar flexion.
- In the thoracic region, stabilizing the scapulae on the rib cage is important because when it’s not done, there is a tendency to overwork the upper trapezius and other muscles around the neck

and upper shoulders. Although the scapulae move with the arms, a sense of stability, not rigidity, should always be maintained.

- With the cervical spine, your aim is to hold a natural curve, so the skull should balance directly above the shoulders when in a neutral position. In most instances, the cervical spine should continue the line created by the thoracic spine during flexion, extension, lateral flexion, and rotation.
- **Core strength** refers to the strength that results from the muscles in your back, abs, and pelvis working together. Not only is core strength vital in protecting the lower back from injury, but research has also shown that it is an important contributor to sports performance. Furthermore, weak core strength can lead to an exaggerated lumbar curve called lordosis, which results in an uneven pressure on the intervertebral disks that can lead to accelerated demise.
- Core strength involves the ability to maintain correct alignment of proximal body parts in order to heighten the efficiency of distal body parts during movement.
- The secret to maintaining core stability lies in generating intra-abdominal pressure, which lends support to the spine in motion or under stress. Intra-abdominal pressure is brought about by the combined action of the transversus abdominis at the pelvic floor, the multifidus at the back, and the diaphragm at the top. These muscles work in unity; contraction of the pelvic floor leads to a co-contraction in the multifidus, which stabilizes the sacrum. A contraction also occurs in the transversus, which pulls in and attaches to the thoracolumbar fascia in the back, which also pulls in. The end result is an increase in intra-abdominal pressure.

Improving Core Strength

- To improve core strength, you should use free-movement and avoid fixed-resistance machines that you find in gyms because they put you in a certain position and then support your movement—allowing you to actually switch off your core muscles. In addition,

most of these machines isolate movements so that only one group of muscles is working at any one time, which is contrary to how we function in everyday activity.

- A better option is to practice compound movements, which involve using several muscle groups at the same time. For example, squats and press-ups are body weight exercises that use a number of muscle groups.
- In these types of exercises, the core muscles have to work hard to maintain the natural, comfortable curve of your spinal alignment, referred to as your **neutral spine**. This ensures that there's minimal stress on the soft tissues surrounding the spine, such as the ligaments and the intervertebral disks.
- In addition to focusing on balance, exercises for the lower back should build strength but also improve range of motion. There should also be an emphasis on engaging your core muscles to create an intra-abdominal balloon that braces the lower spine. This helps to maintain the lumbar curve that's essential to take the load off the spine and associated ligaments.

Back Problems and Solutions

- Back pain can be divided into 2 different categories: chronic pain, which lasts for months and often becomes worse but without an immediately obvious cause, and acute pain, which lasts for days or weeks and is the result of either a specific incident or an underlying condition.
- Paradoxical as it may seem, when lower back pain strikes, your best response is not to rest—possibly making it worse—but to actually continue being active. Some injuries will require an initial period of rest; work with the guidance of your physician on setting a suitable plan of action.
- The simplest and most common back complaint is due to muscle injury—a strain resulting from an awkward lift, for example. In

the early stages, rest is advisable, along with a gentle stretching of the hip flexors that can cause the pelvis to tilt forward. It can also be helpful to gently stretch the piriformis, a hip rotator, because if this is tight, it can collide with other joints. Core strengthening exercises will also help.

- **Sciatica** is characterized by pain or perhaps numbness in the buttocks and rear of the lower leg caused by inflammation that is usually a result of a rupture of an intervertebral disk that begins to impinge on the nerve fibers. Pain is particularly felt when you're bending forward. Stretching the hamstrings and abdominals is advised, combined with exercises to improve core strength.
- **Lumbar stenosis** symptoms are similar to those associated with sciatica but are associated with standing and walking rather than bending. Pain is caused by a narrowing of the neural foramen, which could be caused by extra bone growth due to arthritis or advanced wear and tear leading to pressure on the nerve. A useful stretch is to lie on the floor and pull one or both knees into your chest. A suitable strengthening exercise involves reaching your hand to your opposite lifted knee while marching in place and keeping a neutral, comfortable spine.



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Most lower back problems can be addressed with medication combined with exercises that improve mobility and strength.

Important Terms

core strength: The strength that results from the muscles in your back, abs, and pelvis working together.

erector spinae: A group of deep back muscles—including the iliocostalis, longissimus, and spinalis muscles—that are of varying lengths and run down both sides of the spine, from the cervical all the way down to the lumbar regions. This group produces movements including lifting you from a bent position, bending the trunk to the side, and rotating your upper body.

latissimus dorsi: A surface back muscle that comes up from the iliac crest of the hip, connects through the vertebra T7 up to L5—lumbar 5—passes across the lower ribs, and eventually inserts into the upper arm. It's predominantly responsible for bringing your arm back down to your side, but it's also responsible for inwardly rotating the arm.

levator scapula: A surface back muscle that reaches from vertebra C1 to C3, sometimes to C4, and onto the upper part of the shoulder blade. In addition to assisting the trapezius in lifting, it tilts your head to the side.

lumbar stenosis: A back condition characterized by pain that is caused by a narrowing of the neural foramen, which could be caused by extra bone growth due to arthritis or advanced wear and tear leading to pressure on the nerve. Pain is particularly felt when standing and walking.

neutral spine: The natural, comfortable curve of your spinal alignment.

rhomboid: One of 2 surface back muscles that begin at vertebra C7, go down to T5, and attach to the inner border of the shoulder blade. The major and minor rhomboids retract your shoulder blade.

sacrum: Connects the spine to the pelvis through the 2 sacroiliac joints; the point at which your upper body meets your lower body.

sciatica: A back condition characterized by pain or perhaps numbness in the buttocks and rear of the lower leg caused by inflammation that is usually

a result of a rupture of an intervertebral disk that begins to impinge on the nerve fibers. Pain is particularly felt when bending forward.

segmental muscle: One of a group of deep back muscles—the deepest, in fact—that only link from one vertebra to the next rather than connecting several. The interspinalis assists in extending the spine, and the intertransversarii assist in bending to the side—although all the muscles in these groups have a very limited amount of force.

serratus anterior: A surface back muscle that is situated on the front surface of the scapula and links to the 8th and 9th ribs. It draws the shoulder blades forward.

splenius muscle: A deep back muscle that attaches from cervical to thoracic vertebrae and is responsible for lifting your head when it's down.

transversospinalis muscle: One of a group of deep back muscles—including the semispinalis, multifidus, and rotator muscles—that lies deeper than and is generally shorter than the erector spinae, but it performs almost an identical function in extending, lateral flexing, and rotating the spine.

trapezius: A surface back muscle that runs from the base of the skull and vertebra C1 down to T12, inserting into the clavicle, acromion, and scapula at the back. It can lift and lower to retract the shoulder blade.

21st-Century Yoga

Lecture 18

Yoga-based workouts can be a powerful ally in helping to improve fitness and overall well-being, in addition to assisting in weight loss efforts. In this lecture, you'll discover what yoga is and what its benefits are. This lecture will also dispel the religious implications that sometimes are associated with the practice. With no special clothing or equipment, in the comfort of your own home, you are encouraged to experience the body-toning, tension-releasing opportunity that could open the door for a whole new way of exercise for you.

Fitness Yoga

- The word **yoga** means “union” or “yoke” and can be described as a unique system of physical, mental, and maybe even spiritual development that was developed about 3000 years ago. In its largest context, it can be interpreted to mean the union of the individual soul with the collective soul, but contrary to some beliefs, it's not a religion but, rather, an ancient form of conscious living.
- Unfortunately, it's this potential for yoga to reach into our lives that often repels many people from investigating the practice and its value, perhaps suspecting it to be some form of cult or linked to unusual dietary regimes. In truth, yoga can truly be all things to all people; it just takes some forethought to establish what you want to take from it, and then figure out how to derive that objective.
- Yoga can improve biochemical indicators associated with heart disease, stroke, and diabetes, and it's been shown to reduce symptoms associated with back pain, osteoarthritis, and carpal tunnel syndrome. Research has also found that it helps to control weight gain in middle age.
- Research suggests that yoga can improve mood, counteract stress, reduce heart rate and blood pressure, increase lung capacity,

improve strength and flexibility, and ameliorate conditions such as anxiety, depression, and insomnia.

- **Fitness yoga** marries centuries-old yoga poses with a modern approach to improving well-being, primarily through enhancing both postural awareness and core strength capabilities. Going beyond the realms of traditional body conditioning programs, fitness yoga is a systematic, sensory approach to integrating both mental and physical functions, thereby rendering it a true mind-body experience.
- The key component of mind-body exercise is awareness because it initiates, and actually requires, a profound inwardly directed focus. It differs from traditional exercise in that it's both nonjudgmental and noncompetitive, so there's no emphasis on how much you can lift, how many repetitions you can do, or how fast you can go.
- With fitness yoga, there exists a greater degree of freedom to explore and express yourself—without the pressure to fit into a particular norm. You're not expected to look, move, or feel the same as anybody else; the purpose is to enjoy an individual exercise experience.
- The benefits of this approach are many-fold, predominantly because Western exercise often concentrates on dividing the body into target areas for attention whereas Eastern-based philosophies treat the body as a whole unit, which has greater applications to real-life situations. In addition, Western exercise has come to view flexibility as an unessential component of strength training, a phenomenon well supported by the lack of time spent stretching after most gym activities.
- Mind-body exercise promises to enhance balance by seeking to improve flexibility and helping to move freely but also by seeking the strength to control the stability of movement. Beyond purely the physical benefits, it's widely recognized that once the body is

in tune and balanced, the mind can then become free to both relax and grow.

Goals of Fitness Yoga

- One of the central aims of fitness yoga is to enhance muscular balance and strength, which increase the ability to stabilize the joints. In addition, we want to develop flexibility to predispose a greater range of motion around the joints and to improve skeletal posture, reducing the risk of spine-related ailments. Furthermore, we want to facilitate the ability to optimally function at work or play and to establish a constant dialogue between the mind and body.
- Indian Vedic texts state that yoga integrates the mind with the body, reduces stress and tension, awakens the body, and inspires the mind. From its ancient roots to the present, yoga has provided a demanding fitness program that stretches and tones the body, with emphasis on the spine and the core muscles.
- Yoga includes breathing techniques that improve lung capacity as well as concentration. For some, it may be a way to have fun, to look better, and to feel more relaxed; for others, it's a way of connecting to, perhaps, a higher state of consciousness.
- **Hatha yoga**, the most popular form of yoga, is described as the union of 2 opposites—with “ha” meaning “Sun,” which relates to passion, energy, and positivity, and “tha” meaning “Moon,” which suggests cool and reflective negativity.
- The goal of hatha yoga is to achieve balance and to position oneself in the center. There's a plethora of yoga variations available, and most of them have roots in hatha yoga. The styles differentiate themselves through differences in intensity, sequence, and intention.
- According to the Indian sage Patanjali, there exist 8 limbs in a yogi's lifestyle—all equally important and interconnected. The limbs are designed as a blueprint for a yogic lifestyle, and it's easy

to see how applying them to today's world would make a happier life for us all.

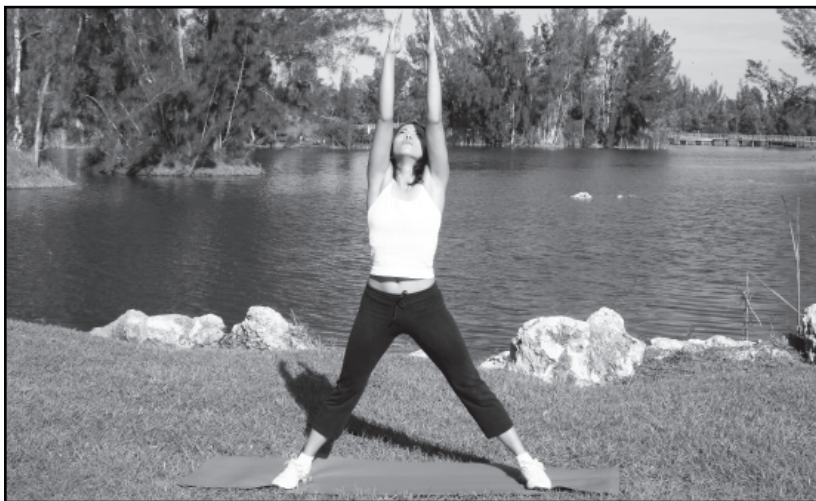
- **Yamas** involves individual practices that make us better human beings and contribute to a better world, including truthfulness, non-stealing, non-harming, leading a godly life, and non-grasping.
- **Niyamas** refers to personal disciplines, such as cleanliness, contentedness, self-discipline, and self-study.
- **Pranayama** refers to breathing exercises, which are vital for many yoga practices.
- **Pratyahara** is the detachment from worldly activities or withdrawal of the senses.
- **Dharana** is mental concentration.
- **Dhyana** is meditation.
- **Samadhi** refers to—for some people—absorption with the Divine, God, or the Absolute. For other people, it's just bliss.
- **Asana** is the practice of physical poses—the poses that we assume during yoga practice.

Practicing Fitness Yoga

- A fitness yoga workout follows a rigid blueprint, starting with some breathing exercises. This basically forms the warm-up, but you should allow a little more time for this. Then, you're going to slowly link poses together as a routine; piecing the sequence together gives you a challenge in terms of continuity and controlling your core strength on the move. You'll then perform the routine dynamically because in everyday life, we move dynamically, so we need to be able to control our core strength as we're moving. Finally, you'll

do the routine with flow, learning how you can mimic harmonious, continuous movement.

- When engaging in fitness yoga, you'll focus on 3 particular areas: muscular strength, flexibility, and balance.
- Begin by standing with your feet together—in a mountain pose—and your hands by your side. Be aware of being balanced. Then, take some deep breaths in and out through your nose.
- You can begin to slow your breathing rate down, trying to get in a little more oxygen and get out a little more carbon dioxide. Breathe deeply.
- Your tidal volume—the amount of air taken in with each breath—is only about 1/3 of your lung capacity. As you go into the lower lobes of the lungs, you get a better exchange of gases, so you start to get rid of a little bit more carbon dioxide, beginning the detoxification process.



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Yoga has been shown to produce positive results for depression, stress, and quality of life.

- Breathing through your nose begins to warm the air, so try to focus on that warmth, taking it deep down into your center. Also, breathing through your nose begins to filter the air, so you're taking in pure air, beginning the purification process. Most importantly, breathing is linked to the flow of energy around your body—the prana. This is why breathing exercises in yoga are called pranayama.
- When you take those deep breaths, try to feel as though you're beginning to wake up the tissues all around your body. Then, take both hands and rest them on your stomach. Take a few deep breaths, and you'll begin to notice that your hands move forward when you breathe in, and they come back slightly when you breathe out—due to the diaphragm moving down and up.
- Now, exaggerate that movement: When you take a deep breath in, consciously push your hands forward, and when you exhale, let them relax back. Keep your spine in a neutral, comfortable position, and breathe at a comfortable, relaxed pace. While doing this, you should begin to feel like you're getting the energy flowing around your body. You're also beginning to warm up from the inside out.
- The next portion may feel strange at first because you're going to breathe in the complete opposite manner of your normal breathing pattern. When you breathe in, pull your hands in, and when you exhale, let them relax forward. Try to keep your shoulders away from your ears. Try to feel the energy flowing all around your body.
- Next, take your hands and wrap them around your ribs. Take a couple of deep breaths and feel how the rib cage expands and then contracts. Now, press on your ribs with your hands so that you have to work harder, through your respiratory muscles, to be able to expand the rib cage. This is resistance training for your respiratory muscles. You should now be beginning to feel like you're getting warmer; your core body temperature should be beginning to rise.
- Relax your arms and go back into your mountain pose. Be aware of your balance, finding your center point. Take a slight sway forward

and backward and side to side, focusing on the soles of the feet. Try to find the point where you feel lightest on your feet—where there’s the least amount of stress on the soles of your feet.

Teaching Points for Fitness Yoga

- When starting a fitness yoga routine, be aware of having the same amount of pressure on the right and left foot. Press your feet down into the ground, feeling as if you’re rooting yourself. If you’ve done traditional yoga, you will be familiar with the idea of initiating the first energy loop into the lower leg. Press down. You should start to feel something in your lower leg.
- To work on your alignment, exhibit an inner spiral of your thighs. Rotate your thighs toward the center. Don’t squeeze them in; turn them in. This may feel a little uncomfortable at first because as you do this, your backside sticks out, exaggerating the curve.
- The next move is to draw your tailbone down. Hopefully, your core muscles have begun to kick in. Check by poking yourself just below the belly button.
- Now, make outer spirals with your arms. Simply rotate them; don’t lift them. Bring your shoulder blades back and down, releasing the tension in the neck.
- Keeping your arms exactly where they are, make inner spirals with your hands. Keep your fingers together and your thumbs in. Focus on your whole body. Reach your fingertips down to the ground, and you’ll start to feel some energy coming through.
- Feel the muscular energy all around your body. This is the feeling that you’re drawing your muscles onto bone—all the way around your body. This is not tension, but intention. Drawing everything in, including the not-so-obvious places like your calves and forearms.
- The opposite of muscular energy is organic energy. This feeling involves imagining the way the Sun works: It draws all the gases

into the center, burns them, and then throws out all the light and heat. Therefore, imagine drawing everything in, and after you take a deep breath, let all the energy come back out. Let it shine out of every cell in your body. Then, you can just relax; give your shoulders a roll, and give your legs a shake.



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Left: Awkward Pose. Middle: Warrior 2. Right: Half-Moon.

Important Terms

asana: The practice of physical poses—the poses that are assumed during yoga practice.

dharana: Mental concentration.

dhyana: Meditation.

fitness yoga: A practice that combines centuries-old yoga poses with a modern approach to improving well-being, primarily through enhancing both postural awareness and core strength capabilities.

hatha yoga: The most popular form of yoga that is described as the union of 2 opposites—with “ha” meaning “Sun,” which relates to passion, energy, and positivity, and “tha” meaning “Moon,” which suggests cool and reflective negativity.

niyamas: Personal disciplines, such as cleanliness, contentedness, self-discipline, and self-study.

pranayama: Breathing exercises.

pratyahara: The detachment from worldly activities or withdrawal of the senses.

samadhi: Absorption with the Divine, God, or the Absolute.

yamas: Individual practices that make us better human beings and contribute to a better world, including truthfulness, non-stealing, non-harming, leading a godly life, and non-grasping.

yoga: Means “union” or “yoke” and can be described as a unique system of physical, mental, and maybe even spiritual development that was developed about 3000 years ago.

Walk Your Way to Fitness

Lecture 19

Perhaps due to its proven simplicity and comparably easy access, walking is the most undervalued of all the exercise formats. In general, many people view it as only being suitable as a route to fitness for the elderly or for the very out of shape. However, both the American Heart Association and the American College of Sports Medicine recommend walking as an exercise intervention that can improve a number of health measures. In this lecture, you will learn the value of walking as a workout mode and how to do it correctly to ensure optimum health benefits.

The Benefits of Walking

- Race walkers can cover a mile in just over 5 minutes and a full marathon in around 3 hours. Although over 40% of journeys in the United States are less than 2 miles, only 10% of these short trips are not made by car. These short trips offer a lot of opportunity for walking.
- Walking a mile burns just as many calories as running—it just takes longer. Walking has been proven to be an effective treatment for mild depression, reducing symptoms by 47%.
- Walking for fitness first gained popularity in the United States in the 1980s after cardiologist James Rippe, a graduate of Harvard Medical School, published details about how beneficial walking was for his patients recovering from a heart attack. His results showed that walking can not only reduce important health parameters such as high blood pressure and cholesterol, but can also significantly aid weight loss.
- Studies have shown that exercise doesn't have to be vigorous to reduce cardiovascular risk factors; even strolling can reduce the risk of cardiovascular disease.

- As with any activity, walking uses energy, so adding walking to your daily activity will burn extra calories. As long as you don't compensate by eating extra food, regular fitness walking will result in weight loss. In addition, if you walk up a steep incline or increase your pace, you burn more calories.
- Race walking speeds of over 5 miles per hour will burn as many as 600 calories per hour. A 12-minute-per-mile pace, about 5 miles per hour, can burn as many as 50% more calories than a 20-minute-per-mile pace, which is 3 miles per hour. If you're walking faster, you'll not only burn more calories, but you'll also spend less time each day exercising.
- As a weight-bearing exercise, walking can also positively impact bone density. Osteoporosis reduces the density of bones and can be life threatening. Several studies have reported that regular walking at moderate to brisk speeds increases bone density—even for just 30 minutes a day.
- Regular aerobic conditioning, which is precisely what walking is, can help reduce stress. A walking program has been shown to produce significant gains in self-image, confidence, and feelings of well-being in addition to reducing depression.
- Exercise-related injuries are shown to be much lower for walking than for most other exercise formats. For example, during running, the body has to absorb impacts equal to around 5 times your body weight, but walking causes impact stresses of only around 2 to 3 times your weight. Therefore, walking is less likely to produce injuries and is consequently being recommended as a rehab activity for injured runners.
- Studies have shown that increasing the intensity of a walking program, unlike other modes of exercise, doesn't carry any increased risk of injury.

- When it comes to exercise for seniors, it can be argued that walking is the foremost option—although, of course, every type of exercise has some risk associated with it. However, because walking is a low-impact activity, the risk is lower compared to other forms of exercise, such as running.

The Walking Motion

- Starting at the top of the body, the shoulder muscles are used when you pump your arms vigorously while walking, and they provide balance as they swing in opposition to your legs.
- Walking with an upright posture is the most efficient way of locomotion, so pulling in the deeper abdominal muscles is important. The hip flexor muscles at the front and top of the thigh are responsible for lifting the leg and swinging through the striding phase of the walk.
- The quadriceps muscles on the front of the thigh are used to extend the knee as each leg is straightened. Your hips sway from side to side as you walk, and the glutei are responsible for this motion. Drawing the leg back and pushing off the ground requires hip extension, which uses the back of the thigh and the glutei.
- The **tibialis anterior** is on the front of the shin and raises the toes as the leg swings forward to ensure that your heel touches down first. The calf muscles provide the upward and forward momentum from the push off the ground as the heel lifts and you project forward.
- The **heel strike** describes the moment the foot first touches the ground and lasts for a split second. This is followed by the **early flatfoot stage**, which is defined as the point at which the whole foot is in contact with the ground, and the body's center of gravity, located in the pelvis in front of the bottom of the spine, is moving forward through the foot. This is an important stage because this is where shock absorption takes place, which is a key to preventing injury.

- The **late flatfoot stage** is the point at which the center of gravity passes forward of the neutral position, and subconsciously, the whole body structure changes from being flexible, in order to absorb shock, to being more rigid, enabling the body to propel forward.
- The final phase is called the **toe-off stage**, the point at which the swing of the leg begins again. This is where the difference between walking and running is most obvious; in walking, the next heel strike occurs immediately on the other foot, but a runner will go through the **floating stage**, describing the moment where both feet are momentarily off the ground.

Common Questions

- Is walking as good as a form of exercise as running? In fact, walking is a much healthier choice because you get all of the benefits of running—such as toning the muscles, improving the cardiorespiratory system, strengthening the immune system, and



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Walking is a great alternative to running, especially because it has a lower impact on your joints.

controlling blood fats and stress hormones—but without the same risk of injury to your joints.

- Can walking really help you lose fat? It can, but the caveat is that just like any other form of exercise, the more effort you put in, the better the results you will achieve.
- To turn a simple walk into a workout, vary the intensity by alternating between a moderate but brisk pace and sprinting, pumping your arms as you vigorously move yourself across the ground. Just 30 minutes of this, including 30-second sprints and 1-minute slow paces for recovery, will lead to serious calorie burn.
- Walking is not just a simpler, easier version of running; you actually burn more calories walking fast than you do running. The 2 activities are obviously similar and offer common benefits, but walking also has the bonus of reducing the likelihood of impact injury. It also affords an opportunity to keep your fitness level up by exercising with certain injuries that running might not allow.
- Walking also provides the ideal gentle workout mode on the day following a race or a particularly heavy training session. Furthermore, it allows partners of disparate abilities to exercise together because the fitter person speed walking will be working hardest if trying to keep up with the less fit person who is running.

Walking Tips

- When outdoor temperatures are high, profuse sweating leads to considerable weight loss. This reduces the amount of blood returning to the heart, which could result in cardiovascular stress as indicated by very high heart rates. On a hot day, you must take a water bottle with you.
- When humidity is high and air temperature is up, the body's ability to dissipate internal heat produced during exercise is impaired. Therefore, you may need to reduce your speed or continue walking during extreme conditions because it could result in heat exhaustion

or perhaps heat stroke. To improve the body's ability to stay cool, you need to choose light, loose clothing that will allow air to circulate around the body.

- If the sun is strong, a hat or visor may be advisable, and a smear of petroleum jelly across your forehead just above your eyebrows will prevent sweat from running into your eyes. In addition, petroleum jelly is useful to lubricate the tops of the legs and under the arms to avoid chafing.
- On a cool or cold day, layering clothing will keep walkers warm at the start of the exercise. As the body becomes warm, outer layers can be removed before the under layers become wet from perspiration. If your clothing becomes wet, it should be changed as soon as possible. Gloves and a hat are advisable if the weather is very cold because a lot of heat is lost through the hands and head.
- In wet weather, you'll chill very quickly unless you protect yourself from the rain, but try to avoid plastic garments because they don't allow perspiration to escape, so you could end up becoming chilled. In addition, windy conditions can significantly alter the intensity of exercise, so adjust your workouts accordingly if you need to.
- Walkers who are accustomed to exercising at lower altitudes will need to decrease their exercise intensity and increase their warm-up and cooldown periods at higher altitudes until they have acclimatized to the new conditions.
- The mechanics of walking are quite distinct from other sports, and thus, there are different requirements for walking shoes. A good walking shoe must be flexible in the forefoot and stiff in the heel with a slightly firmer yet still comfortable middle sole.
- In addition, wear well-fitting, seam-free socks—that are made of cotton or of a wool mix—to prevent chafing and to absorb perspiration.

Walking Workouts

- The following walking technique includes 3 distinct intensity levels. For level 1, called health walking, focus on your posture by lifting up through the center of your body, trying to maintain a large space between your rib cage and your pelvis. Relax your shoulders, and swing your arms in rhythm with your stride
- Keep your arms swinging naturally and comfortably, and relax your elbows as you swing your arms in opposition to your legs. The length of each stride should be comfortable, with stride length varying from one individual to another.
- For level 2, called fitness walking, keep the same posture as in level 1, but bend your elbows so that your arms will swing faster. Swinging your arms faster will cause you to increase your stride frequency.
- Level 3 is known as speed walking and should only be used in short spurts due to the effort involved. As your arms swing from your shoulders, focus on driving your elbows back and keeping them close to the sides of your body. Concentrate on increasing stride frequency—not stride length.
- Like any other exercise class, begin your walking workout with a warm-up, then do the aerobic training section, and follow with a cooldown or stretch.
- Level 1 walking is ideal as a warm-up. Then, start to increase your walking speed from level 1 to level 2, concentrating on good posture.
- Next is the aerobic section, where the aim is to elevate your heart rate for a specific period of time. This section should form the major part of your walk and should feature alternate bursts of level 3 with level 2 for recovery.

- Your cooldown will return your body to its pre-exercise state by reducing your heart rate and breathing rate gradually to more normal levels, followed by stretching the muscles used to maintain or develop flexibility.

Important Terms

early flatfoot stage: The stage of walking at which the whole foot is in contact with the ground. This is an important stage because this is where shock absorption takes place, which is a key to preventing injury.

floating stage: The moment for runners at which both feet are momentarily off the ground.

heel strike: The split second at which the foot first touches the ground when walking.

late flatfoot stage: The stage of walking at which the center of gravity passes forward of the neutral position, and subconsciously, the whole body structure changes from being flexible, in order to absorb shock, to being more rigid, enabling the body to propel forward.

tibialis anterior: A muscle that is located on the front of the shin and is responsible for raising the toes as the leg swings forward to ensure that the heel touches down first when walking.

toe-off stage: The stage of walking at which the swing of the leg begins.

The Amazing Benefits of Stretching

Lecture 20

Flexibility is considered to be one of the health-related components of fitness, and poor flexibility can lead to alignment issues that could increase your risk of postural problems, which can potentially negatively affect your quality of life. In this lecture, you'll learn how to stretch effectively to help keep you mobile well into your later years, and you'll discover a range of techniques that will help improve your flexibility—along with an understanding of why the various techniques work.

Joins and Flexibility

- Flexibility refers to the range of motion around a joint or group of joints. It varies from person to person, but for each individual, it also differs from joint to joint. It's primarily dependent upon the specific joint structure and is significantly influenced by the connective tissues around each of the joints.
- There are 3 different types of joints: joints that are fused and exhibit no movement (the skull), joints with limited movement (the spine), and synovial joints (the elbow and knee) that allow for a higher degree of movement.
- Synovial joints rely upon both a capsule that envelops the whole joint and the supporting ligaments to hold the bones together. The capsule fills with synovial fluid to lubricate the joints, making movement easier, but it's also tough enough to restrict potential damaging movements.
- The ligaments are made of fibrous tissue similar to the capsule and serve to attach bone to bone. Importantly, they also give the joint stability by preventing movement that could cause dislocation, for example.

- Joint health is related to activity levels, age, and gender, and a clear link exists between the amount of exercise taken and the mobility of the joints—with even just regular walking positively affecting the range of motion in the hips and lower spine. Because tightness in these areas can be a contributory factor in the incidence of falls in the elderly, joint health has great value in maintaining good quality of life.
- The American College of Sports Medicine recommends stretching to promote enhanced flexibility as an essential preventive measure. Regular stretching also has been found to significantly reduce lower back pain.
- As we age, there's a gradual slowing of the cell function in muscles, tendons, and ligaments that leads to a buildup of **collagen**, the main component of connective tissue, which becomes denser and less resistant to lengthening. Because connective tissue surrounds the joint, reduced mobility is the result. However, regular stretching can help to maintain the elasticity of connective tissue and reduce the effects of this aging process.
- In general, females tend to have better flexibility than males at most joints, and this can be attributed to small differences in the joint structures and the associated connective tissues. The effect of age on flexibility, however, is considerably greater than gender.
- Body temperature affects range of motion because it improves with increasing heat, which explains the reason that exercise always begins with a warm-up period. Contrary to common belief, rather than shortening your muscles and making them stiffer, weight training exercises that work through your full range of motion will improve your flexibility.
- During pregnancy, the joints and ligaments in the **lumbopelvic area**—which includes the lumbar, stomach, pelvis, and hips—are relaxed to allow for growth and movement of the fetus and to make delivery a little easier. This change is due to increased levels of the

relaxin hormone, which drops to normal levels after the birth, so the connective tissues tighten up again.

- Improving flexibility requires a stretching program that aims to increase the range of motion and that takes into account the factors regarding the joints. Careful consideration should be given to designing a plan to ensure that it's safe, appropriate, and effective.
- Research shows that regular stretching has been shown to produce enhanced range of motion, reduced risk of injury—and the degree of injury if injury occurs—increased sports performance in terms of endurance and skill, improved posture, and a positive impact on mental health by providing a vehicle for physical relaxation.



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Flexibility can be completely maintained throughout your life by doing stretching exercises.

Stretching Techniques

- Stretching can be active, brought about by contracting the opposing muscle group to move the limb to a position where the target muscle is lengthened, or it can be passive, whereby the limb is moved by a partner, yourself, or a prop. Stretching techniques are divided into 3 main categories: ballistic, static, and proprioceptive neuromuscular facilitation (PNF).
- **Ballistic stretching** involves swinging or bouncing a limb into a position beyond the normal joint range, thereby lengthening the associated muscles. It's a common technique for elite sportspeople,

but it's not recommended for the public because it is difficult to execute safely.

- **Static stretching** is the most common method of practice, requiring a gentle movement toward the end position that slowly lengthens the muscle. Then, you hold the point at which there's mild tension for between 15 and 30 seconds. A good tip is to use imagery; try to actually picture the muscle lengthening as you stretch.
- **Proprioceptive neuromuscular facilitation (PNF)** stretching techniques were originally devised as a therapy for patients suffering from muscle-related diseases and work by using the body's nervous system to encourage extended lengthening of the muscles. It uses 3 key responses: the myotatic reflex, the Golgi tendon organ reflex, and the principle of reciprocal inhibition.
- The **myotatic reflex**, also known as the stretch reflex, is an automatic contraction within the muscle. It's a response to a change in the length that is detected by muscle spindles, which lie within the muscle fibers. This is a self-preserving response to the possibility that the muscle might be stretched too far and could cause a tearing of the fibers. This reflex is the reason ballistic stretching carries some risk.
- The **Golgi tendon organ reflex**, also known as the inverse stretch reflex, is the opposite of the myotatic reflex. This receptor is located at the point where the muscle joins the tendon, and it detects tension. If it detects very high tension, it interprets it as a possible threat to the muscle—potentially causing it to tear—so it forces the muscle to relax, thereby removing the threat.
- **Reciprocal inhibition** describes the process whereby one muscle relaxes to some degree if its cooperating pair contracts. These sensory responses are used in combination with a technique called contract-relax-antagonist-contract. First, the target muscle group is stretched slowly, in a passive manner, which avoids initiating the myotatic reflex. Then, it's held in a position while a voluntary

contraction of the muscle is exerted for about 6 seconds without it moving, which will stimulate the Golgi tendon organ reflex that relaxes the muscle. Then, the opposite muscle group is contracted strongly, and by reciprocal inhibition, the target muscle relaxes even more and can then be stretched to a much greater degree. This has been shown to be the best stretching method to improve flexibility.

- A technique that works on the principle of reciprocal innovation is called **active isolated stretching** and is suitable for just about anyone—including elite athletes and those not accustomed to exercise. The body positions are comfortable and easily manageable, and the stretches are gentle and relaxing. Unlike the other techniques, this is an active technique that is performed with a partner.
- Start by contracting the muscles to move through a full range of functional motion. This will result in the opposite muscles switching off and relaxing, allowing a partner to assist the stretch by gently extending the range of motion. This assist should only last for about 2 seconds, and each stretch should be performed 10 times.

Flexibility Guidelines

- As with any form of exercise, you should follow a plan when dealing with flexibility. However, unlike cardio fitness and strength training, there are no universally agreed upon programs for flexibility. Therefore, applying common sense and committing yourself to regular stretching will lead to increased range of motion.
- Try to stretch daily if possible. Withhold static stretches at the point of mild tension for 15 seconds to maintain flexibility but closer to 30 seconds to improve it. Ensure you're warm before stretching—either after some cardio exercise or a warm bath.
- Be aware of your posture; ensure that you are in a comfortable position to stretch that allows you to focus on the target muscle. Perform stretches that target the joints that feel particularly stiff or that replicate movements you need for your chosen sport.

- Use deep breathing, gentle music, and some visualization to help your efforts by helping to relax the muscles. If at any time you feel a sharp or stabbing pain, release the stretch immediately.

Myths and Misconceptions of Stretching

- There are many myths and misconceptions about stretching that, unfortunately, are even held by some lesser qualified fitness professionals.
- Flexibility is not related to your shape because height, weight, arm span, and leg length do not significantly affect range of motion.
- It's easy to assume that weight training leads to stiffness. However, there's no link between muscle size and immobility. In fact, because resistance training results in improvements in the elasticity of the muscles and the tensile strength in the tendons and ligaments, it can increase your range of motion over time—even without stretching.
- Furthermore, flexibility training can actually improve your strength. By increasing your flexibility, the muscles are able to operate over a greater range of motion, thereby recruiting more muscle fibers and generating more force.
- In preparation for exercise and sporting pursuits by engaging in a warm-up, the increased body temperature through movement will stimulate the flow of synovial fluid into the joints that lubricate them. Respiratory speed will increase to introduce more oxygen to generate fuel, and the heart rate will increase to transport nutrients to the working muscles.
- Most importantly, as temperature increases, so does the speed of nerve impulses, and this is the key to reducing the risk of injury. For example, if you stumble on uneven pavement, as your ankle begins to roll, the Golgi tendon organs detect extra tension in the area, and a message gets sent through the spinal cord that orders the muscle to contract, helping you stand back up.

- The faster that message transfers, the less risk there is of injury. The nerve fibers are incased in the myelin sheath, which serve to insulate the nerve fibers because the warmer you are, the faster those messages will transfer.
- In order to reduce the risk of injury, those muscle messages need to transfer extremely quickly. In this case, the key to reducing the risk of injury is to warm up, and the warm-up should focus on mobility and increasing temperature.
- In fact, studies confirm that pre-exercise stretching actually increases the risk of injury by rendering the joints less stable. Stretching to develop flexibility is best left until the end of the session—when you're warm.
- Our final controversy concerns the much-heralded value of stretching in preventing muscle soreness experienced the day following exercise. In fact, muscle soreness is the sum of several factors, including microtrauma to the muscle fibers—inflammation within the cells and irritation of the nerve endings due to additional enzyme activity.
- Because stretching cannot impact these processes that lead to microtrauma, it can't affect muscle soreness. Therefore, if you exercise intensely today, expect muscle soreness tomorrow and embrace it because it's a sign that you worked hard enough to set in motion the adaptive responses that will lead to positive change. A cooldown will help remove waste products, such as lactic acid, and reduce the inflammation to some degree, and stretching can be part of that cooldown.

Important Terms

active isolated stretching: A stretching technique that uses the synchronization of paired muscles to allow for coordinated movements and is performed with a partner.

ballistic stretching: A type of stretching that involves swinging or bouncing a limb into a position beyond the normal joint range, thereby lengthening the associated muscles.

collagen: The main component of connective tissue.

Golgi tendon organ reflex: An automatic relaxing within the muscle that is a response to a change in muscle tension.

lumbopelvic area: The area of the body that includes the lumbar, stomach, pelvis, and hips.

myotatic reflex: An automatic contraction within the muscle that is a response to a change in the length that is detected by muscle spindles.

proprioceptive neuromuscular facilitation (PNF): A stretching technique that works by using the body's nervous system to encourage extended lengthening of the muscles.

reciprocal inhibition: The process in which one muscle relaxes to some degree if its cooperating pair contracts.

static stretching: The most common method of stretching that requires a gentle movement toward the end position that slowly lengthens the muscle. Then, you hold the point at which there's mild tension for between 15 and 30 seconds.

Stay Active—Defy the Aging Process

Lecture 21

Exercise is a key factor in maintaining a good quality of life. Research confirms that fitness levels achieved in your younger years can impact not just your physical, but also your psychological health in later life. If you continue to be active throughout your life, then you can expect to retain a desirable quality of life well into your advanced years. In this lecture, you'll learn about the aging body and investigate how it changes as the years go by. You'll also discover the value that exercise has in helping you resist the aging process.

Fitness and Aging

- The aging process is influenced by a number of factors—but primarily by genetics, disease, and lifestyle. In particular, lifestyle has been shown to be susceptible to manipulation and capable of impacting life span.
- An active lifestyle is recommended for good health regardless of your age, but some researchers even suggest that the older you are, the more important it is. While exercise is of benefit at any age, it's been proposed that age 50 is a critical point at which engaging in regular exercise can protect against the physical and psychological deteriorations associated with getting old—such as frailty and disability.
- The benefits of regular exercise apply at any age, so it's never too late to start a new exercise regime. Exercise can not only add years to your life, but it will also put life in your years—even if you're currently not active.

The Bones and Aging

- A drop in calcium levels is the most noticeable result of aging, and it occurs more in women than in men due to the postmenopause reduction in estrogen levels. As a result, the bones become brittle

and more likely to fracture. Decreased calcium levels introduce the risk of an exacerbated curvature of the spine, leading to poor posture, increased risk of falls, and extra pressure on key joints.

- Inactivity is a major contributor to osteoporosis, and weight-bearing exercise can retain bone mineral density, so regular exercise is encouraged from an early age as a preventive measure.
- Older adults who commit to 1 hour of exercise each day can reduce their risk of hip fracture by as much as 50%. Tennis and jogging are favored in comparison to walking and gardening, which have showed no effect on the rate of fracture incidence.
- Osteoporosis sufferers may already exhibit reduced mobility, so exercise will need to begin gentle. Aquatic exercise is a recommended option to help improve movement, but the buoyancy of the water reduces the weight bearing, which is needed, so switching to dry land is recommended as soon as possible.
- A common feature in older adults is a slight forward bend at the hip and in the lumbar spine, so it's recommended to stretch the muscles at the front of the body, particularly in the hip flexors.

The Joints and Aging

- The most obvious consideration in the joints is the decreased range of motion caused by the stiffening of the connective tissue around them—in combination with the muscles losing their elasticity.
- In addition, the production of synovial fluid decreases and becomes more viscous, so the cartilage that covers the ends of the bones can actually tear and lose fluid, reducing the cushioning effect when the joints move.
- These changes not only restrict movement but can also cause pain. Previous injury is one of the causes for these changes, but leading a sedentary lifestyle can also be a significant cause.

- In the spine, the disks between the vertebrae that are made of cartilage begin to lose their fluid, and increased calcium deposits are noted, so their ability to soften movement in these vital joints is somewhat impaired. These combined changes lead to reduced movement, most noticeably in the ankles, knees, and hips, but this can be overcome through regular activity.
- When considering exercise as an intervention for arthritis, the most common ailment associated with old age, the first thing to appreciate is that exercise will not make the condition worse, which is a common misconception. Not only will it help to improve cardiovascular profile, increase muscular strength, and improve your flexibility, but it can also have a positive impact on mental health.

The Muscles and Aging

- The changes in muscles over time are similar to the changes in bone: There's a progressive loss of tissue with advancing years, but the general decline is more often associated with inactivity rather than age.
- Older people who remain active display better strength and ability to perform their tasks than sedentary counterparts. Research suggests that as we age, there is a decline in fast-twitch muscle fibers due to the speed of their contraction. As a result, power reduces.
- Potential maximum tension is unaffected because the motor unit, which is the nerve and muscle combination, will still perform as designed. Therefore, any decrease in strength is due to other influences.
- Reductions in the number of blood vessels, enzyme concentration, and the ability to store energy in the muscle cells contribute to a decline in muscular endurance.
- Exercise prescription incorporates strength training because gains can be made at any age, and the associated increase in the ability to

perform everyday tasks and the reduced risk of falls also promote a psychological boost.

The Cardiovascular System and Aging

- Age-related changes within the cardiovascular system are less pronounced than in the bones and muscles. The heart retains the capability to supply blood to the body, allowing it to perform everyday tasks.



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- Most of the changes that occur—including decreases in the heart muscle performance, the efficiency of the blood vessels to transport oxygen, and the ability of the skeletal muscle to use oxygen—are due to inactivity rather than age.

Engaging in regular exercise throughout your life will positively affect the quality of your life in later years.

- Fortunately, these drawbacks can be significantly mitigated by regular exercise, which can lead to increases in stroke volume, total blood volume, and good cholesterol. Therefore, adherence to a suitable exercise program can afford a high protection against cardiovascular disease, hypertension, and diabetes.
- Furthermore, although our breathing apparatus is fully grown by our mid-20s, the efficiency of gaseous exchange continues to improve into our early 40s. This is why endurance athletes, such as marathon runners, reach their peak a little later than athletes in other disciplines.

Physiological Changes and Aging

- Lung volume decreases as the lung tissues in the chest wall lose elasticity. There's a reduction in the number of cilia—the tiny hairs that remove particles from the airways—which can increase the risk of infection.
- Collagen builds up around the alveoli, leading to a reduced surface area and diminishing the exchange of gases, which leads to less available oxygen. Calcification affects the trachea and the rib cartilages, leading to a stiffness that reduces the ability to expand and take in more air.
- These factors combine to initiate a gradual increase in the rate of breathing that tends to be shallow-chest breathing. This doesn't preclude exercise, but deep breathing is consciously encouraged, and alternating intervals of higher and lower intensity are preferable.

The Nervous System and Aging

- In regards to the nervous system, evidence shows that coordination declines with age. Interestingly, research has shown that active older people have faster reactions than inactive younger people, suggesting that a sedentary lifestyle is the key factor rather than age.
- In addition, neurons decline naturally, but physical challenges, such as learning new motor skills, can lead to development of an unlimited number of neural pathways. If a muscle is not regularly used, the motor units that control it can shrink, so the neuron becomes less efficient, proving that inactivity accelerates the aging process.
- Due to the cardiovascular changes that take place, blood supply to the brain may decline, restricting the oxygen provided. Without this fuel, brain processes can be prolonged, which is what can cause loss of coordination and an increased risk of balance issues.
- Diminished neural activity can also lead to a slowed reaction to requirements for redistributing blood supply that results in **blood**

pooling, the term given to blood remaining in the extremities, which can cause dizziness. This can manifest itself in a drop of blood pressure that occurs when standing up quickly from a sitting or lying position—called **postural hypotension**.

Seeing and Hearing with Age

- Aging is linked to degeneration in both sight and hearing ability. The lens loses elasticity, making it harder to focus, and the iris muscles weaken, so the amount of light entering the retina is reduced.
- In terms of hearing, the ability to detect higher-pitch tones becomes difficult, but other sounds can be a problem if there is a high level of background noise.
- While many elderly people are unwilling to accept the reduction in these senses, it clearly happens, and it's a contributory factor in balance issues.
- Regular exercise can lead to improvements in the cardiovascular system, breathing function, and muscle performance, and all of these will enhance the efforts of the central nervous system.

Functional Fitness

- Physiologists refer to **functional fitness** as the fitness that is relevant to day-to-day living; it's the difference between independence and potentially becoming a burden on those close to you as you age.
- In order to develop and retain a desirable degree of functional fitness, cardiovascular fitness, muscular strength and endurance, flexibility, balance, and motor skills are the targets for improvement.
- Cardiovascular training will induce improvements in your maximal oxygen uptake, leading to an enhanced ability to walk, cycle, or swim without discomfort. Increasing cardiac outputs, lowering heart rate, and reducing hypertension are key bonuses. The blood supply

and enzyme concentration, leading to better muscle endurance, will increase.

- To bring about these changes, aim to exercise every day if possible—even if you have to build up to this. Try to avoid high-intensity exercise; instead, aim for medium-intensity exercises that last for about 30 minutes. The exercise mode should incorporate movements of the large muscle groups, so walking, cycling, and swimming are the favored options.
- Training for muscular strength and endurance, you can expect increased strength—the ability to lift and carry things at home—and better endurance, enabling you to walk up and down stairs much more easily.
- Increased lean muscle tissue helps to boost metabolism, control body composition, and enhance bone density.
- To bring about these improvements in muscular strength and endurance, include exercises for all the major muscle groups 3 times per week with, ideally, a day’s rest in between to allow the muscles to rest.
- Overload is the key, so workouts must lead to muscular fatigue. Expect to spend about 30 minutes performing 2 to 3 sets of an exercise with 10 to 12 repetitions of each exercise.

Guidelines for Flexibility Training

- Flexibility training can bring several positive benefits, including increased range of motion, lengthening of key postural muscles, improved balance, less stiffness, and less pain when moving.
- Begin with just 2 stretching sessions each week and build up to 5. Remember to always warm up first with at least 5 minutes of gentle cardio-type activity.

- Mix dynamic stretching techniques—but not bouncing—with static stretches that are held at the end point of mild tension for 15 to 30 seconds.
- Try to include stretches for the whole body, targeting problems that may exist. When doing your stretching exercises, try to keep your breathing relaxed.
- To train to improve balance, adopting wide-, narrow-, and single-leg stances for basic exercises such as squats will help to develop static balance. Use movements in all directions to promote gains in dynamic balance, and include exercises that employ functional training equipment, such as core boards and wobble boards.
- Motor skills can also benefit from balance exercises, and playing catch with an uneven ball or with a partner will lead to further gains in coordination and will help you develop quick reactions.

Important Terms

blood pooling: The term given to blood remaining in the extremities, which can cause dizziness.

functional fitness: The fitness that is relevant to day-to-day living.

postural hypotension: The drop of blood pressure that occurs when standing up quickly from a sitting or lying position.

Sitting Disease

Lecture 22

Leading a sedentary lifestyle can have a significantly negative impact on your health, with recent research stacking up to highlight just how dangerous inactivity can be to your future well-being. It's now a proven fact that spending too much time seated will shorten your life. In this lecture, you'll discover the dangers associated with long periods of sitting, and you'll learn a wide range of tactics that you can employ on a daily basis. Whether at work, at home, or on the journey between the 2, you can start to make changes today that will improve your health tomorrow.

Leading a Sedentary Lifestyle

- According to the American Institute for Cancer Research, approximately 100,000 new cases of breast and colon cancer each year are linked to sedentary lifestyles.
- A study at the University of South Carolina showed that people who were inactive for more than 23 hours per week had a 64% greater risk of death from heart disease when compared to a control group, who were sedentary for less than 11 hours per week.
- It's estimated that up to 100,000 people die each year from blood clots, and sitting in one position for too long is the key factor.
- The dangers of sitting were discovered in the late 1950s, when we realized that men who were employed in manual labor roles were less likely to suffer coronary artery disease than those whose jobs were not physically active.
- Research has concluded that there's a significant link between time spent seated and mortality. More importantly, being active doesn't balance out the negative effects of being seated much of the time.

The Physiological Implications of Being Sedentary

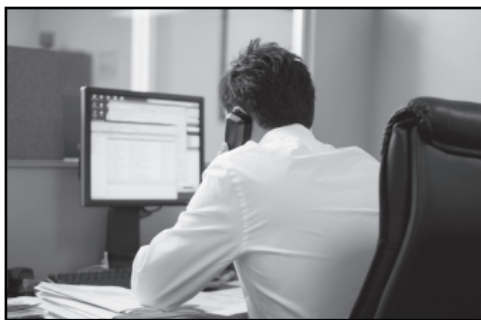
- A 2008 study published in *Current Cardiovascular Risk Reports* showed that if we don't stand, electrical activity within the muscles effectively ceases, leading to a drop of up to 90% in the levels of **lipoprotein lipase**, which is an enzyme that draws fat out of the bloodstream for use as fuel, because it wouldn't be required. This leads to a higher concentration of blood fats that are known to increase the risk of cardiovascular malaise.
- In addition, sitting appears to lead to about a 20% reduction in high-density lipoprotein, or good cholesterol, increasing the risk of suffering from a cardiovascular disease.
- Sitting only requires contractions of the small muscles in the hands and forearms—for example, when typing or changing the television channels with a remote control—and these use up small amounts of energy when compared to the large muscles in the legs, buttocks, and lower back. As a result, your metabolism plummets, so calories are not being consumed but absorbed, a fact that will more than likely manifest itself in the waist area.
- Remaining sedentary for more than 24 hours impairs the ability of our insulin to uptake glucose, which then raises the risk of diabetes. In addition, blood circulation is, to a certain degree, dependent upon movement. When the legs are not moving, the leg muscles are not contracting, and the risk of blood pooling in the lower limbs is increased, potentially leading to a number of health-related issues—including **deep vein thrombosis (DVT)**, which is a clot in the leg or groin, and feeling dizzy when standing. Furthermore, the lymphatic system is solely reliant upon the massage effects of muscles due to movement.
- Even if you hit the gym straight after work, an 8-hour day spent sitting at your desk is going to take its toll in time. Unfortunately, whether you're out of shape or in good shape, too much sitting can be deleterious to your health.

- The human body adapts specifically to the demands that are placed on it; sitting, in effect, trains your body to do nothing and leads to physiological adaptations that reduce your functionality.
- Because the hazards of too much sitting can affect us even when we're active, we need a blueprint to reduce sedentary behavior that involves taking stock of our daily routine and attempting to find opportunities to reduce the time spent seated—particularly for long, uninterrupted bouts.
- This doesn't necessarily mean heading for the gym and a full hour-long workout, but it does involve engaging in non-exercise activity thermogenesis (NEAT), a label coined by Dr. James Levine of the Mayo Clinic in Rochester, Minnesota. NEAT involves finding ways to introduce exercise into your daily routine, thereby reducing the amount of time you spend sitting.

Preventing Sitting Disease

- At work, where the likelihood of being stationed at a desk is an issue, take breaks by walking to the water fountain. In addition to the exercise in getting you there, water has known benefits to health. Furthermore, stand whenever you're taking a phone call, or earn your coffee break by walking up and down the stairs a few times beforehand.
- You can schedule a 5-minute activity period for both the morning and afternoon to take a walk. Even if you can't leave your chair, you can still tone your abdominals by sitting upright with your shoulders drawn back, taking hold of the front edge of the chair with both hands for support, and slowly lifting your knees toward your chest.
- If you're downloading large files, use the time to get out of your seat and do a few squats. If you're photocopying, try some rear leg lifts. If you can hold mobile meetings, try discussing work matters while you stroll around the building or, better still, outside so that you get the boost of fresh air and vitamin D from the natural light.

- Even if you can't leave your desk, a few seated stretches will still bring benefits, so try to repeat the following moves a few times during the day, holding each static position for about 15 seconds.
- First, work through the neck. Take your head, drop your ear down to your shoulder, and then take your opposite hand out to the side and press it away from you. You'll feel a stretch come down through the neck and into the shoulder. Hold the stretch for about 15 seconds.
- Lift your head back up and twist your head to the side, releasing through the neck on the opposite side. You'll need to work on both sides, holding each stretch at the end position to ease the tension and returning back to the center.



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If you work at a desk, perform seated stretches throughout the day to ease the tension in your shoulders, neck, and upper back.

- Then, lift your hands up in front of your chest, interlock your fingers, and keep your elbows bent but reach your arms forward, rounding the shoulders and dropping the chin down. Try to stretch your shoulder blades apart, stretching through the muscles in your upper back.
- Ease out of that stretch and balance it by taking your hands around behind your back in the lower back region. Then, squeeze your shoulder blades together, bringing your elbows toward each other, and you'll feel that stretch through the chest and through the front of the shoulders. Then, take one arm across your chest, take your hand above the elbow, and squeeze it in, feeling a stretch into your shoulder.

- To stretch your triceps, lift your hand up, drop your hand behind your head in between your shoulder blades—with your other hand on your elbow—and gently press down so that your fingertips are sliding down between your shoulder blades. Remember to do both sides and to hold all stretches for 15 seconds.
- At home, the major concern is sitting down in the evening to watch television, so try to stand up or march in place during the commercial breaks. Purchase a piece of home cardio equipment so that you can cycle, walk, or step while watching your favorite shows or movies.
- Do a few tricep dips off the end of the couch or chair while you're waiting for your favorite program to begin. Stand on one leg and keep your balance while the theme song plays at the beginning and end of the show, or if you're waiting for a particular show, switch to the music channel and dance along with whatever is playing for a few minutes.
- You could also try using a fitness ball in your office and home. Instead of sitting in a chair to watch television, you can sit on a fitness ball and gently bounce.
- If you're reading, put your book down, stand up, and walk in place for 2 minutes after reading every 6 pages.
- Keep a resistance band in the kitchen drawer so that you can pump rubber while dinner is cooking.
- The World Health Organization warned that sitting on a plane for more than 4 hours can double your chances of developing a blood clot. In fact, it's estimated that 5% of all air travelers suffer clots, but some people may not know it because the clots may become reabsorbed within the circulatory system. For those who already suffer from circulation problems and for the elderly, the risk of clotting and, therefore, the possibility of deep vein thrombosis (DVT) is increased.

- If a clot breaks away from the wall of the vein and travels within the bloodstream, it may cause a blockage or possibly even lead to a heart attack. If you fly regularly, it's important not to simply ignore leg pain or assume it's just a cramp. If caught early enough and treated with a blood-thinning agent, clots can be relieved before becoming a problem.
- To help reduce your risk of DVT on your next flight, take a few minutes every hour to circle your ankles, to flex and point your feet, to lift and lower your heels, and to lift and lower your thighs. Stretch the calves by placing the toes on the footrest and pressing the heels down to the floor, lengthening the back of the lower leg.
- In addition, get up and walk the length of the aisles at regular intervals, drink plenty of water, and try to avoid diuretics such as alcohol and coffee because dehydration is thought to be a contributory factor.
- You can also make good use of your spare time on a plane or as a passenger in a car by relieving tension and stress with a total body self-massage.

Posture and Breathing

- There is no doubt that long periods of sitting are linked with poor posture, which is a crucial factor in back pain issues. A big problem with being seated is that it's too easy to switch off your core muscles, and your alignment suffers as a result. A disengaged core manifests itself in rounded shoulders and a forward chin position.
- A surprising cause of poor posture is poor breathing technique. When breathing is not effective, the nervous system will attempt to bring about changes that allow for more oxygen to be taken on board and then delivered to all the cells within the body because they need this life-giving fuel. Unfortunately, this can initiate changes in posture.

- While the diaphragm plays a vital role in contracting to give more space in the thoracic cavity, producing a pressure drop that leads to inhalation, its action is supported by the pectoralis minor and sternocleidomastoid muscles, which lift the rib cage. If breathing is not adequate, the nervous system will influence posture to put these muscles in a position that will allow them to better assist respiration—where it’s easier for them to lift the rib cage.
- Moving the shoulders and chin forward results in these 2 muscles having a better line of pull; rather than pulling slightly backward, they are able to pull directly upward, which helps to expand the rib cage and create more space for air to enter.
- The greatest concern is that as these muscles work harder, they also become stronger and stiffer, so it’s harder for them to return to a more natural posture. Fortunately, breathing exercises can help you overcome this.

Important Terms

deep vein thrombosis (DVT): A clot in the leg or groin.

lipoprotein lipase: An enzyme that draws fat out of the bloodstream for use as fuel.

Exercise for Weight Loss

Lecture 23

Research shows that excess body fat carries an increased health risk. Therefore, more importantly for health instead of for aesthetic reasons, weight management and, particularly, weight loss should be a focus of every individual. The goal of this lecture is to analyze the role of exercise as a tool to achieve weight loss, helping you to understand how and why exercise works. By the end of the lecture, you should feel confident that you have the requisite knowledge of exercise for weight loss to make the right choices for your body—today, tomorrow, and for the rest of your life.

BMI and Obesity

- **Body mass index (BMI)** is calculated as your weight in kilograms divided by the square of your height in meters. For example, a person who is 5 feet 9 inches tall and weighs 125 pounds has a BMI of 18.5.
- The Centers for Disease Control and Prevention suggest that a BMI of 18.5 to 24.9 is a healthy range, with 25.0 to 29.9 being overweight and more than 30 being classified as obese. This is merely a guideline that correlates to the amount of body fat in the general population, and athletes or extremely muscular individuals will score falsely high on this scale.
- The percentage of overweight individuals is growing because of a very simple mathematical equation: the sum of calories in minus calories out. If more calories are consumed in the form of food than are used up through activity and metabolism, the result is weight gain.
- Fortunately, dietary restriction and increased exercise will lead to a calorie deficit and, therefore, to weight loss. Unfortunately, however, this technological age in which we now live has led to a predominantly sedentary lifestyle for most of us, and essential

movement for everyday tasks has become minimized. When this is combined with the incredibly easy access to calorie-dense foods, it's easy to understand how the equation works against us, leading to weight problems.

- We've evolved as a species that was occasionally threatened with famine and that required considerable physical effort to acquire food, and as a result, we developed the ability to take in and store food in the form of fat tissue. The existence of readily available food and the removal of the necessity to hunt for it have led to an expanding global waistband.
- When you eat and how much you sleep are factors in being overweight, but those are largely choices we can influence.
- There are other contributors to being overweight, including genetics. There's no doubt that heredity plays a role in our physical makeup—or, rather, it can explain disorders that contribute to increased weight—but genetics cannot account for a significant portion of obese people.
- In general, women carry more body fat than men but, usually, around the hips and thighs—known as a **gynoid**, or pear-shaped, body—while men's fat deposits tend to be around the stomach, which is referred to as the **android**, or apple, shape. For men, the increased abdominal fat is likely to lead to a greater risk of cardiovascular disease.

Storing Fat

- We store fat in the body in the form of **triglycerides**, which are composed of 3 fatty acid molecules found within specific fat cells known as **adipocytes**. There is also a small amount of fat residing within the muscle cells, ready to be used as fuel for exercise, although most will come through the bloodstream.
- The release of fat from storage to be used as fuel is regulated by 2 enzymes: hormone-sensitive lipase and lipoprotein lipase.

Hormone-sensitive lipase is located in the fat cell and acts to break apart the triglyceride, releasing the 3 fatty acids into the bloodstream. This is influenced by the hormone **epinephrine**, which increases in concentration during cardio exercise. The responsiveness of hormone-sensitive lipase increases during cardio exercise as well.

- A training effect of regular exercise is that this phenomenon improves; as we get fitter, the enzyme responds to lower levels of epinephrine and, therefore, more readily breaks apart the triglycerides to be used as energy.
- Conversely, the lipoprotein lipase is found on the walls of the blood vessels and acts as a transporter, mopping up triglycerides in the blood and taking them to storage sites to be used as fuel later.
- Exercise, especially when combined with reduced calorie intake through sensible eating, is the optimum approach to sustained weight loss—not only decreasing body fat but also enhancing cardiovascular profile, improving insulin sensitivity, and lowering blood pressure.

Misconceptions about Losing Weight

- Losing weight through exercise can be somewhat confusing. For example, cardio machines in the gym recommend built-in fat-burning programs at around 60% to 70% of maximum working heart rate—which we calculate by subtracting your age from 220—although this is a fairly low intensity.
- This is based on the premise that at lower intensities, the majority of the calories burned are from fat stores—rather than carbohydrate, which is stored in the muscles and liver. It is true that as the intensity increases, a lower proportion of the fuel will be provided by fat, but the important factor is the total number of calories expended.
- Therefore, a vigorous workout may burn a lesser percentage of calories from fat stores, but the total amount could be greater than

working out for the same length of time at a lower intensity. As your fitness level starts to improve through regular activity, your ability to achieve and maintain higher intensities will also improve, and therefore, your capacity to burn fat during exercise will increase.

- It's important to begin exercise gently, particularly if you have not done it in a while, but accelerated results will come from increasing the intensity of exercise, so you should try to do that as soon as possible. In addition, consult your physician before embarking on a new exercise regime.
- Another common misconception is that fat burning during exercise only begins after a set period, usually quoted as being around 20 or 30 minutes. Fat metabolism is, indeed, a slow starter because transport to and utilization in the muscles requires time to work effectively. After a while, the switch takes place from carbohydrate to fat for fuel, and this switch occurs sooner for fitter people because the fitter you are, the more fat you will be able to burn during exercise.
- Studies have shown that there are a number of physiological adaptations as a result of cardio exercise that help to shift body fat, and regular exercise helps us become better at using our fat stores.

Exercising for Weight Loss

- An exercise-for-fat-loss program will depend on frequency and duration. Because the aim is to burn as many calories as possible, exercising more often and for longer will help tip the energy balance equation toward a negative calorie deficit.
- When considering exercise for weight loss, thought should be given to the influence of **excess postexercise oxygen consumption (EPOC)**, which is the number of calories that are burned immediately after exercise has ceased. This is due to the increased metabolic effect of your body removing waste products from the cells and then refueling. EPOC is dependent upon the intensity of the workout.

- Fat can be burned at any exercise intensity, and low-intensity exercise is recommended for those with a low fitness level because it is more likely to encourage them to stick with it.
- While the percentage of fat compared to carbohydrate being used as fuel varies with intensity, the most important figure is the total number of calories consumed. Frequency and duration need to be high enough to have a significant impact on reducing body fat, and EPOC contributes significantly to calorie expenditure and is greater for higher-intensity exercise sessions.
- Although exercise can make a big difference in the amount of calories used up, weight loss will only be achieved if you don't eat too much. Regular resistance training results in a short-term boost in fat burning after exercise but a long-term increase in muscle tissue, which is associated with an increase in resting metabolic rate.
- The best exercise prescription is to combine intense cardio and resistance training modes. Because low-calorie diets lead to a slowing of the metabolism, resistance training is a vital tool to counter this and is highly valuable to help you maintain weight-loss progress—as long as you're combining exercise and food restriction.
- You get out of exercise what you put in, so resistance training needs to be intense and progressive. Weights should be selected to produce momentary



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Research shows that people who lose a significant amount of weight and keep it off frequently step on scales to keep track of their progress.

muscular fatigue at around 12 to 15 repetitions and then increased once it becomes too easy.

Getting Results

- High-intensity interval training requires 10 sets of 4 minutes at 95% of your maximum working heart rate with 2 minutes of rest in between.
- A resistance training circuit involves about 20 repetitions at each of 12 weight-training stations with little or no rest, and the stations ideally should alternate between upper and lower body for a good calorie burn.
- Sprint interval training involves maximum effort for 30 seconds followed by 4 minutes of light exercise—repeated 6 times.
- Fartlek training involves interspersing a steady pace with quicker bursts of varying duration in an unstructured format.
- Metabolic conditioning is the idea of working continuous cardio at a moderate intensity of around 70% of your maximum working heart rate for around 40 to 60 minutes.
- Step-up interval training begins at an easy cardio pace, and speed increases perhaps every 4 minutes by about 15% until you reach the set target of between 20 and 60 minutes.
- As you start to become fitter, another technique is near-maximal training, which involves 5 sets of 5 minutes at 95% of your maximum working heart rate followed by 5 minutes at 50%.

Losing Weight and Keeping It Off

- Both research and anecdotal evidence suggest that most of us are capable of successfully losing weight, but the bigger challenge is maintaining our new weight. The triggers to weight regain can be divided into 3 distinct categories: lifestyle, stress, and hormones.

- Being involved in sports, especially team sports, can be a great motivator to remaining regularly active. Marriage is commonly accompanied by a reduction in exercise levels and an increase in food intake—particularly for men. Those who give up smoking may find that weight increases because nicotine speeds up metabolic rate, and withdrawing it causes a decrease. Holiday seasons present the risk of gaining back lost weight, but standing away from the buffet table, for example, will help.
- In addition, restrained eaters can sometimes worry less about their weight when under stress and then throw caution to the wind regarding food intake, so efforts should be made to try to adhere to regular patterns. Bereavement can lead to comfort eating and a lack of motivation to exercise. Divorce can be associated with feelings of depression and a break in routine that affects both eating and activity patterns.
- Furthermore, changes linked to menopause are known to generally lead to a shift in body composition, so resistance training is particularly useful at this time. Pregnancy will lead to an increase in body weight, but it's important to try to restrict this to about 10 kilograms. Fat cells multiply during growth spurts and are then retained for life, so restraining junk-food consumption is key during periods of growth such as puberty.
- A recurring problem is, after a concentrated weight-loss effort, gaining more weight than was lost. Those who successfully keep the weight off have been shown to exercise for 250 minutes per week, frequently step on a scale, never skip breakfast, and maintain a written record of their weight-loss progress and a food diary.
- Exercise can help tackle cellulite—the result of fat protruding from the subcutaneous layer into the skin due to laxity in the connective

tissue within the skin—by helping to reduce the presence of body fat and by toning the muscles.

Important Terms

adipocyte: A fat cell.

android: The apple shape associated with men's bodies.

body mass index (BMI): Calculated as your weight in kilograms divided by the square of your height in meters.

epinephrine: A hormone that increases in concentration during cardio exercise.

excess postexercise oxygen consumption (EPOC): The number of calories that are burned immediately after exercise has ceased—due to the increased metabolic effect of your body removing waste products from the cells and then refueling.

gynoid: The pear shape associated with women's bodies.

hormone-sensitive lipase: An enzyme that is located in the fat cell and acts to break apart the triglyceride, releasing the 3 fatty acids into the bloodstream.

triglyceride: A group of 3 fatty acid molecules found within specific fat cells known as adipocytes.

Mobilizers and Stabilizers—Managing Your Abs

Lecture 24

The perfect stomach remains the most significant aesthetic indicator of fitness and continues to be the focus of advertising campaigns for well-known brands and a multitude of products and services. In this lecture, you will learn about the abdominal muscles, and you will discover whether your expectations for your abs are realistic. In addition, you will explore a range of exercises that target both the mobilizers and stabilizers and feature varying levels of difficulty so that you can work your way up to more demanding exercises.

The Abdominal Muscles

- There are 2 types of abdominal muscles: mobilizers and stabilizers. **Mobilizer muscles** bring about movement, and **stabilizer muscles** work to fix body parts in place.
- The **rectus abdominis** is the most visible mobilizer, stretching from the **xiphoid process**, where the ribs meet at the sternum, and ribs 5 to 7 down to the pelvis through a sheath, or **aponeurosis**, that joins to the symphysis pubis. The aponeurosis is divided by tendon insertions that run across it and, more noticeably, centrally to give the appearance of separate blocks.
- Interestingly, these divisions are not uniform, so you may see an 8-pack rather than a 6-pack in some people. This is purely due to genetics rather than a response to working out. When contracted, the rectus abdominis, like any other, draws its ends closer together so that the ribs move closer to the hips.
- The oblique muscles are located on the sides of the abdominal region. The external oblique muscles are larger than the internal oblique muscles and run from ribs 5 to 12 down to the iliac crest, the highest point of the hip, and partly into the linea alba, the tendinous line at the center. The internal oblique muscles are

positioned between ribs 8 to 12 and the linea alba. These muscles work in tandem to assist the rectus abdominis in drawing the ribs and hips closer together, but they also serve to rotate the trunk and to laterally flex.

- When you bend sideways, the 2 oblique muscles on the same side work together, but due to their diagonal alignment, the external oblique on one side works in harmony with the internal oblique on the other side when engaging in a rotating movement.
- The stabilizer muscles are located beneath the mobilizers. The **transversus abdominis** runs from the thoracolumbar fascia of the back and the iliac crest through the lower 6 ribs and into the linea alba. The transversus abdominis is responsible for pulling in, compressing the abdominal cavity, and creating pressure that splints the lumbar spine as a result. The internal oblique muscle can assist in creating this intra-abdominal pressure.

Exercises to Tone Your Mobilizer Muscles

- Because there are 2 different groups of muscles involved in the abdominals, you need 2 different sets of exercises to tone them. Selecting the wrong exercises might lead to not achieving your goals.
- The mobilizers require movement to train them while the stabilizers require static, or isometric, contractions that challenge you to hold a position.
- To join in on the exercises, you just need enough space to lie down on the floor and perhaps a mat if you'd like. You will start with exercises for your mobilizers by engaging in a sit-up and a reverse curl.
- With the following exercises, your goal is to do between 12 and 15 repetitions, but you can build up to that goal. If you find any of the exercises easy, you can add a couple of extra repetitions. After

you start to reach the point of momentary muscular fatigue, take a short rest.

- For the sit-up, make sure you keep your elbows back and rest your head in your hands so that you can support the weight of your head. Also, be aware of having a neutral, or comfortable, spine position. Then, bring your feet up and bend your knees, which helps to keep a relaxed lower spine position.
- Start by doing single sit-ups with a comfortable rhythm. Use visualization to imagine your abdominal muscles as a spring that you're squeezing together, trying to bring your ribs closer to your hips. Breathe out as you go up and in as you go down—don't hold your breath. Take a short rest when you start to experience fatigue.
- Then, sit up and down at 1/2 the speed you were just going—2 counts up and 2 counts down. Focus on sitting up, getting a maximal contraction. Relax your head and neck, and try not to hold your breath. Take a short rest.
- Next, sit up for 3 counts and down for 1. Rest. Hopefully, you're beginning to feel that these are becoming more difficult as you go slower.
- Finally, sit up for 7 counts and down for 1. To start, take a deep breath. Take a quick rest.
- By slowing down the count, you are forcing to recruit all the muscle fibers in the abdominals. The slow-twitch fibers will work first, and then they'll start to exhaust, so you'll have to recruit some of the fast-twitch fibers. As they begin to exhaust, you'll recruit the rest of the fast-twitch fibers, reaching the point of momentary muscular fatigue, which is what you need—overload for all the muscles.
- With sit-ups, you're working predominantly the upper part of your abdominals, but with reverse curls, you'll switch to working on the

lower part of your abdominals. However, the same timing is used when doing reverse curls.

- Start by lying down, putting your hands down by your sides and bringing your knees up to your chest. In the air, cross your feet over each other. It is important to drop your heels down; you don't want to be swinging your legs.
- This exercise involves a very small movement: Bring your knees a little closer to your chest, lift your hips off the floor, and lower them back down—but don't swing your legs. It's a squeeze in the lower abdominals that lifts your hips off the floor.
- Start with a single count up and down at a comfortable pace. With this exercise, you may notice a little bit of strain in your neck; try to keep your neck relaxed by drawing your shoulders down. You can use your hands, placed at each side on the floor, for a little bit of balance. Take a short rest.
- Then, as you did with the sit-ups, move on to taking 2 counts up and 2 counts down. Rest. Next, take 3 counts up and 1 count down. Rest. Finally, take 7 counts up and 1 count down. Rest.
- To work the oblique muscles, you will do a modified version of the exercise that involves sitting up with a twisting motion, bringing your elbow across to your opposite knee. As you bring your knee to your elbow, you will actually bring the same knee to the same elbow.
- Start by lying down with your hands behind your head and do 4 movements: sit up, twist, back, and down. As you sit up, tilt to the side a little. The work of the rotation comes from the oblique muscles—not from the arm and leg. If you find this movement easy, you can always add a few repetitions at the end.
- To work all 3 of these muscles—the upper and lower abdominals and the oblique muscles—take a dumbbell or any weight in either

one of your hands and sit up, twisting the dumbbell across to the other side of your body. Then, switch sides. Rest.

Exercises to Tone Your Stabilizer Muscles

- The stabilizers are the muscles that work to hold your posture in place, particularly your neutral alignment—that comfortable position for the spine, particularly for the lower spine. By definition, these muscles require isometric contractions that don't move. These muscles are involved in holding a particular position.
- First, you will do a plank, which you might have done by resting on the forearms. The challenge is to go into the full position, which will cause some bone loading through the wrists, strengthening the bones in the wrist.
- Start by lying on your stomach and slowly lifting your body off the floor with your hands, which should be located directly under your shoulders. Then, drop your hips just a little bit so that you are

in a neutral spine position—with a gentle lordotic curve. Don't stick your backside in the air or drop your hips down. Gravity is trying to pull you down, so you have to fight against it by pulling in tight through the abdominals but also at your sides.



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A typical plank position involves resting on your forearms, but the full position brings you up onto your hands.

Take a little rest. To release the pressure that you might experience, you can rest into the child's pose if you're familiar with yoga poses.

- Your challenge is to progress through variations of this exercise that become more difficult as you go along. You should find the exercise

that you can do comfortably, and then try to hold that position for as long as you can—increasing with practice.

- Begin in your plank position. A tip is to lock into the middle first, engaging your core muscles and pulling in through your stomach, waist, and pelvic floor. Keep the energy fixed in the middle, and lift one foot off the floor. The challenge is to hold the position, against the force of gravity, for as long as you can. It's important to take a rest when you get to the point where you start to shake—if not before.
- For the next level, after you assume your plank position, drop your hips down slightly so that there is a natural curve in your lower spine. Use a mirror, if you can, to check your position. Then, lift one leg off the floor and slightly out to the side. This position is tricky because you're trying to maintain your neutral alignment. Take a brief rest.
- Having targeted the lower body, now try a variation that involves the upper body. Again, start in the plank position. The challenge is to stay fixed in the middle and then lift one hand up toward your shoulder without rotating. When you start to reach the point of overload, take a rest.
- Taking this one step further, start in your plank position—keeping your abs in tight and your hips in a neutral position—and lift one arm and the opposite leg. After you can no longer hold the position, rest down onto your knees. This is a tricky exercise, but it should give you something to aim for.
- Another exercise that will strengthen your stabilizers involves kneeling on the floor, sitting up nice and tall. Start with a simple lateral flexion—bending to the side. Hold that position, and then return to the center. Rest.
- A variation of this exercise involves starting in the same position but lifting your hands up above your head with your shoulders

down. Engage your core muscles before you move, and then lean to one side. Don't twist—just lean. You can do this on both sides, resting in between changes in position.

Exercising Your Abs

- All of these abdominal exercises will, over time, help to firm the muscles and possibly create a slimmer outline through improved posture, leading you to pull in your stomach. However, we all have a great natural 6-pack, but for many of us, it's hidden in a corpulent cover-up.
- Don't be fooled by advertisers' claims that exercising your abdominals will remove body fat from your problem area. A crucial factor in any plan to redefine your body shape is to strip away the body fat that covers your abdominal muscles, which can only be achieved by creating a negative calorie balance. The best way to achieve this is through a combination of cardio exercise and sensible eating.

Important Terms

aponeurosis: A sheath in the abdomen that is divided by tendon insertions that run across it and, more noticeably, centrally to give the appearance of separate blocks.

mobilizer muscle: An abdominal muscle that brings about movement.

rectus abdominis: The most visible mobilizer that stretches from the xiphoid process, where the ribs meet at the sternum, and ribs 5 to 7 down to the pelvis through a sheath, or aponeurosis, that joins to the symphysis pubis.

stabilizer muscle: An abdominal muscle that works to fix body parts in place.

transversus abdominis: A stabilizer muscle that runs from the thoracolumbar fascia of the back and the iliac crest through the lower 6 ribs and into the

linea alba. It is responsible for pulling in, compressing the abdominal cavity, and creating pressure that splints the lumbar spine as a result.

xiphoid process: The point at which the ribs meet at the sternum.

Body Weight Workout

Lecture 25

The great thing about a body weight workout is that it simply involves using the weight of your body against gravity. You don't need any expensive equipment, and you can do it anywhere—indoors or outside. You can take it on vacation with you, and you can use it if you're working away from home. Furthermore, because you'll be working with your whole body, you'll be engaging in functional fitness, working on balance and core strength, which can help you in your day-to-day life.

Guidelines

- Before you start, it's important to warm up with gentle, mobilizing movements from your head to your toe that start to work through the dynamic range of movement through your joints, to get the synovial fluid working, and to raise your body temperature. Start gently with a walk and perhaps slowly build up into a jog.
- With each of the following exercises in this workout, your goal is to complete 1 set of 15 repetitions. If you regularly exercise, you might want to try to complete 2 sets of each exercise, and if you are an advanced exerciser, you can try to aim for completing 3 sets. Regardless of how many sets you choose to do, make sure you take a brief rest in between exercises.

Side Lunge: Reach Right

- Starting with your feet about hip-width apart, take a lunge out to the right with your right leg pointing outward and slightly to the side. Your left leg remains straight. Hinge at the hip, and reach your right hands down and out to the right. Return to your starting position.
- Make sure that you're not rounding your spine.
- Keep your abdominals pulled in tight, working your core strength.
- You should start feeling a little warmer now.

Hindu Press-Up

- Start in a downward dog position—a yoga pose. You should be forming an upside-down V with your body, with your backside sticking up in the air. Then, take your chin down to the floor, go through your hands, and up into the cobra pose. Keep your legs and pelvis on the floor, but your stomach and upper body are hoisted up by your arms. Return to downward dog by dropping your chin down and lifting yourself back into an upside-down V position.
- This exercise involves both dynamic flexibility and strength.
- You're working through the range of motion of your shoulders, into the lower back, and into the hamstrings as you come back up from the cobra into the downward dog.
- You'll feel a stretch through your calf and Achilles' heel in the back and another stretch in your chest and shoulders in the front.
- Remember to keep breathing; don't hold your breath during strength exercises.
- Be careful not to lock your arms, and make sure the whole movement is under control.

Side Lunge: Reach Left

- From a standing position, lunge to your left side, working your left leg.
- When you step out, remember to point your knee and toe slightly out so that you can follow the natural hinge movement.
- When you're bending, don't round your shoulders and lower back; instead, hinge from your hip.
- Keep your abdominals in tight.

- In this exercise, you're working through your core muscles as well as the front and back of your left thigh and gluteus. The bonus is that you're also working the dynamic flexibility of your right leg.

Gecko Row

- The gecko row involves challenging the position of your postural muscles; you're going to try to keep your body in a fixed position. Start by getting down into a press-up position, but keep your feet wide for stability. The goal of the exercise is to bring your left knee up to your right elbow at the same time, briefly holding the position. This challenges the muscles around the lumbopelvic region. Pull your abs and obliques in tight. Try not to twist or stick your backside up in the air. Then, switch legs and arms.
- Do this exercise slowly.
- The challenge is to keep the natural alignment in your lower spine.
- Don't round your shoulders.
- Let the top of your head drop forward.
- Don't worry if you lose your balance a couple of times—that's going to happen. Just reset yourself if you do.

Single-Leg Squat: Right

- Imagine you're picking something up from the floor. Start by lifting your right leg in front of you. Bend over, and reach your left hand down to the floor. You can use your right arm for balance by holding it out straight to the right side. Keep your abdominals in tight as you go down. This motion involves hinging your hip—*not* bending or rounding it. Then, stand up onto your right foot, lift your left leg, and bend down.
- You might start to wobble a little, but just reset yourself.

- A single-leg squat is the most effective exercise you can do to tone your glutei.
- You're trying to fight any rotation through the knees or hips, working your stabilizer muscles.

Lying Triceps Press: Right

- Start by lying down on your left side, with a little bend in your knees to make them comfortable. Bring your right hand over the front of your body and keep your left hand down on the floor. Your right elbow should be pointed upward. Press up straight through your right triceps, and then bring it back down.
- Try to keep your body in a comfortable position, and make sure you're not lifting through your waist.
- Try to relax your head and neck.
- Naturally, you'll feel your abs trying to work, but try to concentrate on the muscles that should be doing the work—the triceps at the back of the arm.

Single-Left Squat: Left

- This time, you'll do some single-leg squats by lifting your left leg.
- Again, you can hold your left arm out for balance.
- Don't let your shoulder drop forward.
- Keep your abdominals in tight.
- In this exercise, you're challenging your core muscles and your stabilizers around the hip and knee to help keep your balance.
- This is also a great toning exercise for your thigh and buttocks.

Lying Triceps Press: Left

- This time, you'll start by lying down on your right side and pressing your left arm up, working your left triceps.
- Keep your right hand out of the way so that you can press up and down with your left arm.
- Keep your breathing relaxed.
- This is an isolation exercise that is targeting only your left triceps.

Plank Up and Down

- When doing planks, the challenge is to keep your hips fixed—with your lower back in a neutral, comfortable spine—while you're changing your position. From the plank position—starting on your hands and toes with your arms straight—lock your abs in tight and try to avoid too much rotation as you go down onto one elbow and then the next. Then, raise back up onto your hands from your elbows.



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When doing a side plank, the key is to engage your core muscles, which will help stabilize your body.

- Keep your backside down so that you have a natural bend in your lower back—a lordotic lumbar curve.
- When you start to get a little fatigued, don't stick your backside up in the air.

- The challenge is to work particularly on the transversus muscle across the middle of the abs, so keep your belly button pulled in tight.
- Your inner obliques and pelvic floor are also being worked, and all of these muscles are working to keep your lower spine in place.

Diagonal Lift: Right

- This exercise offers a variation on the single-leg squat, turning it into a diagonal lift by adding some rotation. Start by lifting your right leg behind you, keeping your left arm out for balance. As you go down toward the floor, reach to the right side. As you come up, reach to the left side. You're going from a low diagonal to an upper diagonal.
- As you come up, extend through the position; instead of coming straight up, you're extending to the opposite side.
- There is some balance work involved with this exercise.

Diagonal Lift: Left

- This time, start on your right foot and lift your left leg, keeping your right arm out for balance. Again, reach down and come up to the opposite diagonal.
- Your balance will improve with practice.
- The spine flexes and extends, but you should be hyperextending it with this exercise.
- It's important to work through your full range of motion.

Single-Leg Bridge

- Start by lying with your back on the floor. Bend your left knee so that your left leg is propped up, and lift your right leg straight out in a comfortable position. Press into your right heel, and lift your whole body as one. Make sure your shoulders stay on the floor, and

keep your abs in tight. Then, lower back down, and try not to put too much stress on your neck.

- Keep the movement under control by doing this exercise slowly.
- Don't swing your leg. The lift should be coming from pressing the heel down on your right foot so that you feel the work of the hamstring at the back of the thigh and into the gluteus.
- The challenge is for your core strength to stabilize you in the middle.
- Then, do the same exercise, but lift your left leg.
- Be aware if you notice any difference from one side to the other; perhaps one leg needs a little extra work.

V Sit-Up

- Normally, a sit-up works only the upper part of your abdominals, and a reverse curl only works the lower parts, but this exercise combines the 2 to work both. Start in a sitting position and lift both legs in front of you, bending at the knee. Then, raise your arms out to each side. Do a sit-up in this position, lowering your body down without having your feet touch the floor. Then, come back up to the original position and bring your knees to your chest.
- This exercises the top and bottom of the rectus abdominis.
- When exercising your abdominals, picture the abdominal muscles as being a spring. As you're sitting up, try to squeeze that spring together.

Turkish Stand-Up

- The goal of this exercise is simply to stand up without using one of your hands. Start by sitting on the floor, and raise either one of your hands toward the ceiling—and keep it there throughout the exercise. Once you are standing up, keep your hand in the air and

try to sit back down again. It doesn't matter which hand you use in the beginning; switch to the other hand after 7 repetitions.

- This is a whole-body exercise. You're using your abs on the first part of that movement, and you really need to use your legs. The thoracolumbar fascia, the sheath at the back of the core muscles, helps transfer the strength from your upper to your lower body—it's what gets you up and down.

Cooldown

- Start with some gentle movements to get your joints moving—similar to the types of exercises you did in the warm-up.
- Let your pulse rate and temperature drop slightly.
- Then, do some stretches—perhaps 1 set of 15 for each exercise, building up to 2 sets and then 3 sets.

Medicine Ball Workout

Lecture 26

While both speed of movement and pure strength are important criteria for many athletes, the vital ingredient is the marriage of these, which results in power. A medicine ball serves as a great tool for developing power and lends itself to a plethora of both individual and partner drills that will enhance performance in most sports. Furthermore, medicine balls are relatively cheap and require very little storage space, so you can easily adopt the workouts in this lecture to ensure your home workouts are fun and always keep you moving closer to your goals.

Guidelines

- Always warm up first, taking about 5 minutes to raise your core body temperature with light cardio, and mobilize your joints by gently moving your limbs through various planes of motion.
- You will need space for a couple of these exercises. It won't be a problem if you're working out at the gym, but you may need to move outside if you're working out at home.
- Choose a weight of ball that is challenging but does not slow down your movements too much.
- Do 12 to 15 repetitions for each exercise.
- Never sacrifice correct technique for speed of movement in the search for more power.
- Workouts like these that concentrate on power are best done when you're ready to do them—not after an intense cardio workout or heavy resistance session, for example.

Squat and Throw

- For this exercise, make sure your feet are a little wider than hip-width apart.
- When squatting, press into your heels, keep your abs in tight, and keep your shoulders back.
- Don't let the ball pull you forward.
- This is a plyometric, or explosive, exercise, so you will be making an explosive movement as you come up from your squat.
- Because it is a medicine ball, it'll go up and bounce practically right in front of you, so you can grab it immediately and continue doing more repetitions.
- Don't throw the ball with your arms; instead, your arms should be almost straight, and you should use your abs and legs as sources of power.
- Work within your full, comfortable range of motion.

Lunge and Twist

- Focus on your core, pull your abdominals in tight, pull in through your waist, and lift up through the pelvic floor.
- Keep your feet hip-width apart—even when you step out into your lunge—because if you don't, you'll lose your balance.
- Keep your arms slightly bent throughout the movement.
- Try to rotate your hips—and upper body—as much as you can to execute a deep lunge and twist.
- By rotating your spine, you're also working your obliques.

Chop

- In this exercise, you experience movement through the lower spine, working your core muscles and obliques, which are working contralaterally.
- This is a great exercise for anyone who plays golf or tennis.
- When doing a chop, keep your arms almost straight—but not quite.
- Slow is better on these kinds of exercises.
- This exercise involves some rotation, but there's also a mix of flexion and extension through the lower spine because you're flexing at the hip to reach the ball down to the floor.
- Keep your chin back and your head lifted. Try not to drop your head particularly as you move toward the floor.
- Try to keep a neutral, comfortable position in your lower spine.
- When you switch to the other side, you may notice that one side is a little more flexible or stronger than the other. Be aware of those weaknesses so that you can work to improve any muscular imbalances.
- The weight of the ball you select shouldn't feel too easy; it should be beginning to feel difficult as you approach 12 to 15 repetitions.
- If you have any shoulder mobility issues, you might want to drop the ball for this exercise because you can just as well do it with your hands.

Sprint Pass

- This exercise is designed to be done with a partner, but you can also throw the medicine ball against the wall instead.
- Make sure that you are standing up straight and tall.

- This is a true power exercise; it works your entire body.
- This exercise starts with the power in your legs and transfers it into your arms. To get that power to move from your legs to your upper body, you need a strong core, so there is an emphasis on your abdominals.
- Be aware of keeping your abdominals in really tight to protect your lower spine.
- This exercise works the thoracolumbar fascia, which is the key to transferring the load from the upper body to the lower, and vice versa.

Lean

- Make sure to start in a wide kneeling position, which will help keep your hips square to the front.
- If you have any shoulder or lower back problems, start by trying this exercise without the resistance.
- When you lean out to the side, hold it for 3 seconds and then return to your starting position, using smooth movements throughout.
- It is important to keep your hips, chest, and shoulders square to the front. Don't let yourself twist—even though you are going to feel the inclination to do so.
- Focus on pulling your abdominals and obliques in tight, reinforcing the thoracolumbar fascia.
- Take a quick rest as you switch to the other side.
- It is best to move slowly through the movements of this exercise.
- Drop the top of your head so that you have a nice, long alignment of the spine.

- Avoid rotating your hips and exaggerating your lumbar curve.
- Focus on pulling in your transversus muscle, across the front of your abdominal region, to prevent you from arching your lower back too much.
- Try to keep your breathing relaxed throughout this exercise.

Press-Up

- The target areas for this exercise are the chest, the front of the shoulders, and the triceps.
- For this exercise, an extra challenge for the core muscles can be attained by making sure that you keep your abdominals in tight and your hips in a comfortable position.
- When you're in your press-up position—whether you're in a full press-up position or on your knees—the important thing is to not drop your hips down.
- Don't stick your backside up in the air; you want to maintain a comfortable alignment in your lower spine.
- To find your neutral spine, drop it and lift it until you find the position that feels most comfortable.
- By adding the medicine ball to this press-up exercise, it puts a challenge on the muscles around the shoulder girdle. You have to focus on maintaining stability through the shoulder girdle as you work on an unstable surface.
- Try not to twist your hips, even though you're fighting the feeling to drop them.

V Sit-Up

- You have 2 options for this exercise: You can keep your feet down on the floor if you want to try the easier version, or you can lift them

up to the ceiling if you think you can handle it. For both positions, you can either use the ball or have no resistance.

- Slow is better for this exercise because you want your abdominals to have more time under tension.



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Adding a medicine ball to your workout is a great way to develop power and enhance fitness.

- For any abdominal exercise, try to think of your abdominals as being a spring, and really try to squeeze it as you pull up.
- Keep your breathing relaxed, and exhale on the exertion—breathe out on your way up.

Chest Press

- The triceps can be a problem area, so make sure that you're in a comfortable spine position and that you have some space to do this exercise.
- To begin, don't push the ball up too high. Take a couple of practice throws, which will allow you to determine where you need to throw it, and then you can start to make the movement more dynamic.
- This chest press is similar to a basketball chest pass, and it's similar to a press-up, but you are using the muscle fibers in a different way for this exercise.
- The goal is to incorporate plyometrics, so you want to exhibit an explosive movement.

- The challenge is to keep yourself in a neutral spine position throughout the exercise.
- As you push the ball up, exhale.

Cooldown

- Finish your workout with some stretches that will work the major muscle groups, including the hamstrings, quads, abdominals, lower spine, and inner and outer thigh.
- For static stretching, take your muscles past their normal length, and hold the position for about 15 seconds.
- If you start this workout and progress through all the exercises, then you might want to run through the exercises with no weight at first. Then, progress to a very light ball. Obviously, increasing the weight of the ball makes the exercises more difficult.
- Additionally, you can do 1 set of each exercise, take a quick rest, and then do another set. However, you can also do these exercises as a circuit, which involves doing the whole routine straight through and then doing the whole routine again.
- Don't do too much too soon. Only increase the resistance of the ball or add extra circuits if you find that these exercises are easy and that there is room for progression.
- One way to progress is to generate more power, which is where plyometric exercises come in. For example, with the squat and throw, you can throw the ball higher; with the sprint pass, you can make the movement more explosive.
- If you're struggling for balance, you can try grabbing one of your ears to stay upright. This is probably an effect of the vestibular balance system.

- Toward the end of your cooldown, your pulse rate should be decreasing, and you can take a few deep breaths to complete your workout.

Step and Interval Workout

Lecture 27

For this step workout, you're going to use some interval training techniques to improve the capabilities of your cardiovascular system. You're also going to alternate between cardio and strength exercises, which will allow you to burn a lot of calories and tone your body at the same time. You're going to do 1 minute of cardio exercises, 30 seconds of rest, and then 1 minute of strength exercises. Within each 1-minute session, spend the first 15 seconds making sure you have the correct technique, and then begin to increase your rate of exercise.

Guidelines

- For the following exercises, you'll need a step platform—a great tool to have. If you don't have one, they're easy to find, and they're not too expensive.
- Start with a warm-up that involves a few mobilizing exercises, working through all the major joints. You can do some basic stepping up and down on the step.
- The following exercises alternate between cardio and strength exercises.
- Do each exercise for 1 minute with a 30-second rest between exercises, which results in a 2:1 work-to-rest ratio.
- Take some water breaks whenever you need them.

Shuffle

- When using a step platform, try not to stomp on it—just keep your feet nice and light.
- Find a good pace, and keep moving.

- Use your arms as well, and keep your abs in tight.
- After 1 minute, take a deep breath, and rest for 30 seconds. Keep your feet moving at a slow pace.
- You might have to straighten your step because it might move a little during this exercise.

Press-Up Walk

- Start in a full press-up position, but if you start to fatigue, then you can drop your knees down, resting your knees on the floor.
- Throughout the exercise, keep your abs in tight and keep breathing.
- This is a strength exercise that works your chest, the front of your shoulders, and your triceps.

Over the Top

- In dancing terms, this exercise involves doing a chassé, or sashay, across the top of the step.
- Try to control your lateral motion while stepping over the step.
- Keep your feet light so that there is less impact, and try to make your movements quick.
- Because you're working on your aerobic fitness, the goal is to increase your heart rate during this exercise.
- This exercise focuses on the large muscle groups.
- Try to increase your pace for the last 15 seconds.

3-Direction Lunge: Right

- This exercise focuses on the hips and thighs.
- Make sure that your lunges are deep to maximize your workout.

- Increase your pace if you can throughout the exercise.
- This is a strength exercise, but because you're using large muscle groups, you'll also need to make sure enough oxygen is being passed through to your lungs and heart.
- Make sure you're on the ball of your foot when doing lunges.

Jumping Jacks

- Throughout this exercise, you want to keep moving—even if you need to stop and take a few deep breaths—because of the effects of blood pooling.
- When doing jumping jacks, remain light on your feet; you should be on your toes.
- Get into a good rhythm and then keep that pace up.



If it's too difficult for you to do jumping jacks using a step, you can start by doing them on the ground.

- Use your hands for balance if you need to.
- Keep your abs in tight.

3-Direction Lunge: Left

- Keep your abdominals in tight throughout this exercise.
- Start with a strong forward stride for the lunge, and try to sink down low into it. Pick up the pace when you can.
- This exercise works to tone the hips and thighs, moving those large muscle groups.
- Although this is a strength exercise, some cardio work is still involved.
- When lunging, you'll get a forward hinge from the hip, but don't round your spine. Keep your chest lifted.

Across the Top

- This exercise is similar to the exercise you did that involved going over the top of the step, but it is a little more difficult.
- Don't worry about the height; keep your feet moving quickly across the step.
- For the last 5 seconds, try to speed up your pace.

Triceps Dips

- For this exercise, start with your hands slightly wider than your hips on either side and with your fingers pointing in the same direction you're facing. Lift your backside off the step, keeping your knees and elbows slightly bent.
- Keep your abdominals in tight; keep your chest and head lifted.
- This exercise shouldn't be too difficult, so get a good pace going.

- This exercise focuses on the triceps, but you are also working on your core, keeping your abs in tight.
- When you're about halfway through, increase your pace.
- During the last 15 seconds, you should start to feel a burn, which is the lactic acid buildup.

Knee Repeater: Right

- Make sure your right foot remains on the step throughout this exercise.
- Move as quickly as you can for the entire minute.
- Use your arms. Make sure to keep your trunk fixed, which will improve the efficiency of the speed and power in your arms and legs.
- Your body temperature should start increasing, getting your heart and lungs working.

Twist and Reach Up

- The goal for this exercise is to get your blood moving from one area of your body to another—namely, from your upper body to your lower body.
- You're mainly working the rectus abdominis, but you're also working the obliques when you twist.
- You can pick either arm to reach with because you're going to reach with the other one for the next set.
- Keep your feet flat and your knees bent.
- Find your comfortable, neutral spine position—a position where the lower back has a bit of an arch.

- As you do this exercise, you should begin to reach a little bit higher than the last time, making sure that you're also getting a good twist.
- At the end, take a quick walk around to keep your blood from pooling. Take some deep breaths because taking oxygen in helps to clear the lactic acid that is building up.

Knee Repeater: Left

- The goal is to move your feet as quickly as possible and to increase your speed as you can.
- Keep your left foot on the step throughout this exercise.
- Your heart rate should be increasing. Burning calories and improving your fitness level should be the focus of this exercise. The fitter you are, the sooner you start to burn fat as an energy source.

Twist and Reach Up

- For this exercise, reach up with the opposite hand that you chose for the first twist.
- You're working your abdominals and obliques as you sit up and reach across.
- Get into a good pace, and continue that pace unless you feel as though you can move faster.
- Exhale on the exertion—in this case, on the sit-up; breathe out as you come up, and breathe in as you go down.
- If you need to take a brief rest, you can, but start back up as soon as you can.

Speed Skating

- As you straddle the step and make a speed skating movement from side to side, make sure that your heel lifts up and over the step, focusing on your lateral motion.
- This exercise involves dynamic equilibrium and controlling your lateral movement by bending down on your knee and loading up the muscle, which results in a large force that propels you in the other direction.
- Move your arms side to side along with your feet, and increase your speed as you become comfortable with the movement. The bigger the movement, the more calories you're going to burn.

Side Plank Hip Hitch: Right

- This exercise focuses on the core muscles and the obliques.
- After you bring one of your legs out to the side, you can put your other leg wherever it is comfortable—in front or behind your body.
- Make sure to drop your hips and then lift them to create the hip hitch. Avoid rotating your hips.
- Keep a long position—from the top of your head down through your tailbone to your heel.
- Remain balanced throughout the exercise by keeping your abdominals pulled in tight.
- This exercise involves a much smaller movement than most of the other exercises, but it's a really good exercise to work your core muscles and obliques. These muscles work on stabilizing your lumbopelvic region.
- Try to keep your breathing relaxed and constant when doing this exercise.

Jump Up and Click Heels

- Whatever energy you have, you're going to squeeze it out for this exercise.
- When it comes to fitness, the more you put in, the more you're going to get out. Take about 10 seconds to get into the rhythm of the technique, and then increase your speed as much as you can.
- Don't rest in between jumps—unless you absolutely have to.
- Land quietly if you can. The softer the landings, the easier this exercise is on your joints.

Side Plank Hip Hitch: Left

- Again, this exercise focuses on your core and oblique muscles.
- You should be sweating at least a little bit. Remember that the waste products of exercise include carbon dioxide, water, and heat.
- As you become fitter, this exercise will get easier. Eventually, you might be able to build up from 1 minute to 1 minute and 30 seconds, or you might choose to do the entire routine in 2 circuits.

Cooldown

- At the end of your workout, you can sit down on your step and do a couple of easy stretches.
- Do a few mobilizing moves—just as you did at the beginning of the workout. Then, stretch the large muscle groups, including the quads and hamstrings.

Dumbbell Workout

Lecture 28

A dumbbell workout is another great home workout. If you don't have dumbbells, they are relatively inexpensive to purchase, but you can also improvise with a few cans of beans or a couple bags of sugar. Weight training brings a number of health benefits, including reduced risk of osteoporosis, lowered blood pressure, and shorter gastrointestinal transit time. When it comes to changing your shape, weight training is the top choice due to its effect on raising your metabolic rate, which helps you burn more energy quickly. In addition, it can completely resculpt your silhouette.

Guidelines

- Before you begin this workout, remember that muscle training comes with a few common myths, including the myth that women will become big and bulky if they do weight training. In fact, the key to muscle growth is the testosterone hormone, and women don't naturally possess this in their bodies in high enough concentrations to produce bulky arms or shoulders.
- To ensure you get the most out of this workout, keep in mind that the longer a muscle is forced to work against resistance, the more damage there will be to the muscle fibers and, therefore, the greater the adaptations will be in their structure. Therefore, the harder you work, the better the results you will achieve.
- This workout involves a continuous rhythm pattern, and the following pattern of counts has been devised to enable you to exhaust all the muscle fibers. For each exercise, you're going to do 1 count up and 1 count down 8 times, 2 counts up and 2 counts down 4 times, 3 counts up and 1 count down 4 times, and 7 counts up and 1 count down 2 times.
- To help you with the rhythm, you'll need some music playing that's ideally in the medium range of beats per minute. If the music is too

fast, the singles—1 count up and 1 count down—will be impossible to complete, ending up with short movements. If the music is too slow, the 7 counts up and 1 count down will take an eternity—probably leaving you in pain.

- Beginners should aim for 1 to 2 sets of each exercise, and advanced people can try to do 3 sets of each exercise.
- The amount of weight you should use when starting with dumbbells will typically be lighter than what you will be using once you master the techniques involved with weight lifting. Work with the heaviest weight that you can manage—while still maintaining good form. Switch to a lower weight if you reach a point of failure, which involves not being able to complete the repetition or maintain correct form. The best way to determine what weight you should be using for each exercise is simply trial and error. Start with a light weight, and make adjustments as necessary.
- The following exercises cover your whole body, alternating working the upper and lower body. This results in shifting the blood from one part of the body to the other, which will lead to a greater calorie burn. In addition, while one part of the body is resting, you can work another part of the body, so you won't need to rest in between exercises, allowing you to get more work done in a shorter amount of time.
- First, take about 5 minutes to warm up.
- The following exercises include sections that focus on the legs and back, shoulders and legs, and then chest and abdominals.

Squats

- When you pick up your weights, make sure to bend your knees, keeping your abdominals in tight.
- Keep your shoulders back and down.

- Your feet should be about hip-width apart, and your heels should be down on the floor.
- By the time you get to the last count—7 counts up and 1 count down—you should feel the muscles working hard in the legs and buttocks.

Bent-Over Row

- For this exercise, you're going to bring your dumbbells in front of your body, keeping your knees slightly bent.



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- Keep your abdominals in tight, and hinge from the hip.
- You're going to lean forward and drop your dumbbells down to just below your knees.
- Don't let your back become rounded.
- Keep your elbows up and high.
- This exercise works the upper back—especially between the shoulder blades—when squeezing the rhomboids together. You're also working your biceps and the back of your shoulder.
- At the end of this exercise, straighten yourself up, roll your shoulders, and give your legs a little shake.

Always be sure to bend your knees when picking up your weights to begin your workout.

Lunge: Right

- Start with your right leg forward and your left leg behind your body, remaining on the ball of your left foot.

- Make sure your shoulders are back and down, and then drop your knee down.
- Keep your abs in tight.
- This exercise really works the front of your right thigh.

Prone Fly: Left

- For this exercise, you're going to drop the dumbbell in your right hand and rest your right elbow on your right knee.
- With a slight bend in your elbow, lift the dumbbell in your left hand, squeezing your shoulder blades together.
- Keep your hips, chest, and shoulders facing the front.
- This exercise really works the back of the shoulder and upper back.
- Keep your abs in tight, making sure not to twist your body.

Lunge: Left

- This exercise requires both dumbbells, so pick up the one you dropped for the last exercise.
- This time, start with your left leg forward and your right leg behind your body, remaining on the ball of your right foot.
- Remember to keep your shoulders back and down and to not twist your right leg on the lunge.
- Keep your chest and head lifted.
- Squeeze your buttocks for extra power.

Prone Fly: Right

- If you're starting to get fatigued, switch to a slightly lighter weight. It's important to get your form correct.

- This time, you're going to drop the dumbbell in your left hand and rest your left elbow on your left knee.
- With a slight bend in your elbow, lift the dumbbell in your right hand, squeezing your shoulder blades together.
- Don't let your body twist.
- This exercise really works the back of the shoulder.
- Remember to keep your hips square to the front and your abs in tight.
- At the end of this exercise, you can drop your dumbbell and take a short break. Dry your body off if you need to, and take a sip of water.

Plié

- Be careful when picking up your dumbbells.
- Your feet are going to be wide, and your knees and toes are going to point outward. You're going to rest the dumbbells on top of your thighs and push your knees out, following the line of the toes.
- In addition to working the front and back of your thighs, you're also starting to work the inner thighs—the adductors.
- Keep your abs in tight, chest up, and heels down.

Lateral Raise

- Your feet should be hip-width apart, and your knees and elbows should be slightly bent.
- When you lift your arms up to the sides, they should reach to about the level of your head.
- Keep your abs in tight.

- The exercise works your shoulders—specifically, your deltoids.

Plié

- Remember to keep your feet wide and to rest your dumbbells on top of your thighs, making sure your knees and toes are pointing outward.
- When you sit down, don't stick your backside out; try to keep it tucked underneath.
- Keep your abs in tight, and you'll start to feel this exercise in your inner thighs, the front and back of your thighs, and your buttocks.
- Dip your body as low as you can comfortably go.
- Do this exercise slowly; you don't have to come back up too soon.

Shoulder Press and Twist

- Start with slightly bent knees. This position protects you from swaying backward and forward, which puts a lot of strain on the lower back.
- Bring your dumbbells up—with your palms facing your body and your knuckles facing outward. As you press up, twist your palms to the front.
- Don't lock your elbows at the top of the movement.
- You should have a controlled momentum throughout this exercise.
- Use your knees to carefully put your dumbbells down.
- Dry your body off if you need to, and take a sip of water.

Press-Up

- Start by getting down onto the floor or a mat in an all-fours position.

- You're going to use your dumbbells as a rest for your press-up position, so both hands are going to be on your dumbbells.
- Begin on your knees or in the full press-up position—whichever you feel comfortable with. The full press-up position becomes difficult by the end of the exercise.



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When doing a crunch, support the weight of your head with your hands, and keep your feet hip-width apart.

- Your slow counts should be on the way up.
- Keep your abdominals in tight throughout the exercise.
- Your elbows are out to the sides, but don't lock your arms when you reach the top of the movement.

Sit-Up

- From the press-up position, you're going to flip yourself over to work on your abdominals. Basically, you'll be doing a simple crunch.
- Put your hands behind your head to support the weight of your head—taking the stress off the neck—and keep your elbows back.
- Your feet should be about hip-width apart.
- Your slow counts should be on the way up.
- Squeeze your abdominals, lifting your shoulders off the floor or mat.

- Focus on the abdominal muscles, concentrating on squeezing your ribs closer to your hips.

Press-Up

- Turn yourself over from the sit-up position to set up for the press-up position.
- This time, your slow counts will be on the way down—rather than on the way up.
- Remember to keep your abdominals in tight.
- Maintain a comfortable curve in your lower spine.
- Remember not to lock your arms at the top of the movement.

Sit-Up

- Again, turn yourself over from the press-up position and put your hands behind your head. Keep your feet about hip-width apart, making sure you are in a comfortable lower spine position.
- This time, your slow counts will be on the way down—rather than on the way up.
- Focus on pulling your ribs to your hips. Imagine that your abdominals have a spring in them, and squeeze the 2 ends together.

Cooldown

- At the end of your last sit-up, pull your knees into your chest and rest.
- Then, take the time to do some stretching.
- At this point—when your body temperature is high—you should hold your stretches for about 15 to 30 seconds, which will help you to gradually cool down.

Combat Workout

Lecture 29

Whether you're a hardcore combat fanatic or have no boxing or martial arts experience, you can expect to get great results from this combat workout. Combining cardio, punching, and kicking rounds to burn calories with unique sculpting moves, this routine is guaranteed to reshape your whole body while helping you improve your suppleness, enhance your concentration skills, and give you extra confidence. In addition to the health-related fitness components associated with this workout—including cardio, endurance, and flexibility gains—you will also be honing various skill-related fitness components, including agility, balance, coordination, power, and reaction time.

Guidelines

- It's always important to do about a 5-minute warm-up before you start that includes some gentle movements—such as arm swings, knee lifts, and shoulder circles—to mobilize your joints. You should also march in place to get your heart rate up slightly and to begin to increase your core body temperature, which helps to reduce your risk of injury.
- If it's possible, check your technique in a mirror—particularly your posture.
- Be careful not to round your shoulders, and keep your abs pulled in at all times.
- When you're kicking, take a slight lean backward, but don't sink into your hips.
- Be careful to control your momentum.
- Don't lock your arms or knees on the kicks; keep them soft and control them.

The 3 Blocks

Rising Block

- Start with your right leg forward. Bring your hands up, in loose fists, to your face, and practice your mean face.
- Then, bounce in place. If you want to keep the intensity fairly moderate, just bounce a little using your legs. If you want to increase the intensity and burn more calories, bounce on your toes. Either way, keep your hands up to your face to defend it.
- Every technique that you will learn starts from the feet, so you will be working from the ground up.
- Each technique is a whole-body workout because for any technique to be effective, you have to use your whole body.
- To start, push your right foot forward, along with your hips, moving into a lunge. Then, add a rising block to defend your face. There should be some tension in your arms.
- Then, increase it to double time. Imagine someone is trying to take a swing at you, so you've got to defend your face.
- Keep your abs in tight throughout the movements.
- Take a short walk around. Get your breath back.
- Switch legs. Put your left leg forward, and repeat the same movements. Make sure your muscles are doing some work.

Cross

- To defend your body, move your arm across your chest. Start with one foot in front of the other, and push into a lunge using your hips.

- Then, increase the speed to double time. Push your arm across your chest with a little tension in your arm. Make sure you keep your arm in line with your chest. Don't bring your arm too high; remember, you're defending your chest.
- Keep your abs in tight throughout the movements. All the power is coming from the middle of your body.
- Switch legs, and repeat the movements. Regain your breath in between.

Down

- Start by pushing your right foot forward. Make sure your hips come with your foot, and go down with a little dip.
- Don't lock your arm; keep it slightly bent.
- Imagine that someone is taking a kick straight at you. You have to block it.
- You can keep your other hand anywhere you like—just keep it close.
- Increase your speed to double time.
- Switch legs, and repeat.

Combination

- Combine all 3 blocks: rise, cross, down. Once you have the moves down, increase the pace.
- Get on your toes if you aren't already.
- Double time.
- Switch legs, and repeat.

- Take a quick break, and go get a sip of water.

The 4 Punches

Jab

- To generate the power that's all in the middle of the body, you need to start from the ground up. Put your right foot forward, and bring your hands up to your face.
- Make sure you're taking your whole body with you; bring your rear hip forward. There's also some work going on in your glutei.
- Pretend that you are placing your right hand on your opponent's chin. Make sure your punch is accurate, directing it straight down the middle.
- Make sure your arm doesn't lock. Next, snap your arm back.
- Make sure there's some tension in your abs.
- Keep your shoulders down and relaxed.
- Double time.
- Switch legs, and repeat. Take a rest in between.

Cross

- The important thing is to get your body in the right position. Start by squatting down a little into your lunge.
- Twist your rear foot—your left foot to start—which allows you to twist your body with some power.
- Your left hand goes straight down the middle to the chin of your opponent. Add a little bit of a snap to your punch.

- This exercise works your core and your obliques.
- Double time.
- Switch legs, and repeat. Take a quick break.

Hook

- This time, twist your right leg on the ball of the right foot.
- As your body turns, you can put some power into a hook. Make a round movement with your elbow up high. You're aiming for the side of your opponent's head—the side of the jaw.
- Keep your shoulders down and your head up tall.
- Double time.
- Switch legs, and repeat.

Uppercut

- This punch is similar to the cross. Your left foot twists forward, but instead of just turning your body to the front, lift your body up, gaining power from your legs.
- Add the uppercut, which is aimed at the underside of your opponent's chin. You might want to picture someone in front of you that you really don't like.
- This exercise works your quads, hamstrings, and glutei.
- Double time.
- Switch legs, and repeat.

Combination

- Put all 4 punches together. Start with your right leg forward. Slowly bring your hands up and do the punches in order.

- This portion of the workout will help the skill-related fitness component of coordination.
- Remember that all your power comes from your toes.
- Don't get flustered if you get a few of the movements wrong. As long as you're moving, you'll be improving.
- After you have the movements down, speed up your pace.
- Switch legs, and repeat.
- Take a quick break, and get a drink of water.

The 3 Kicks

Front Kick

- Each technique is going to be set up with a step. You're going to start nice and slowly.
- Get your hips in the right position.
- Take a step with your left foot, and lift your right leg into the space in front of you. Then, bring your right leg down and back into the original position.
- When you step, make sure you point your toes to the front because your hips, chest, and shoulders need to be facing the front. The power is in your hips, so you want to push them forward.



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When kicking, make sure that you don't lock your kicking knee or your standing knee.

- Tilt your head back slightly so that you maintain a long line through the spine.
- Next, add the front kick. You'll be kicking with the ball of your foot, so you pull the toes back. The kick should not only be going up in the air, but it should also be going forward. There should be a little bit of a snap as your leg comes back to you.
- Keep your hands up and your abs in tight. Keep your shoulders down.
- Double time.
- Take a deep breath, and switch legs. Repeat.
- Fighters and boxers normally have a stronger, more flexible, easier to coordinate side, so you may notice as you swap from side to side that one side is not as good as the other. That just means that you need more work on it.

Side Kick

- Turn your feet and body to the side, but keep your head and hands toward the front. Take a little squat down.
- This time, you're going to take a step forward with your back leg and then lift the front leg, pointing the knee toward the side.
- When you add the kick—nice and low at first—this position allows you to really push with the side of your foot and hips.
- Make sure your knee comes back after your kick in a controlled way.
- Act as if you're pushing somebody away with your kick.
- Keep your hands up and your shoulders down.

- Double time.
- Switch legs, and repeat.

Round Kick

- Start with your right leg forward, and add a little bounce to your lunge. Turn yourself sideways, keeping your head and hands facing the front. Step forward—just as you did for the side kick—but lift your leg into a hurdle position.
- Your knee should be slightly higher than your ankle, which sort of slopes a little bit.
- Keep your hips, chest, and shoulders stable. Keep your hands under control.
- As you lift your leg, lean away from your opponent, which allows you to lift your leg a little higher.
- When you kick, point your toes toward your opponent because that will allow you to kick with your laces on top. Add a flick to your kick, and control the momentum of your leg on its way back with your hamstrings.
- Keep your abs in tight and your shoulders down.
- Double time.
- Switch legs, and repeat.

Combination

- Link the 3 kicks together. Start with your hands up and your right leg forward. Add a little bounce. Slowly go from the front kick to the side kick and, finally, to the round kick.
- You're going to need to take small steps in between each kick and shuffle yourself backward at the end.

- Double time.
- Switch legs, and repeat.
- Get a quick sip of water, and take a short break.

Finale

- In the final round, you're going to put everything together, nice and slowly. Start on your toes with the blocks, adding the punches and then the kicks.
- Double time.
- Switch legs, and repeat.

Cooldown

- Do a few minutes of shadowboxing to cool you down, and then do some static stretches of the major muscle groups.
- If you still have any energy left, do a few more combinations of each side—just be careful, as you get tired, not to lock your arms and legs.

Fitness Ball Workout

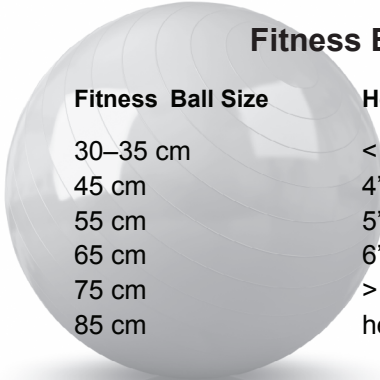
Lecture 30

Fitness balls, also called Swiss balls and stability balls, are great tools for working whole-body strength. Because you're working on an unstable surface, you can start to put some stress on your core muscles, helping to develop them—which, in turn, can help you look slimmer and taller and can help you improve the health of your lower spine. Before you start a fitness ball workout, it is important to choose the right ball for your body because fitness balls come in many different sizes.

Guidelines

- When using exercise balls, you need to check regularly that they're fully inflated.
- Ideally, you'll use your exercise balls on a smooth surface. You may choose to use a mat for the following exercises.
- For the following exercises, be aware of keeping the natural curves in your spine at all times—particularly the normal, neutral curve in your lower back.

Figure 30.1



Fitness Ball Size	Height of Individual
30–35 cm	< 4'10" (< 145 cm)
45 cm	4'8"–5'5" (140–165 cm)
55 cm	5'6"–6'0" (165–185 cm)
65 cm	6'0"–6'5" (185–195 cm)
75 cm	> 6'5" (> 195 cm)
85 cm	heavier or long-legged exercisers

- It's always important to warm up, which you can use the ball for. The main goal of your warm-up is to increase your body temperature by doing some mobilizing exercise for 3 to 5 minutes.
- Always exercise under control; remember that slower is better.
- It's useful to practice using a fitness ball if you've never used one before by sitting on the ball and getting a feeling for your natural alignment and the way it changes.
- As with most of the workouts, your target for each exercise is 12 to 15 repetitions.
- Beginners should probably aim to complete 1 set, but if you're already doing some exercise, you might want to aim for 2 sets. Advanced exercises should attempt to complete 3 sets of each exercise.

Wall Squat

- This is an exercise that you can do against a wall with your exercise ball.
- Make sure your feet are about hip-width apart.
- The benefit of doing this exercise against the wall is that it allows you to get a little deeper into the squat because you can use the wall for support.
- By going deeper into the squat, you are able to work through a greater range in the quadriceps and glutei as a result of the hip flexion and extension. In this way, your strength is angle specific.
- If you only work through a partial range, you'll only develop strength through that partial range. Instead, you're able to develop strength through a greater range of motion, which could be useful in sports performance and in everyday tasks.

Sideways Single-Leg Wall Squat

- This is a more difficult variation of the wall squat that involves a single-leg squat.
- You can lift your arm for balance, keeping your abdominals in tight.
- Be aware of your alignment. You want to have a nice lift through the top of your head, including a long neck and long spine.
- You need to make sure that you're keeping your hips square, which forces you to fight against the rotation of the hips.
- When you change legs, you can either turn around and face the other way or continue to do it in the same direction.
- When doing this exercise, you can either lean against the wall, or a partner can provide the balance. Once you've practiced this exercise, you and a partner can work together, but it's tricky because you need to work in unison.

Single-Leg Adduction

- This is an exercise that works the inner thigh but also works your core muscles—particularly the obliques.
- There are 2 positions for this exercise: resting on your elbow or resting your head on your hand, whichever is comfortable for you. The important thing is to make sure that you have a nice line through the body—from the heel through to the tailbone to the top of the head.
- Press down onto the ball with your top leg, lifting your hips. Make sure you are not twisting or rotating your hips.
- The knee of your top leg should be slightly bent—not locked. Your other leg is bent underneath for support.
- Try to keep your breathing nice and relaxed.

- Do this exercise slowly and under control, making sure you're not dropping your body with gravity.
- Exhale on the exertion; breathe out as you press onto the ball.

Leg Curl

- The leg curl, or hamstring curl, is a great exercise for the back of the thighs, but it also works the glutei.
- You have 2 options for this exercise: You can keep your hips down a little lower and curl your heel toward your backside, or as you curl, you can also lift your hips up, getting a full extension through the posterior chain.
- Keep your shoulders down on the floor so that you don't feel a strain through the back of your neck.
- You might find that you need your hands to help you with your balance.
- Don't worry if you lose the ball a few times—just reset yourself and continue with your repetitions.

Press-Up on Ball

- This exercise works on challenging not just the chest and the triceps with some shoulder work involved in the press-up, but there is also an extra challenge in terms of the instability that is presented by the ball.
- You have 2 options for this exercise: You can either do a full press-up, or you can go onto your knees for the press-up.
- The key is dropping your chest down to the ball and controlling that movement.
- This exercise works the smaller muscles, the stabilizers, that are located around the shoulder girdle. These are called the rotator

cuff muscles and are a group of 4 muscles that attach to your shoulder blade to help stabilize the shoulder: the supraspinatus, the infraspinatus, the teres minor, and the subscapularis. For this exercise, these muscles are working to control the wobble that you probably feel.

Hyperextension

- Roll forward on the ball, making sure the ball is under your hips.
- There are 2 options for this exercise: You can put your hands on the ball to stabilize yourself, or you can make it slightly more difficult by putting your hands behind your head.
- Try to maintain a long spine as you lift yourself up backward. Your spine is designed to flex and extend, and if you extend past the center line, it's called hyperextension.
- If your hands are behind your head, you have to balance through your pelvis because otherwise, you'll wobble. You have to stabilize yourself through the lumbopelvic region as well as with the erector spinae muscles, which are the muscles in the lower back that help to give you a strong movement through the hyperextension.
- Try to keep your breathing relaxed, which can be more difficult for this exercise. You have to breathe consciously because of the pressure on your abdomen.

Reverse Prone Fly

- If you find this exercise easy, you can add extra weight to this exercise by using dumbbells.
- When resting the ball on your abdomen and chest area, your arms are lifted out to either side. Your elbows will be slightly bent, but if you straighten your elbows a little, the exercise is slightly more difficult. If you bend your elbows, creating a smaller lever, the exercise is slightly easier.

- You want to squeeze your shoulder blades together, working the rhomboid muscles that attach from the inside of your shoulder blades to the first 4 thoracic vertebrae. You're also working the middle part of the trapezius.
- This is a great exercise for toning your back muscles and helping you maintain your natural, neutral alignment.

Reverse Hyperextension

- This exercise works to stabilize your shoulders. You're working the triceps, and you're also getting some bone loading through the wrists, which is beneficial in terms of protecting against osteoporosis and fractures.
- Be careful when lifting your legs through your lower body. You want it to be a smooth, controlled movement.
- You're working through the erector spinae, the glutei, and the hamstrings. The core is working to maintain your balance so that you're not wobbling around on the ball.
- You can take a short break in between each set if you're feeling any stress to your muscles.

Press-Up on Floor

- You have 2 options for this exercise: You can either rest your feet on the ball, or you can rest your knees—or maybe even your hips—on the ball. The higher the ball is on the line of the body, the easier the exercise will be because the ball's taking more of the weight of your body.
- You want to maintain a natural curve through your lower spine. You have to fight the tendency for your hips to drop down in this position.

- Be careful not to lock your arms at the top of the movement, which can put an extra strain on your elbows. Make sure that your movement is controlled.

Crunch

- For this exercise, you have 2 options: You can do a normal crunch movement, or you can drop yourself further behind the ball. If you do this exercise on the floor, you can only go as far down as horizontal. However, the ball allows you to work through a greater range for the abdominal muscles.
- You need to stabilize yourself, so make sure your feet are planted wide. A smooth surface, such as a mat, helps to stabilize you.
- Your hips should be slightly lifted; don't let them drop down.
- As with any crunch-type exercise, try to picture your abdominal muscles squeezing together like a spring, moving your ribs closer to your hips to work the rectus abdominis.



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The challenge when using an exercise ball in your workout is to control it by keeping your core muscles stabilized.

Side Crunch

- For this exercise, you're going to be positioned sideways on the ball—with one leg over the top and one leg straight out, which will prevent you from twisting your hips. Keep one hand behind your head.
- Stabilize yourself on the ball; get in a comfortable position.

- You don't want to twist your hips. Instead, your spine is moving in lateral flexion, working the obliques.
- Focus on your waist, pulling your ribs to your hips.
- Don't hold your breath.
- It's OK to wobble a little on the ball. Just reset yourself, and get ready for the next repetition.

Jackknife

- It doesn't matter whether you start with the ball in your hands or feet, but the key is to swap the ball from one to the other each time your body comes up.
- This exercise works the abdominals, but it also works the chest and inner thighs as you squeeze the ball.
- Slow is better with this exercise. Otherwise, you might spend much of your time chasing the ball that's rolling all over the floor.

Rollout on Knees

- The rest of the exercises in this workout are dynamic; they're all isotonic exercises that involve the shortening and lengthening of muscles. However, this exercise is an isometric exercise in which the deeper postural muscles are working to hold you in a position.
- For this exercise, the challenge is to hold a fairly awkward position. As you roll the ball forward, your hips begin to drop. Keep your abdominals in tight to stop your hips from dropping.
- It's vital to ensure that your technique is correct. Therefore, if your hips start to drop down, take a brief rest and reset yourself.
- Your goal is to do 3 to 5 repetitions of this exercise—not 12 to 15—because the challenge is to build up the amount of time that you can hold the position, training the endurance in your postural muscles.

Cooldown

- At the end of your workout, cool down and stretch.
- Hold static stretches for about 15 seconds.
- Stretch through the major muscle groups that you used during this workout.
- Your core body temperature should gradually drop, and your breathing should return to normal.
- Hopefully, as you stretch, you will feel a hint of the work you did in your muscles.
- Straighten up your body, and take a deep breath. Shake out your hands and legs.

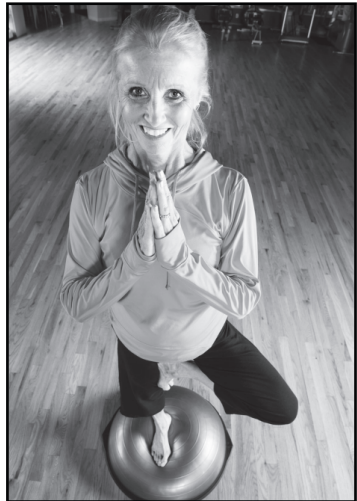
Balance Board Workout

Lecture 31

Balance boards, core boards, and Bosu balls provide an unstable surface, forcing you to engage your core muscles to control your balance. This workout is a great total-body workout, and it also works on proprioception. Within the joints, joint receptors—including the Golgi tendon organ and the stretch reflex—detect movement of the joints and cause contractions to control movement. If you strengthen these areas, you'll reduce your risk of injury. In addition, exercising on balance boards allows you to recruit 20% more muscle fiber, causing you to get an even better workout than you would on a flat surface.

Guidelines

- The following exercises are going to be done in a circuit, involving 1 minute of each exercise and then a rest of about 15 to 20 seconds in between exercises.
- During that minute, try to get a feel for the form of the exercise in the beginning, and then at least for the following 30 seconds, try to increase your pace.
- Before you do any workout, it's important to warm up—for example, making circles with your shoulders and wrists and marching in place—to increase your body temperature slightly.



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A Bosu ball provides an unstable surface that adds the challenge of balancing to your workout.

- If at any time you need to rest and grab some water, you can do that during the breaks between exercises.
- You can purchase balance boards at a sports store; they are relatively inexpensive.
- Be careful when getting onto your balance board. If you're not used to it, take your time and practice a few times before you start your workout.

Run in Place: Right

- Start by placing your right leg forward.
- Get into a rhythm, and keep it going.
- Pump your arms forward and backward.
- Try to control your movement.
- If you lose your balance, it's OK to reset yourself.
- Be aware of pulling your abdominals in tight. You'll also feel some tension in the glutei. Focus on controlling your trunk, pulling in through the waist.
- By tilting forward and backward, you're working your legs and getting a cardio effect. You're also challenging the smaller muscles—the joint receptors—in your ankles to control that movement.

Run in Place: Left

- Reset yourself, and place your left leg forward this time. Start slowly.
- Be aware of any differences you might have from one side to the other so that you can work on any weaknesses.

- Remember to pump your arms. Keep them moving.
- Take some deep breaths. Keep your abdominals in tight and your chest lifted.
- You're training the joint receptors to get used to responding to different angles.

Squat

- Unlike the last exercise, which focused on cardio, this is a toning exercise.
- Try to stay balanced in the middle of the board, but you might drift from one side to the other. Pull in tight through the abdominals to keep your trunk strong.
- As you squat down, lift your arms forward to help you balance.
- When your muscles shake, they are trying to respond to the extra challenge of balancing.
- If you lose your balance, just reset yourself.
- You're working the front and back of the thigh and the glutei. This is a whole-body workout.

Lunge off Rear: Right

- The goal of this exercise is to try to keep your right leg balanced while your left leg lunges off the board. Don't let your right leg tilt to one side or the other.
- Your arms should be working as well when lunging.
- Try to place your left foot further back as a challenge.
- Make sure your left foot is on the ball of the foot when it reaches back and lands on the floor.

Lunge off Rear: Left

- Switch legs. This time, your left leg is in the center of the board and is the leg you're trying to keep balanced.
- Keep your hips square. Don't let your knee twist.
- Start nice and easy for the first few. Get used to the movement.
- Keep your chest lifted, and keep your abdominals in tight.
- Increase your pace if you can to burn more calories.
- Not only are you toning your hips and thighs, but you're also getting a cardio effect, burning calories. You're also working on the agility skill of proprioception, which is useful to develop if you're a sports performer but is also helpful in reducing the risk of injuries.

Lunge off Side: Right

- This exercise involves lunging off the side with the same setup as the last exercise. Start with your right foot in the center of the board.
- Point your left toe and bend your knee slightly outward as you lunge down.
- Try to keep your right foot balanced. Don't let the board tilt to one side or the other. The challenge is to keep it in the center.
- Use your arms in opposition.
- Pick up the pace when you can.
- Pull your abs in tight, and keep your chest lifted.
- The challenge is to try to sink lower into your lunge.

Lunge off Side: Left

- This time, start with your left foot on the board, making sure it's in the center. Try to get used to that balance point.
- Keep your head and chest lifted all the time.
- Keep your abs and waist pulled in tight.
- You should feel some work in the lower leg and the gluteus, but you will really feel your abdominals working hard if you keep them in tight.
- Sink lower into your lunge. The more you bend your right knee, the more work your quads, hamstrings, and gluteus will do.

Run in Place: Side to Side

- Instead of running forward and backward, this time you're running side to side, working through the range of motion in your ankles.
- Use your arms in opposition.
- The challenge is to keep your abdominals in tight and to keep the movement fluid.
- Pick up the pace so that you are running.
- You want to get some movement through the ankle, forcing the joint receptors to detect to and then causing the muscles to contract to control it. This movement helps to speed up the nerve messages that are traveling to and from the brain, reducing your risk of injury.

Twists

- This exercise focuses on your obliques, and it will help you understand how core strength is important for integrating the power and strength from your upper and lower body.

- The thoracolumbar fascia is the sheath in the lower back to which many different muscles attach—particularly, the transversus abdominis and the internal obliques, which are key core muscles. From below the hamstrings, the glutei indirectly attach to the thoracolumbar fascia, linking your upper and lower body.
- Try to use your upper and lower body to help you twist side to side.
- Use your arms and legs. To try to integrate the upper and lower parts; keep your abdominals in tight.
- You will lose your balance with this exercise; just keep resetting yourself.
- One of the principles of fitness is that you only begin to progress when you approach your limit. Therefore, if you're at the boundary where you're starting to lose your balance, that's good because that's where your balance begins to develop and improve.

Chop: Right

- You're going to put your right foot on the board and bring your left foot out to the side—not too wide.
- The key is to twist and control the movement of your midsection—while also controlling the tilt forward, backward, and side to side.
- Be careful of your knee; it is not designed to bend inward.
- Try to keep the board balanced; try not to let it touch the floor on the side.
- This is another exercise that links the upper body to the lower body. To do that effectively, you need to keep your core engaged.
- This is a whole-body workout—from the upper body, through the middle, and down to the legs. You're also doing some toning work with your legs as you squat and lift.

Chop: Left

- Switch legs, and set yourself up for the chop.
- While you're twisting on the board, you're also trying to balance it.
- Make sure you're twisting on the ball of your right foot so that your knee doesn't bend inward.
- This movement relates to playing golf and maybe even to tennis. You can't do either of those sports without a strong core.

Squat and Lift Knee: Right

- Start with your right foot on the board, and you're going to lift your left knee. Try to balance the board in the center.
- Bring your hands forward slightly.
- Keep your abdominals in tight and your chest lifted.
- When your upper body comes forward, don't round your spine. Instead, hinge your hip forward.
- You're working your abdominals, but you're also working your lower leg, focusing on balance and proprioception.

Squat and Lift Knee: Left

- This time, balance your left foot on the board.
- Keep your abs in tight.
- Your arms should work in opposition to your legs.
- Make sure you're focusing on keeping the board balanced in the center, and make sure you're getting low on the squats. The more you bend your knee, the more work you're doing through the legs and buttocks.

Kick Front and Touch Board: Right

- Start with your right foot on the board, and kick with your left leg.
- Try to keep the board balanced, but you might find that it tilts one way or the other. Your balance will improve with practice.
- Keep your chest up when you kick, and keep your abs in tight.
- When you touch the board, don't round your spine. Bend your knees, and hinge from the hip.

Kick Front and Touch Board: Left

- Start with your left foot on the board this time.
- The challenge is to try your hardest to keep the board balanced.
- You may have done this exercise on firm ground, but once you start doing it on an unstable surface, it becomes a whole different exercise.
- Bend your knees a little to get down to the board.

Press-Up with Twists

- You're going to get on your knees for this press-up exercise to make sure that you can do the full movement.
- Your normal press-up is not going to move, so you're just working the chest, the front of the shoulder, and the triceps. However, because this exercise involves a twist, there's extra work going on around your shoulder girdle that involves the rotator cuff muscles. The goal is to control the movement of the shoulder.
- Keep your abdominals pulled in tight. You don't want your backside sticking up or your hips dropping down. Maintain a natural, normal curve in your lower spine.

- It often works better to breathe in on the way down and breathe out on the way up.
- Don't lock your arms at the top of the press-up.

Triceps Dips

- You may have done this exercise before on a chair or on a step platform, but once you do it on a balance board, it's a much greater challenge because finding your balance point is not easy.
- Be careful not to lock your arms, and keep your abdominals in tight.
- Don't push your hips forward.
- In addition to working your triceps, this exercise works your shoulder girdle, which keeps you from wobbling.

Cooldown

- To cool down, do some mobilizing exercises just like you did for the warm-up.
- Then, move on to some static stretches, holding them for about 30 seconds each.

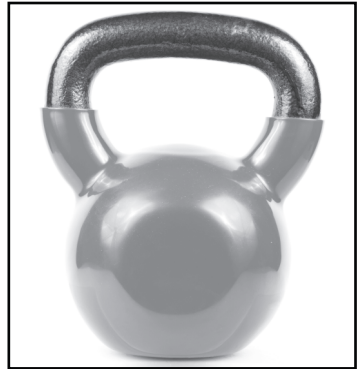
Kettlebell Workout

Lecture 32

Because kettlebells come in many different weights and there is a wide spectrum of exercises you can perform with them, a kettlebell is the perfect addition to anyone's fitness armory. Its unique design allows for swinging movements that incorporate momentum, which stimulates a different neuromuscular response than your body experiences with other resistance tools. Training with a kettlebell is founded on multijoint movements through different planes, creating a functional routine. This type of workout is a time-efficient way to improve your cardiorespiratory fitness, strength, and endurance. In addition, you can expect to improve your core strength, balance, posture, and coordination.

Guidelines

- With kettlebell exercises—even more so than with other resistance tools—technique is vitally important because you have to work hard to control the momentum of the weight.
- Start with a light weight and only a small range of movement, and then you can increase both as you become comfortable with them. It is vital to observe the progressive overload maxim: If you want to avoid hitting a plateau, you need to keep increasing the weight as you become stronger.
- As with any workout, you need to start with a good warm-up; particularly, be aware of exercises that mobilize the lower spine because that's where you're going to be focusing.



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Kettlebell workouts can be used to increase your functional strength, making it easier to perform daily tasks.

- If you have any lower back injuries, this is probably not the ideal workout for you.
- Your target for each of the exercises is 12 repetitions on each side.
- Put your kettlebells down in between sets, and rotate through your lower spine, and do a few quick shoulder circles. Give yourself a brief posture break in between exercises.

Alternate Swing

- Start by dropping the weight down, making sure that your knees are slightly bent and that your abdominals are in really tight.
- You're going to alternate arms and do 12 repetitions on each side, so you can start with either arm. You might want to keep your other arm out for balance.
- Pressing through the heels, you will feel work being done through the hamstrings, glutei, and thighs.
- At all times, try to maintain a gentle curve in your lower spine.
- Let the weight swing naturally—up to about shoulder or face level—and then grab it with your other hand.
- The reason that this is such a time-efficient workout is because it works the whole body.
- The bending of your knee creates a contraction in the thighs, working the quadriceps and hamstrings. The whole posterior chain—including the glutei and the lower back—works to control the momentum that you don't get with other resistance tools. The rotator cuff muscles, located around the shoulder blades, work to stop the momentum, pulling you forward. You're also working the shoulder when you lift the weight.

- You should notice your heart rate increasing as you're doing this exercise.

Single-Leg Dead Lift

- This is a great exercise for the glutei and hamstrings.
- Be careful when picking up your weights. Make sure you bend your knees first and then pick it up, taking it in both hands.
- Keep your hips, chest, and shoulders square to the front because you're going to hinge from the hip.
- Start with your left leg behind you, and let yourself drop the weight down—but don't let it pull your shoulders down—until as far as it's comfortable, getting a stretch through the hamstring.
- Keep your abdominals in tight, and keep your shoulders back and down. Don't let your hip rotate up.
- Lift at your own comfortable pace. Slow is best.
- If you lose your balance, you can always reset yourself.
- Your front leg—your right leg—should be straight but not locked at the knee. There may be a slight bend to help with balance, but keep it almost straight.
- You're working on your dynamic range of motion through your hamstrings.
- Maintain a long line though your spine—from the top of your head to your tailbone down to your heel.
- Make sure you keep breathing at a normal, steady rate.

- Be aware that you may feel slightly different as you switch from one side to the other so that you can focus on the weaker or less flexible side.

Lunge Twist

- This exercise works the legs, quadriceps, hamstrings, and glutei—the big muscle groups. The more muscle groups you include, the greater the calorie burn will be. There's also some work going on in your arms and shoulders when holding the kettlebell in position, and the rotation is brought about by the oblique muscles, which are working through the waist.
- Step your left leg back, put it on the ball of the foot, drop your knee down to the ground, and rotate the kettlebell. It's all one movement.
- Keep your head lifted the whole time.
- Keep good posture by making sure your abdominals are pulled in all the time, working through those deeper core muscles, which can only help to protect the lower back if they're strong.
- Be careful of balance. When you step back, make sure to keep your feet about hip-width apart.
- Make sure you go as low as you can when lunging.
- Because you're working such large muscle groups, your heart rate may start to increase because you have to make sure that your heart is pumping enough blood to reach all of those muscles. Therefore, you may feel that you're getting a cardio effect from this workout, even though you might be going quite slowly.

One-Handed Plié Lift

- For the plié, you're going to take your feet wide, and point your knees and toes out.

- Keep your abdominals in tight, and make sure you're hinging from the hip—not bending from the back. Maintain a long spine.
- This exercise is going to put a lot of stress through your core muscles, so you might want to drop down to a slightly lighter weight—or at least start with a lighter weight, and then switch as needed.
- You'll start to notice a cardio effect because you're working the big muscle groups. You're working many muscles at once, but you're also creating a greater calorie burn at the same time, so 30 minutes is all you need with exercises like these.
- This is a plyometric, or explosive, exercise, so make sure you use some energy when you jump. However, at all times, you must protect your lower back with your core muscles during a movement like this.

Prone Row

- The challenge of this exercise is core strength protection for your lower back.
- Make sure you're in a comfortable, neutral spine position that allows your spine to be in its natural alignment.
- To make this exercise slightly easier, place your feet hip-width apart, but if you're feeling strong, you can keep them together.
- If you're new to this exercise, keep your knees on the floor, but if you are going to do that, place your feet slightly further back so that you're not in an all-fours position.
- Find the position that feels right for your lower spine, and then lock it in by keeping your abdominals in tight. Don't drop your backside down, and don't stick it up in the air.
- The row works your biceps, rear shoulder, and upper back.

- The challenge is to keep gravity from pulling your hips down. The glutei, hamstrings, obliques, and the transversus muscle—which runs across the center of the abdomen—are pulling in to try to keep the center locked.
- If you start to lose your neutral spine position, put your knees down. Take a rest if you've done 1 set.
- Make sure to keep your breathing constant, and keep your chest, hips, and shoulders square to the floor.

Turkish Stand-Up

- You might want to start with a lighter weight for this exercise. Because this is a difficult exercise, do 12 repetitions total—6 on either side.
- The challenge is to stand up without using the hand that is holding the weight, but if you get stuck, then use your free hand to help you up.
- You might need to keep your other hand out for balance.
- Your whole body is working during this exercise, but you really need to work hard with your core muscles to transfer strength from the lower to the upper body.
- Because you're using various muscles, you'll start to see a cardio effect because your heart has to work a little harder to get the blood around. You're also starting to use more calories.
- You might see differences from one side to the other, so take note of them.
- Go slowly on your way down, and remain under control.

Single Shoulder Press

- Be careful when you pick up your kettlebell. Bend your knees.

- For this exercise, you might want to keep your free hand out or on your hip for balance.
- Make sure that your elbow is slightly bent; don't lock it.
- Keep your abdominals in tight.
- As you take your very small squat, you're really working the shoulders.
- Keep your head tall, and keep your chin in.
- You're working your whole body—from your legs, through your core, and then through your upper body.
- Because your elbow is extended, you're working the triceps as well as the shoulder.
- As with all of these kettlebell exercises, you're focusing on your core. Having a strong core will enable you to perform better through your legs and arms.

Russian Twist

- This exercise focuses on working your core muscles, which help to strengthen the lower back.
- Start with your feet about hip-width apart, and make sure your abdominals are in tight.
- Make sure that you've got a long line from the top of your head down to your tailbone. You're sitting tall and then hinging backward—but not rounding—so that you can keep your abdominals in tight and keep the natural curve in your lower spine. The obliques are working at the waist to twist you from side to side.
- Try not to hold your breath.

- The challenge is to keep the transversus muscle, across the middle of the abs, pulled in really tight.

Cooldown

- In your cooldown, you should focus particularly on the lower back with some simple exercises.
- Drop yourself down onto your back, and pull your knees into your chest. Then, you can rock forward and backward slightly on the floor or a mat, massaging the lower spine.
- Next, bring your legs down to one side, and take your arms across to the other. Hold that position for about 15 to 30 seconds, and then switch to the other side.
- Also, you can get into a child's pose from yoga.
- Don't forget the lower body stretches because you've done a lot of work with your quads, hamstrings, and glutei.

Plyometrics Workout

Lecture 33

Plyometrics, also known as jump training, involves stretching the muscles prior to contracting them. This type of training, when used safely and effectively, strengthens muscles and decreases impact forces on the joints. Plyometrics mimics the motions used in sports—such as skiing, tennis, and volleyball. These exercises are designed to increase muscular power and explosiveness. However, because this type of training is so intense, it results in a considerable calorie expenditure, so it's valuable in weight management and not purely for the elite sportsperson.

Guidelines

- Plyometrics is a beneficial training practice for those trying to increase their explosiveness, but you shouldn't incorporate it into every workout. It's intense, so your body needs time to recover.
- If you incorporate a plyometric workout into your training routine 1 day per week, it'll add variety and give an intensity boost that will improve the effects of your routine.
- A safe and effective plyometric program stresses quality of jumps—not quantity of jumps—so safe landing techniques are important because you want to reduce impact forces. Stop and reset yourself if you feel your form beginning to falter.
- Stretching a muscle prior to contracting it recruits the stretch reflex of the muscle to enhance the power of the second jump. This prestretching of the muscle occurs when you perform one jump after the other.
- Use visualization techniques to promote low-impact landings. For example, try to imagine yourself landing as light as a feather, and then think of recoiling like a spring after the impact.

- When landing, try to avoid excessive side-to-side movements, even when you're performing lateral movements.
- Landing forces can be absorbed from the knee musculature, which includes the quadriceps, hamstrings, and gastrocnemius. These work more effectively when the knee is bent, primarily at the inner hinge joint.
- In addition to jumping-based drills used to develop power in the legs, you can also use explosive exercises to target the upper body.
- Unlike traditional toning and body-sculpting exercises—where the focus is on slow, controlled, isolated movements—plyometric exercises focus on being explosive, including full-body movements that are great for burning a large number of calories, toning the major muscle groups in the body, and helping to improve core strength.
- For the following exercises, do 30 seconds of each exercise, and then take a 30-second rest. If you're a beginner, you might want to do 12 repetitions and then take a 30-second rest. Either way, do 2 sets of each exercise.
- Before you start the second set, take some deep breaths, and get a sip of water if you need to.
- If you find that you are mostly working on your technique for many of the exercises, do 1 more set of each exercise at the end of the workout. Do only 15 seconds, but really push yourself.
- As always, you need to warm up with gentle movements to mobilize your joints and to raise your body temperature, including marching in place and building up to a jog, lifting your knees, pointing your toes, and making circles with your arms.
- Suitable footwear with good cushioning and lateral support is ideal when doing these exercises.

- Concentrate on soft landing by flexing your joints. The quieter you land, the better your technique and results will be.
- Ensure that you are well hydrated before and during this workout.

Power Squat Press

- Be careful how you pick up your dumbbell—or other resistance tool, such as a medicine ball or a few cans of beans.
- The goal of this exercise is to squat, pressing into the heels.
- The feet are about hip-width apart.
- Keep your abdominals pulled in tight.
- Hold your resistance tool at chest level.
- You can take the first set nice and easy, focusing on getting used to the technique. For the second set, increase your pace.
- Try to land softly by bending through your knees, hips, and ankles.
- You should roll from toe to heel upon landing.
- You'll begin to feel that you're working several muscle groups during this exercise, which is going to contribute to increased calorie burn.
- The challenge for the second set is to squat deeper, jump higher, and go faster.
- Work at your own pace, but keep a quick rhythm. However, don't sacrifice technique for speed.

Squat Jumps

- For this exercise, be careful jumping on and off your step. You've got to make sure that you land straight into your squats. Ideally, there will be no noise on your landings.
- For the first set, jump on the step, and get used to stepping back down by just walking down. Also adjust to jumping up onto the step.
- For the second set, you should be able to jump both on and off. The secret is quiet landings going up and quiet landings going down.
- Don't jump forward; focus on jumping up.
- Make sure you land with your whole foot on the step—toe down to heel—bending straight into the squat to keep it soft.
- You're bending straight into your knees, ankles, and hips, and you're working through your core muscles, keeping the abs tight at all times.

Power Lunge

- Start with one foot on the board and one foot off—it doesn't matter which one you start with. The foot that is off the board should be on the ball of the foot.
- You're not shuffling side to side during this exercise; instead, you're jumping.
- Use your arms to throw yourself up in the air.
- You can use your first set just to get comfortable with the technique.
- Make sure you're getting some good height and landing quietly. Make sure your whole foot lands on the board.
- Sink down into your lunge. Try not to look down too much.

- Work at your own pace, and get a good rhythm going.
- For the second set, challenge yourself to see how high you can jump and how fast you can go.
- By the end of the second set, you should feel that the muscles in your legs did some work.

Lateral Jump

- For this exercise, you're going to move laterally over the step.
- There are 2 options for the first set. You could just step over the step to begin with and then maybe progress a little. In other words, take a step, hold it for a second, and then maybe bounce a little before you go back over—building up to a full jump over without a rest in between. First, get used to the lateral technique of getting up and over the step.
- The other option is to jump with both feet, but take a little hop before you go back over.
- Either way, make sure you're clearing the step by lifting up. Try to control your lateral movement by sinking down and getting yourself ready to jump.
- For the second set, increase your pace. If you can, try to jump straight over and straight back. It's OK if you need to take a hop before you go back over or if you need to take a rest to regain your balance. You can even lower your step if that will help you. This exercise is about quality—not quantity.

Lateral Power Lunge

- For this exercise, you're still moving from side to side on the step, but this time, keep one foot on the step. However, just as with the power lunge, you're not shuffling from side to side.

- The goal of this exercise involves shortening the muscles first and then allowing them to contract. Therefore, it's about height and landing straight into the lunge.
- Land with your foot flat on the step—*toe to heel*.
- Take a really good squat down, keeping your abs in tight.
- Use your arms to bring you up.
- Get the feel of the exercise during the first set.
- Even though you're traveling laterally, think about getting some height.
- Bend the knee to preload the muscles—using the elasticity in them to give you power—and then land quietly.
- For the second set, increase your height and pace.



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When lunging off the side of a step, be careful that you are aware of how far away the step is.

- Hopefully, you can feel that your hips and thighs are doing some work during this exercise.
- Land quietly by bending straight into your hips, knees, and ankles. You want a cushioned, quiet landing. The quieter it is, the safer it is because it's less impact for your hips, knees, and ankles to absorb.
- You should feel this workout in your heart, lungs, and legs, involving the cardiovascular, energy, and lactate systems.

Power Push-Up

- The plyometric technique can be used for upper body work; a power push-up is an example.
- Start with your hands on the step, and set up for a normal push-up, but on the push, your hands should leave the step for just a second.
- As soon as your hands land on the step, bend into your elbows and through your shoulders.
- If you start to get tired, your knees can drop down to the floor.
- Keep your abdominals in tight.
- For the first set, take a nice and easy pace.
- This exercise works the chest, the front of the shoulders, and the triceps at the back of the arm. Hopefully, it's also working your heart and lungs.
- If you need a quick breather between push-ups, take one, but then keep going. Work at your own level.

Cooldown

- Get up and walk around a little, cooling down in the process.

- Do some simple, gentle, rhythmic movements just like you did for the warm-up.
- Take a few deep breaths.
- Do some arm circles, rotations, and knee lifts to gradually bring your heart rate down.
- Plyometric training is not easy, so you shouldn't do it every day of the week, but you can throw it in to vary your training.
- Plyometric exercises are great if you're involved in sports because explosiveness and power are vital in sports.
- These types of exercises burn a lot of calories because they are demanding and they use the big muscle groups.
- While isolation exercises usually focus on just one muscle, plyometric exercises are compound exercises, which involve many muscles working together. This results in a huge calorie burn, which earns you a calorie deficit at the end of the day.
- One of the barriers to fitness is time, and another benefit of a plyometric workout is that you don't need much time to do it because it's intense. The more you put into an exercise, the more you get out of it, so if it's intense, you're going to get great results.

Resistance Band Workout

Lecture 34

Resistance bands have different thicknesses, so you can vary the amount of resistance you want for any exercise. Resistance band workouts are perfect for the home environment, but the bands are also portable. You can take them with you whenever you go on vacation—just in case there isn't a gym—and they don't take up much space, so you can easily pack them into your suitcase. You may have seen resistance bands without handles, but use the ones with handles for this workout. It can be uncomfortable to wrap the ones without handles around your hand.

Guidelines

- As with any workout, it's important to warm up with aerobic-type movements that involve large muscle groups.
- For each exercise, do 1 set of 15 repetitions on each side, when applicable. Regular exercisers should do 2 sets of each exercise, and advanced exercisers should do 3 sets of each exercise.
- Particularly as you start to progress and become stronger, you'll need to get a thicker band to work with as exercises become easier for you.

Squat

- Sit down into your squat as low as you comfortably can, pressing into the heels.
- Bend your knees slightly; don't lock them. Keep your heels down.
- Make sure to keep your abdominals in tight so that you're not sticking your backside out too far and so that you're not getting too much of an arch in your lower spine.
- Keep your chest lifted and your head up.

- You're working against the resistance in the band as you press up.
- This exercise works the front of the thighs, the back of the thighs, and the glutei.

Lunge

- Start with your right leg forward and your left leg back, but make sure your 2 feet are slightly spread out to help you balance.
- Keep your hips, chest, and shoulders square to the front.
- Slow is better with these exercises because you want to make sure that your movements are under control.
- Keep your abdominals pulled in tight to create a long spine.
- Be careful not to twist the rear foot; make sure it faces the front and is resting on the ball of the foot.
- Keep your breathing relaxed and constant.
- When switching your legs, be careful. You don't want the bands to suddenly spring up and hit you.
- Your hands should come up to shoulder level. Keep your head up.
- Try to focus your mind on the muscles that are doing the work—the thighs, quadriceps, hamstrings, and glutei.

Hip Abduction

- This exercise targets the hips and the side of the buttocks.
- Keep your abs in tight, and stand up tall. A slight lean is OK, but try not to lean too much.
- The benefit of doing this exercise standing rather than lying down is that on the other side of the hip, you have to work to support your

structure and to remain balanced, so your supporting leg is working as well.

- Make sure that most of the work is coming from lifting your leg out to the side, working against the resistance.
- The further you lift your leg, the more the band is stretching and the more resistance it will give you, so it will be more difficult.

Plié

- Start by stepping out wide, pointing the toes and knees out slightly. When you sit down into your plié, your knees follow the line of the toes.
- This exercise focuses on the gluteus and hip adductors, which work the inner thigh.
- Keep your abdominals in tight so that your backside doesn't stick out when you go down.

Bent-Over Row

- For this exercise, you're going to lean forward with your knees bent, keeping your abs in tight to protect your lower back.
- Your hips are fixed as you row backward, lifting your elbows up to the ceiling.
- This exercise focuses on the upper back, but you're also working the biceps, shoulder blades, and core muscles. You're also working the legs isometrically.
- Focus your mind on squeezing your shoulder blades together as you row backward.
- By putting only one foot on the band, you can change this exercise slightly to make it more difficult.

- Rather than working the upper back, this change shifts the focus onto the rhomboids in between the shoulder blades, which are great for helping to improve your posture.
- Keep both knees bent, and place your other foot behind you for balance.
- This bent-over position allows you to work against gravity.
- You can make this exercise slightly easier by keeping your elbows bent, or you can make it more difficult by bringing your arms further up.

Pull-Down

- Start with your feet about hip-width apart and with your abdominals in tight.
- Fold your resistance band in half, and lift it up just above your head.
- Don't let the band pull you into an arched position. Keeping your knees slightly bent—not locking them—will help.
- Keep your breathing relaxed.
- Work against the resistance on your way back up. Don't let it spring back; control it.
- You're working the upper back as well as the lower part of the trapezius.

Chest Fly

- Wrap your resistance band around your hands a few times to shorten it. If the band still feels too light, wrap it around again.
- Your arms should be almost straight—but not quite—and at chest level. Your knees should also be slightly bent to give you a balanced position.

- Keep your abdominals in tight.
- This exercise works the pectoral muscles of the chest. Make sure you're not working your arms; instead, concentrate on working the chest.

Lateral Raise

- Choose one foot to start with, and place it on the resistance band, making sure that it is stable. You don't want it jumping up. Keep your other foot behind you.
- Make sure your knees are slightly bent for balance.
- You're targeting the middle part of the deltoid, the shoulder muscle.
- Lift up to the side—just above shoulder level. Be careful to keep your elbows slightly bent; don't lock them.
- Keep your abs in tight, and be careful not to arch your back. Keep your head up.
- Slow is better, particularly on the way down.
- Work against the natural elasticity of the band.
- Your body position stays fixed; just your arms are working.
- You have a choice: If you start to fatigue, you can bend your arms a little more, or if you're feeling strong, keep your arms almost straight as you lift up.

Shoulder Press

- Slightly bending your knees helps you to maintain your stability. It helps you to keep your hips fixed and your lower spine in place so that you can focus on just the shoulders doing the work.
- Keep your abdominals in tight.

- When you press up, make sure your hands are slightly in front—not behind, which is uncomfortable on the shoulders.
- Don't lock your elbows when you press up because that can put a lot of strain on the tendons around the elbows.
- This exercise works the middle and front parts of the shoulder.

Front Raise

- This exercise works the anterior part of the deltoid. The shoulder muscle splits into 3 parts, and this exercise enables you to work all of them.
- Start by lifting your arms up to face level, keeping your head up.
- If you have any concerns about your lower back, you might find it easier to alternate sides. If not, you can pull your abs in really tight to work both sides at once.
- Your arms should be slightly bent, lifting out to the front in a semicircular movement.
- Concentrate on working against the resistance on the way back down.
- Keep your knees slightly bent with your feet apart for stability.

Upright Row

- Place both feet on the resistance band for this exercise. Turn your palms toward your body.
- Keep your knees slightly bent and your abdominals in tight.
- The goal for this exercise is to lift your elbows up high.
- Try to keep your shoulders down so that you're not pinching the neck.

- The work is coming from lifting the elbows up and out, working the deltoid and the upper part of the trapezius.
- Don't hold your breath. Exhale on the exertion; breathe out as you lift, and breathe in as you go back down.

Biceps Curl

- In addition to flexing at the elbow, the biceps are responsible for twisting.
- Start with your palms facing your sides, and then as you lift up, turn your palms toward your body.



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Resistance bands require you to work against the resistance of the band while maintaining control of your movements.

- It is vital not to lean back; you don't want to put any strain on your lower back.
- Keep your abs in tight. The only thing that's moving is your arms.
- Keep your elbows fixed to your side as you lift up—don't swing your arms.
- Keep your knees slightly bent to give you stability.

Concentration Curl

- Even though you're bent over and supporting yourself, you still need to keep your abdominals in tight to fix your position so that the biceps can do the work. Your abs are fixator muscles.
- Keep your breathing relaxed, and make sure you're not twisting your spine.

- Your head should drop forward so that your neck is relaxed.
- The shoulder muscles are also fixator muscles that work to fix the position of your elbows so that they don't move.

Triceps Extension

- This exercise works the back of the arms. Pull down on the band to give you the tension to work against. The more you pull down, the tougher it is, and the better your results will be.
- Your goal is to achieve muscular fatigue by the final repetition. If it feels too easy, you won't experience overload, so be tough on yourself.
- Keep your knees slightly bent to give you better stability.
- Pull your abs—fixator muscles—in tight so that nothing else moves.
- Try not to push your head forward; your neck should be in a comfortable position.
- Try not to lock your arm at the top; keep it a little soft.
- Try not to rush your movements. Slow is better.

Waist Twist

- The best way to work your abs with a resistance band is to loop it around a door handle or banister. Just make sure that one end is fixed.
- Stabilize yourself by pulling your abs in tight.
- Bend your knees, and point your toes slightly out. Your arms should also be slightly bent.
- The abdominals work contralaterally by working the external obliques on one side and the internal obliques on the other side.

- This exercise focuses on the waist by targeting the oblique muscles on the sides.

Chop

- This exercise makes the waist twist more challenging by still including rotation but adding flexion by involving the abdominals.
- Keep your knees bent.
- Your legs will move a little bit for this exercise, but that's OK.
- Slower is better.
- Focus on the abdominals and the obliques that are doing the work. Don't think about the arms.
- Keep your breathing relaxed and your head up.
- Make sure you stabilize yourself with a wide base, and rotate through the lower spine.
- Make sure you stay far enough away from the fixed end of your band so that there is always enough tension.
- Keep your arms only slightly bent, and don't push with your arms. This exercise is all about rotating through the middle.

Cooldown

- Your cooldown should be similar to your warm-up, including a few mobilizing exercises that move through large muscle groups.
- Then, do some stretches for the major muscle groups.

Training Bar Workout

Lecture 35

Training bars come in different weights and can be used for a variety of exercises. If you don't have a training bar, you can easily buy one from a decent sports retailer. For this workout, you should use an 8- to 12-pound bar. Ideally, beginners will work with a training bar that weighs around 3 to 6 pounds. The intermediate level is between 9 and 18, and the advanced level is anywhere from 24 up to 36. If you don't have a training bar, you can use a broom handle to get used to the exercises until you get one.

Guidelines

- Before this workout, as with any workout, you need to have a good warm-up—perhaps including practicing some of the moves you're going to do in your workout, such as squats and biceps curls.
- Do 1 set of 15 repetitions of each exercise. If you're already exercising regularly, do 2 sets of each exercise, and if you're more advanced, do 3 sets of each exercise.
- Your core strength helps you integrate the strength in your upper and lower body. The following exercises set you up with an upper body exercise followed by a lower body exercise, and then you're going to combine the 2 together, repeating for several sets.



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When picking up your training bar, be careful not to lift with your back; instead, lift with your knees.

Squat

- Rest the bar across the top of your back, grabbing it lightly. Never squeeze it.
- Keep your feet about hip-width apart, press down into the heels.
- Keep your abdominals in tight. Resist the temptation to let your stomach or shoulders drop forward.
- This exercise works the quadriceps, hamstrings, and glutei. It is a great exercise for your entire lower body.

Shoulder Press Front

- Bring the bar over to the front of your body.
- Keep your abs in tight, and keep your knees slightly bent for balance, which takes the strain off the lower back. There should be some tension through the legs, stopping you from swaying backward and forward, which puts stress on the back.
- You should press straight up but slightly forward because if you push directly upward, it's an uncomfortable position for the shoulder complex. Ideally, you should be able to look straight ahead but use your peripherals to see the bar slightly.
- Don't hold your breath. Exhale on the exertion; breathe out as you press.
- Your elbow should be straight, but don't lock it. Control the momentum of your arm.

Squat and Press

- Lock your middle, pulling in through the stomach and waist.
- Start with the bar at chest level. Squat down and press up at the same time.

- You should notice that much more work is required to pull your abs in when you go down. There will be a tendency for your stomach to want to drop forward. Keep it in tight so that you maintain a comfortable, neutral spine.
- Make sure you keep breathing.
- This exercise works the legs and the shoulders—the upper and lower body.
- The great thing about combining exercises is that you use more muscle groups. The more muscle groups you use, the more demanding in terms of energy, so you're burning more calories.

Rear Lunge: Right

- Rest the bar on top of your shoulders.
- Keep your feet hip-width apart.
- When you step back with your right foot, place it on the ball of the foot.
- Make sure you don't twist your rear knee.
- Don't let your body drop forward. Keep your abs in tight as you step back.
- Working through a greater range of motion requires more muscular effort, so stepping further back makes it more demanding through the legs.

Rear Lunge: Left

- Be aware if there's any difference from one side to the other; if one side is a little weaker, it might need some extra work.
- Start with your feet hip-width apart.

- Keep your abs in tight, and stand up tall with your chest lifted.
- Make sure you're stepping onto the ball of the foot with your rear leg and that your rear knee drops straight down.
- This exercise works the front of the thigh, the back of the thigh, and the gluteus. You're using many large muscle groups, which use a lot of energy, so you're toning and burning calories at the same time.

Rowing Side to Side

- To maintain stability, keep your feet hip-width apart and your knees slightly bent. If you find that you start to wobble through the lower spine, do a split lunge—one foot in front of the other—because that's even more stable.
- This exercise challenges your core strength. The rotation tries to throw your lower spine around, so you have to pull in tight through the transversus abdominis—across the middle—and the internal obliques—the smaller oblique muscles—pulling the thoracolumbar fascia at the back that splits the lower spine to keep you stable.
- Core strength involves having strength in the middle that allows you to generate strength and power through the limbs.

Rear Lunge (Right) and Row

- You're going to row in opposition to the lunge so that you get some rotation, which causes your core muscles to work harder.
- You should feel the hip flexors on your side working as you're rotating.
- Don't sacrifice your technique on the lunge—keep it nice and deep. Make your legs do some work.
- Your arms and shoulders are doing some work by moving the bar, but you're using your obliques to turn, and you're keeping your abdominals pulled in tight to maintain your position.

Rear Lunge (Left) and Row

- Switch sides, noticing any differences between the sides.
- Keep your head up and your chest lifted. Keep breathing.
- When dealing with core strength, you're keeping your spine fixed in a central column, and all the movement of the arms and legs is going on around the outside.

Plié

- Keep your feet out wide. The wider you go, the more muscular energy is involved and the greater the toning effect will be.
- Your knees should follow the line of the toes, and resist the temptation for your knees to drop in toward the center.
- This exercise works the front and back of the thigh, and it even works the adductor muscles in the inner thigh.
- Keep your abdominals in tight as you go down. Be careful not to stick your backside out
- You should be staying a little more upright than you do for a normal squat, letting the legs do the work.
- Slow is better for these exercises.

Biceps Curl

- Make sure that you fix your elbows by your side, really getting into just your bicep.
- Keep your feet about hip-width apart. Avoid any swinging movement by keeping your knees just slightly bent, which will engage your core muscles, locking on your lower body and keeping you fixed.

- Exhale on the way up, and inhale on the way down—don't hold your breath.
- Focus your mind on the feeling of the muscle that's doing the work—your bicep. Try to imagine your bicep muscle shortening and lengthening, performing concentric and eccentric contractions.

Plié and Biceps Curl

- For this exercise, you're combining your upper and lower body, and that integration relies on your core strength, so keep your abdominals in tight.
- Keep your legs nice and wide, and keep your elbows fixed to your sides.
- Keep your chest lifted and your head up.
- Make sure your knees don't collapse into the center—keep them out.
- Control the momentum on the bar on the way down.
- You should start to feel the inner thigh working as you do some deep pliés.

Front Lunge: Right

- The front lunge is a little trickier than the rear lunge because of stability issues.
- If you have had knee injuries, this is a great exercise to do, but take your time with it because it builds up the muscles around the knee that help control your motion.
- Start with your feet about hip-width apart, and rest the bar on your back.

- If you're not careful, you could have some stability issue when you lunge, but your knee might also shoot forward too far, which would put a strain under the patella tendon. You don't want your knee to go past the line of your toe when you're moving.
- Keep your abs in tight, shoulders back, and chest lifted.
- Work at your own pace.
- The longer the lunge, the more muscular energy and muscle fibers you're using, and the better the toning effects will be.
- Control your movements; don't allow your body to wobble from side to side.
- You should feel some work in the front or back of the thigh as you lower down, but as you come back, you should start to feel it in the gluteus.

Front Lunge: Left

- Switch sides, making sure your feet are hip-width apart.
- As you step out, press off your front heel to get you back to where you start.
- You're working your gluteus by pushing your heel off the floor. This movement involves hip extension.

Lateral Raise: Right

- Make sure you hold the bar in the middle. It doesn't matter if the bar wobbles a little bit—just try to reset it.
- In terms of stability, this exercise challenges the core strength, so try to keep your feet hip-width apart with your knees slightly bent.
- Keep your elbows slightly bent, and lift the bar to about shoulder level.

- This is an isolation exercise, so nothing but the deltoids should be moving.
- You should feel your abs working because there is a balance issue. If you're not locking your abs in the center as you slowly lift, you're going to fall over.
- Concentrate on your shoulder. If you focus on the muscle that's doing the work, you're more likely to get the technique right.

Lateral Raise: Left

- When switching sides, be aware that you might have imbalances from one side to the other.
- Think about your technique. You're in a braced position with your abs in tight and your knees slightly bent.
- All the work is coming from the shoulder. Particularly, some of the work is coming from the front and back of the shoulder—the anterior and posterior deltoid—but most of the work is coming from the middle part of the shoulder, the medial deltoid.
- Slowly lower the bar down; don't swing it or let it drop quickly. You're working against gravity.

Front Lunge (Right) and Lateral Raise (Left)

- You're going to lunge in opposition to the lateral raise so that you remain balanced.
- When you step forward, there are some stability issues, so make sure your knee doesn't wobble and make sure it doesn't go too far forward when lifting the bar.
- Keep your feet about hip-width apart. You can also put your other arm out or on your hip for balance.
- Lunge deep, and lift the bar up to shoulder level.

- Keep your abs in tight.
- This is a whole-body exercise. You're working your calves, hamstrings, quads, glutei, abdominals, obliques, and shoulders.

Front Lunge (Left) and Lateral Raise (Right)

- Take your feet out wide again, and start on your other side.
- Control your forward lunge, which should be as deep as possible.
- Make sure your body stays upright in the center.
- Keep your head and chest lifted.
- This exercise relies on your core strength.

Sit-Up and Reach

- This exercise works your rectus abdominis by trying to draw your ribs close to your hips.
- Start with your feet about hip-width apart. Press the bar up, sitting up straight and tall.
- Make sure that the movement is initiated by your abdominals by thinking about your abdominals as a spring that you are squeezing together.
- Breathe out on the way up and in on the way down.
- Try to keep your heels down if you can. Your feet might wobble a little, but that doesn't matter as long as you're working your abdominals.
- When you were standing, you were working the deeper postural muscles that pull in and fix you. For this exercise, you're working the rectus, which is a mobilizer—responsible for moving you.

Sit-Up and Twist

- For this exercise, you're still using the rectus, but you're also adding work for the internal and external obliques.
- The internal obliques are deeper, and they work on your core strength. The external obliques are what help you with rotation. They work together but sort of in opposition because of the angle at which the muscle fibers run.

Sit-Up and Reach and Twist

- Adding the previous 2 exercises together, you are going to sit up—using your rectus—and then use your obliques as you reach the bar up and over to the side. There is also some coordination movement involved.
- Keep your movements smooth. Don't let yourself fall back down; instead, slowly lower yourself down.
- You might be getting tired, but don't sacrifice your form.
- Make your obliques do some work by really twisting your body.

Cooldown

- As always, cool down after your workout.
- Because your core has done a lot of work, do some stretches for the lower back and spine.
- Hold your stretches for about 30 seconds because you're warm, which is the perfect time to stretch.

Stretching Routine

Lecture 36

The following stretching routine is designed to introduce you to a range of stretches that will help improve your flexibility. All you need is some space around you, some loose clothing to wear, and the thermostat set to a comfortably warm temperature. This routine can be used at the end of any workout that you do to ensure that your muscles will be prepared for the next time you need to use them. By the end of this routine, you will appreciate the many reasons that stretching is beneficial for both your body and mind.

The Benefits of Stretching

- Flexibility refers to the range of motion around a joint or group of joints. It varies from person to person and from joint to joint. It is primarily dependent upon the specific joint structure and is significantly influenced by the connective tissues around each of the joints. Because joint health is related to activity levels, age, and gender, these are key considerations in determining flexibility.
- In addition to the 3 fundamental determinants, there are 3 less influential items.
 - Body temperature affects range of motion, which is known to improve along with increasing heat. This is why exercise always begins with a warm-up period.
 - Contrary to common belief, rather than shortening your muscles and making them stiffer, weight training exercises that work through your full range of motion will improve your flexibility.
 - During pregnancy, the joints and ligaments in the lumbopelvic region are relaxed to allow for growth and

movement of the fetus, making delivery a little easier in the process.

- Regular stretching has been shown to produce the following positive adaptations.
 - Enhanced range of motion.
 - Reduced risk of injury and degree of such if injury does occur.
 - Increased sports performance in terms of endurance and skill.
 - Improved posture, leading to reduced risk of lower back malady.
 - Increased positive impact on mental health by providing a vehicle for physical relaxation.
- Static stretching is the most common method of stretching that involves a gentle movement toward the end position to slowly lengthen the muscle and then holding at the point of mild tension for between 15 and 30 seconds.
- The idea of collagen creep is that after you hold a static stretch for about 6 or 8 seconds, the connective tissues around the muscle begin to stretch to align themselves in the same direction. After you start



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Your calf muscles are most likely used in any workout, so you should take the time to stretch them.

to feel some mild tension, the tension will subside, and then you'll be able to ease a little further into the stretch. Breathe out as you stretch further into the position.

Warm-Up

- Make sure that you have some space to stretch, and make sure it's quiet.
- Start with some mobility work—from the top of the body to the bottom—to get the synovial fluid into the joints, and then move into stretching.
- Start with your feet about hip-width apart. Bend your knees slightly.
- Tilt your head from side to side at your own relaxed pace.
- Be aware if there's any differences from one side to the other.
- Next, drop your head down and lift it up. Don't flick your head back; just lift from the chin and look up at the ceiling.
- Then, make a half circle, starting with your head to one side and slowly rolling over to the other. Avoid squeezing at the back and impinging the blood vessels.
- Gently roll your shoulders forward. Then, roll them backward.
- Bring your arms up to chest level, and open them out, keeping your abs in tight, hips fixed, and knees slightly bent.
- Then, bring your arms forward and make some big circles. The shoulder is the only joint in the body that can do this movement of circumduction. Then, reverse your circles, bringing your arms backward. Try to do one forward and one backward as a mental challenge.

- Bring your knee up to about waist height, working through the hip flexors.
- Bring your heel up to your backside to do a leg curl, working the hamstring muscles at the back of the thigh.
- Try to get a good range of motion through the ball-and-socket joint at your hip by doing a hip circle on both sides.
- Starting with either leg, do a heel dig: Put one foot in front of your body and then the other, bringing your heel down and lifting your toe up. This stretches your calf and your Achilles tendon.
- Starting with your knees slightly bent, work on the flexion and extension of your spine. Take a deep breath, and be aware of lengthening your spine. When you exhale, try to blow all of the air out, which will start to draw the ribs down toward the hips. As you get toward the end of the breath, you'll start to feel your abdominals engaging deeper and pulling you down into that flex position. Then, take a deep breath in, lifting your face up and forward.
- Then, add an arm swing. Lift your arms up when you breathe in, and when you exhale, let them drop down. Let this pull you down slightly. Feel the back rounding, and then open it up.

Standing Stretches

- Drop one of your ears to your shoulder. Take your palm out to the opposite side, and press it down to the ground. You should feel a stretch coming through the neck and down into the shoulder. Try to keep your breathing relaxed. Switch to the other side, making sure to center yourself.
- Stretch your shoulders by lifting your head up, and bringing one of your arms across your chest. Hold your arm just above the elbow, squeezing it a little so that it goes further across. Don't let your body twist. Ease into your stretch position—to the point where you feel mild tension, and then hold it. Keep your breathing relaxed,

and enjoy being at peace for a moment. When you're ready, switch to the other side.

- Bring your hands behind your back, and put your palms together. Lift away slightly from your backside, squeezing your shoulder blades together. Try not to arch your back; try not to stick your chin out. This is a great stretch for the pectoral muscles but also for the front of your shoulders and chest. Try to picture the elastic fibers of the chest muscles stretching gently.
- Then, bring your hands up to the front of your body. You can either interlock your fingers or put one on top of the other. Your arms should stay slightly bent while you stretch forward. The goal is to reach your hands forward and to round the back, stretching through the muscles in the upper back by pulling your shoulder blades apart. Drop your chin down onto your chest.
- To stretch your triceps, take one arm, and drop it down behind your body. Place your hand with your fingers pointing down onto the back of your spine. Put your other hand on top of the elbow and encourage your hand to walk further down the spine by pressing down onto it. Keep your abdominals in tight.
- Put your hands on top of your knees, which should be bent. To stretch your lower back, pull your belly button in tight, trying to lift your lower back up to the ceiling by rounding through your lower spine. This exercise works the erector spinae muscles. You're supporting the weight of your back by putting your hands on your thighs. Slowly, curl back up.
- To stretch your hip flexors, bring your left foot back, and rest it on the ball of the foot. Your hips, chest, and shoulders should face the front. Bend both knees. Tilt your pelvis up and forward, which will flex the iliopsoas muscles of the hip flexors. Switch feet, and repeat.
- To stretch your quadriceps, start by holding your left foot. Squeeze your heel close to your backside without squeezing it directly into

your backside because that would put a lot of pressure under the patella tendon of the knee. Then, push your hip forward.

- Switch legs. For balance, you can bend your supporting knee. If you're struggling with your balance, you can hold onto something, or you can just reset yourself if you wobble.
- Because they are opposing muscle groups, you need to stretch the hamstring at the back of the thigh after stretching the quadriceps at the front. Start with your left foot out, keeping your heel down. Bend your right leg, and put your hands on your right thigh. Trying not to round your spine, bring your chest forward. As you drop your chest, you'll feel a stretch in the hamstring. Let the top of your head drop forward to maintain the natural curve in your lower spine. Switch legs, and repeat.
- To stretch your inner thigh, take a wide stance on the floor or on a mat. Point your toes out, and point your knees out along the line of your toes. Place your hands just above your knees, and push backward as if you are getting ready to sit down. You're opening your inner thigh, stretching the adductor muscles. Keep your shoulders and breathing relaxed.
- To stretch your outer thigh, bring your left foot over your right foot. With your left hand, you are going to displace your hip by leaning and pushing your hip at the same time. This stretches the lateral complex of the hip and your smaller gluteus muscles, but also the iliotibial band down the side of your leg. This is an important stretch for runners. Switch legs, and repeat.
- There are 2 muscles in the calf: the gastrocnemius and the soleus. You can stretch these muscles by bringing your left foot back, making sure your feet are facing forward, and sinking onto your front leg. Keep your back heel down, but shift your weight forward to feel the calf stretching. You might need to support your weight on your front leg. Switch legs, and repeat.

- As you ease out of that stretch, bend your knee to sink a little lower down in order to stretch the soleus and the Achilles tendon. Make sure your feet are about hip-width apart for balance. Shift your weight forward, keeping your heel down and leg straight. For runners, this is a particularly important stretch. Switch legs, and repeat.
- The great thing about standing stretches is that you can do them anywhere and at any time.

Floor Stretches

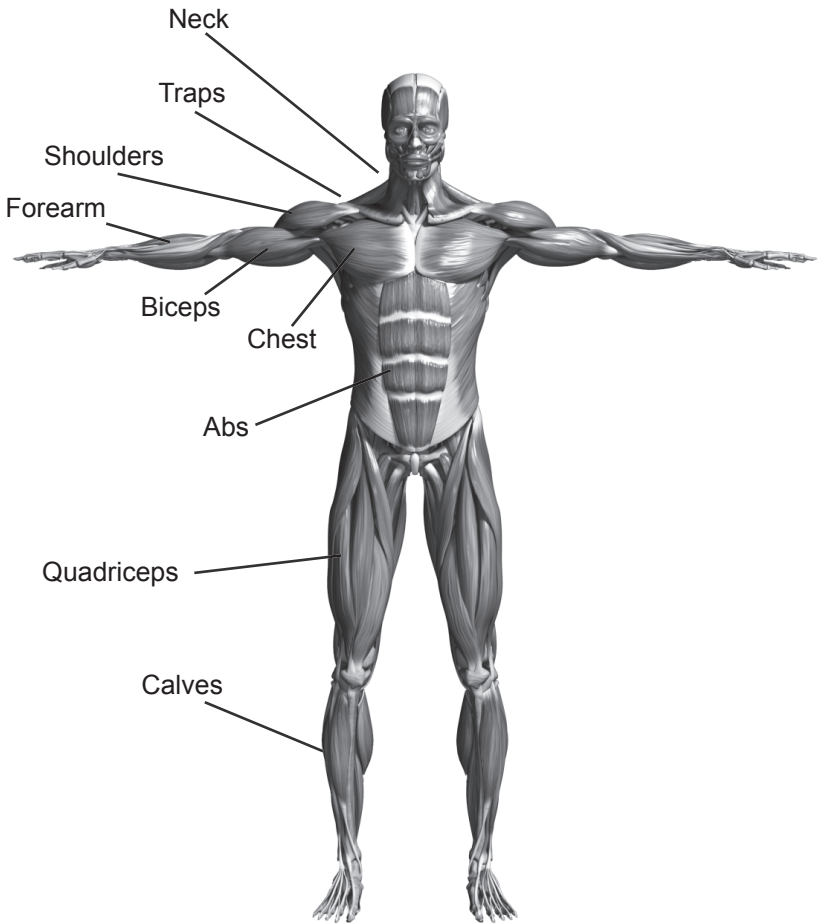
- Start by stretching your lower back by getting down onto all fours, placing your hands directly under your shoulders and your knees directly under your hips. Drop your chin down, and pull your belly button in as much as you can so that you're pulling your lower back up toward the ceiling. Try to round your spine.
- Take your left arm, and reach it down. Drop down onto your shoulder if you can—keep your hips over your knees—to feel a stretch across the shoulder and into the upper back. Try to keep your breathing relaxed. Switch arms, and repeat. You can turn your head into that position.
- Reset yourself with your hands under your shoulders and your knees under your hips. Take your left hand—this time, keep looking at your hand—and lift it up to the point at which you can feel a rotation through your lower spine. Try not to sit backward; keep your weight forward. You're stretching the lower back and the shoulders, releasing through the chest. Switch arms, and repeat.
- Next, go into an upward dog position—a yoga pose. Start by lying down on the floor or on a mat and lifting your hips and chest up off the floor. Lift your face up and forward. You're trying to extend up and forward—not backward—through the spine. Keep your shoulders back and down. This is a position of hyperextension, where you go slightly beyond the normal range.

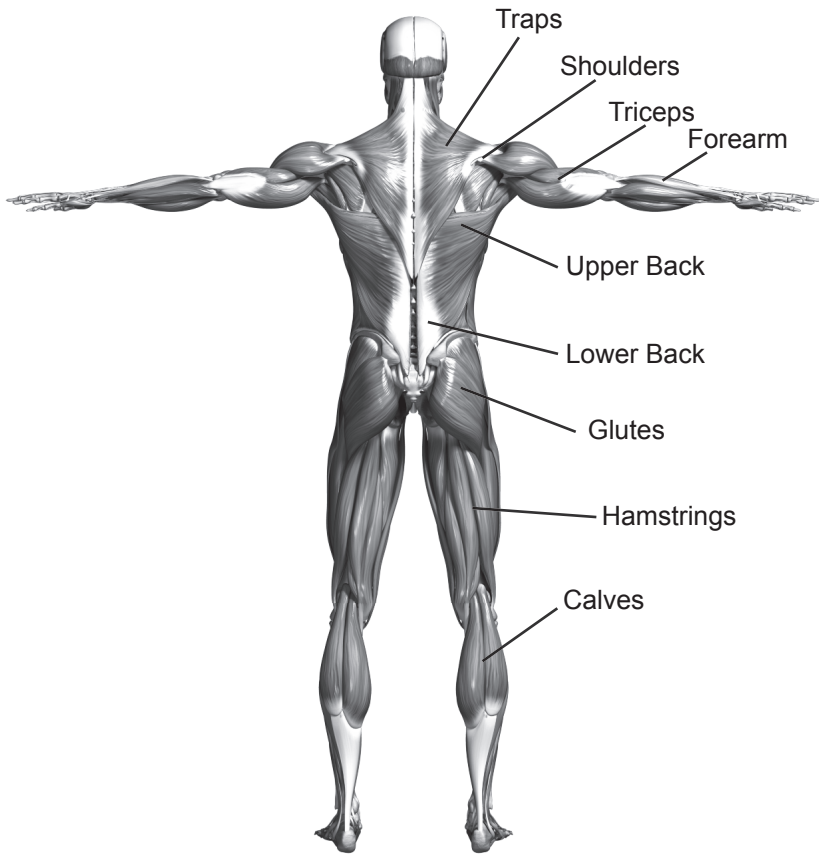
- Sit back into a child's pose. This is a great pose because it can affect different people in different ways; experiment with it to see how it works for you.
- Return onto all fours and into a swan position. Bring your left foot forward. Bring your knee up, and turn it slightly to the side. Then, sit back. This pose also has many benefits; it's a great combination stretch. Focus on bringing your hips down, and try to keep your upper body relaxed. Switch to the other side, and repeat.
- Then, walk your hands back out of that position, and turn your feet to the back with your head down, and lie down in the corpse pose. Enjoy the moment, and be aware of how loose you feel throughout your body.

Guidelines for Stretching

- Try to stretch regularly, daily if possible.
- Hold static stretches at the point of mild tension for 15 seconds to maintain flexibility and for 30 seconds to improve it.
- Ensure that you are warm before stretching—either after some cardio exercises or after bathing.
- Be aware of your posture, ensuring that you are in a comfortable position to stretch that allows you to focus on the target muscle.
- Perform stretches that target the joints in which you feel particularly stiff or that replicate movements you need for your chosen sport or daily life.
- Use deep breathing, gentle music, and suitable visualization to enhance your efforts by helping to relax the muscles.
- If at any time you feel a sharp or stabbing pain, release the stretch immediately.

Muscles of the Human Body





Glossary

1-repetition maximum: The maximum amount of resistance that a person can lift just once.

abduction: The movement of a limb away from the midline of the body.

Achilles tendonitis: A condition characterized by soreness and stiffness at the back of the ankle—in the Achilles tendon.

active isolated stretching: A stretching technique that uses the synchronization of paired muscles to allow for coordinated movements and is performed with a partner.

adduction: The movement of a limb toward or across the center line of the body.

adenosine triphosphate (ATP): The chemical in your muscles that breaks down to produce energy and, in turn, relies on the breakdown of carbohydrate, fat, and protein.

adipocyte: A fat cell.

aerobic: With oxygen.

aerobic capacity: Maximal oxygen uptake.

agility: The ability to change direction of the body or parts of the body, incorporating elements of deceleration and acceleration.

anaerobic: Without oxygen.

anaerobic threshold: The point at which lactic acid builds up in the body when a person starts to fatigue.

anatomy: The study of the bones, muscles, and other components that form the human body.

android: The apple shape associated with men's bodies.

aponeurosis: A sheath in the abdomen that is divided by tendon insertions that run across it and, more noticeably, centrally to give the appearance of separate blocks.

arthritis: An umbrella term for a large number of rheumatic diseases that affect the joints and the soft tissues around them, including conditions such as childhood arthritis, fibromyalgia, and lupus.

asana: The practice of physical poses—the poses that are assumed during yoga practice.

asthma: A condition whereby the tubes that carry air to the lungs become irritated, which sometimes narrows and perhaps produces more mucus than normal, restricting the ability to breathe.

atrium: One of the 2 upper chambers of the heart.

balance: The ability to maintain both static and dynamic equilibrium of the body parts as well as the whole body.

ballistic stretching: A type of stretching that involves swinging or bouncing a limb into a position beyond the normal joint range, thereby lengthening the associated muscles.

bioelectrical impedance analysis: A method of measuring body composition that involves passing a small electric current through the body and measuring the resistance to its flow to determine body fat.

blood pooling: The term given to blood remaining in the extremities, which can cause dizziness.

body composition: The proportional segmentation of body weight into lean and fat constituents.

body mass index (BMI): Calculated as your weight in kilograms divided by the square of your height in meters.

brain stem: The lower part of the brain that connects to the spinal cord and is responsible for the body's heartbeat, breathing, digestion, and circulation of the blood around the body—and for keeping a person awake and alert.

buoyancy: The degree to which your body floats when it's immersed in water.

calcitriol: A hormone that governs the flow of calcium into and out of the bone tissue.

cardiac cycle: A cycle that includes the duration of 1 heartbeat and the rest period that immediately follows it.

cardiac output: A term that quantifies the workload of the heart that is calculated as the sum of the stroke volume multiplied by the pulse rate.

cardiovascular endurance: The capability of the heart, lungs, and circulatory system to take in, absorb, and use oxygen.

central fatigue: The effect of messages in motor pathways from the brain and spinal cord to the muscles that leads to a reduction in effort or complete cessation of activity.

cerebellum: The bottom rear portion of the brain that governs movement by controlling balance and muscle contractions.

chi: A healthy flow of this internal energy is believed in Eastern cultures to reflect optimum balance in mind, body, and spirit.

chronic obstructive pulmonary disease (COPD): An umbrella term covering a number of conditions, such as emphysema—where the alveoli

lose their elasticity and, therefore, their ability to take in oxygen—and bronchitis, which involves a buildup of phlegm that causes coughing.

circumduction: The act of performing a full circle that is unique to the shoulder joint.

collagen: The main component of connective tissue.

concentric contraction: The contraction that occurs when a muscle develops tension as it shortens.

continuous training: Training that is based on working out at a constant intensity for a specific duration of time.

coordination: The ability to perform a range of simple to complex movements with precision, timing, and continuity.

core strength: The strength that results from the muscles in your back, abs, and pelvis working together.

cortical bone: The type of bone that is the exterior of bone that is dense and strong—also known as compact bone.

creatine phosphate: A compound of creatine and phosphoric acid that can donate a phosphate molecule to ADP, making it ATP.

cross-training: Training that involves using different cardio workout modes either on different days or even within the same workout.

deep vein thrombosis (DVT): A clot in the leg or groin.

depression: The act of pulling a joint down.

dharana: Mental concentration.

dhyana: Meditation.

diastasis: The separation of parts that are normally joined together.

diastole: The stage of the cardiac cycle in which the pressure on the heart walls is at its lowest.

diastolic pressure: The pressure inside the arteries when the heart is between beats—during the relaxed phase of the cardiac cycle.

dorsiflexion: Pulling the toes upward, toward the body.

dual-energy X-ray absorptiometry: A very accurate method of measuring body composition that involves passing 2 types of X-rays through the body and uses a special scanner that is able to differentiate between fat, bone, and muscle tissue.

early flatfoot stage: The stage of walking at which the whole foot is in contact with the ground. This is an important stage because this is where shock absorption takes place, which is a key to preventing injury.

eccentric contraction: The contraction that occurs when a muscle actively lengthens.

elevation: The act of raising a joint.

endomysium: The connective tissue that covers the bundles of muscle fibers that are found within the perimysium.

epimysium: A strong connective tissue that surrounds the whole muscle.

epinephrine: A hormone that increases in concentration during cardio exercise.

erector spinae: A group of deep back muscles—including the iliocostalis, longissimus, and spinalis muscles—that are of varying lengths and run down both sides of the spine, from the cervical all the way down to the lumbar regions. This group produces movements including lifting you from a bent position, bending the trunk to the side, and rotating your upper body.

essential fat: The amount of fat that is needed and is found in the bone marrow and the organs.

excess postexercise oxygen consumption (EPOC): The number of calories that are burned immediately after exercise has ceased—due to the increased metabolic effect of your body removing waste products from the cells and then refueling.

extension: Increasing the angle at a joint, or straightening.

fartlek training: Training that introduces short, fast bursts between periods of average exercise.

fascia: The soft layer of connective tissue that surrounds muscles.

fast-twitch fibers: Muscle fibers that are white in color and hold low levels of mitochondria. They contract quickly, but they also tire equally rapidly, so they're suited for activities that are high in intensity but short in duration.

fatigue: An exercise-induced reduction in the ability to generate force or maintain an exercise intensity.

fibroblast: A type of cell that breaks down the clot that is formed by platelets once the damaged cells in an area of injury have been cleared, allowing scar tissue to be laid down.

fitness: A subjective state that is related specifically to an individual's personal medical history, current health status, socioeconomic situation, and perhaps sporting aspirations. In addition, fitness could be considered in emotional, mental, and even spiritual dimensions.

fitness yoga: A practice that combines centuries-old yoga poses with a modern approach to improving well-being, primarily through enhancing both postural awareness and core strength capabilities.

flexibility: The mobility of the joints and their associated soft-tissue structures.

flexion: A reduction in the angle at a joint, or bending.

floating stage: The moment for runners at which both feet are momentarily off the ground.

frontal lobe: The top front portion of the brain that determines emotions and is the logical part involved in solving problems, planning, and organizing.

functional fitness: The fitness that is relevant to day-to-day living.

glucose: The form of sugar that's transported and used by your body for energy.

glycolysis: The process through which glucose can produce ATP without oxygen.

Golgi tendon organ reflex: An automatic relaxing within the muscle that is a response to a change in muscle tension.

goniometry: The art of measuring flexibility.

gynoid: The pear shape associated with women's bodies.

hatha yoga: The most popular form of yoga that is described as the union of 2 opposites—with “ha” meaning “Sun,” which relates to passion, energy, and positivity, and “tha” meaning “Moon,” which suggests cool and reflective negativity.

heel strike: The split second at which the foot first touches the ground when walking.

high-density lipoprotein (HDL): The “good” cholesterol.

hip hitch: The act of lifting the hip away from the floor and back down.

hippocampus: The part of the brain that plays a role in memory function.

homeostasis: When the body's many systems function in harmony, causing the body to operate most efficiently.

horizontal extension: A backward movement in a horizontal plane.

horizontal flexion: A forward movement in a horizontal plane.

hormone-sensitive lipase: An enzyme that is located in the fat cell and acts to break apart the triglyceride, releasing the 3 fatty acids into the bloodstream.

hyaline cartilage: The material that covers the ends of most bones and acts to both assist shock absorption and reduce friction between articulating bones.

hydrostatic pressure: The constant pressure exerted by the water equally around the body.

hydrostatic weighing: A method of measuring body composition that is based on the premise that fat—being less dense than lean body tissue such as muscle and bone—is more buoyant, allowing a comparison of dry land and underwater weights to be used in calculating fairly accurate percentages for each.

hyperextension: The continuation of extension beyond the anatomical position.

hypertonic drink: A beverage that contains a higher percentage of carbohydrates; it is useful for recovery after a long workout or an endurance event.

hypotonic drink: A beverage that has a low carbohydrate concentration; it is useful for sports participants to rehydrate when lots of energy is not required.

iliotibial band syndrome: A friction problem between the thick band of fascia that runs down the outside of the knee and the lateral femoral condyle, or bottom end of the thigh bone.

imagery: The act of using some or all of your senses to create an experience in your mind.

immediate recovery: The type of recovery that begins during exercise.

intercostal muscles: The small muscles that are located between the ribs and aid in breathing.

interval training: Training that features spells of exercise interspersed with low-intensity periods to allow for recovery before the next period.

intervertebral disk: A fibrous cartilage mass that forms the cushioning between the bones of the spine to allow movement, acting as a shock absorber.

involuntary muscle: The type of muscle that is smooth in appearance and is not contracted intentionally—also known as visceral muscle.

isometric contraction: The contraction that occurs when a muscle doesn't shorten or lengthen.

isotonic drink: A beverage that has a similar concentration of carbohydrates to body fluids, so it is quickly absorbed; it is useful for tackling thirst during a workout or sports participation.

kyphosis: An exaggerated rounding of the thoracic spine—a hunched position sometimes known as dowager's hump—that can result from growing issues during adolescence, degenerative disease such as arthritis, compression fractures, prolapsed disks, and even lazy posture.

lamina flow: The smooth flow of water molecules.

larynx: The voice box.

late flatfoot stage: The stage of walking at which the center of gravity passes forward of the neutral position, and subconsciously, the whole body structure

changes from being flexible, in order to absorb shock, to being more rigid, enabling the body to propel forward.

lateral extension: The return from a sideways position.

lateral flexion: Sideways bending.

latissimus dorsi: A surface back muscle that comes up from the iliac crest of the hip, connects through the vertebra T7 up to L5—lumbar 5—passes across the lower ribs, and eventually inserts into the upper arm. It's predominantly responsible for bringing your arm back down to your side, but it's also responsible for inwardly rotating the arm.

levator scapula: A surface back muscle that reaches from vertebra C1 to C3, sometimes to C4, and onto the upper part of the shoulder blade. In addition to assisting the trapezius in lifting, it tilts your head to the side.

ligament: A thick cord that connects bones together and gives the joints stability.

linea alba: The tendinous line in the middle of the abdominals.

lipoprotein lipase: An enzyme that draws fat out of the bloodstream for use as fuel.

lordosis: A curvature of the lumbar spine that makes the backside stick out and can be caused by poor posture.

low-density lipoprotein (LDL): The “bad” cholesterol.

lumbar stenosis: A back condition characterized by pain that is caused by a narrowing of the neural foramen, which could be caused by extra bone growth due to arthritis or advanced wear and tear leading to pressure on the nerve. Pain is particularly felt when standing and walking.

lumbopelvic area: The area of the body that includes the lumbar, stomach, pelvis, and hips.

lung cancer: A type of cancer that develops when cells change shape and grow, linking with other damaged cells to form a tumor that can then grow and spread to other parts of the lung and beyond—usually very slowly.

maximal oxygen uptake: The body's ability to take in oxygen and transport it to the working muscles.

meditation: A form of mental exercise that is based on the belief that the mind determines the quality of life.

mobilizer muscle: An abdominal muscle that brings about movement.

motor unit: A group of muscle fibers and the nerve that links them to either the central nervous system or the spinal cord.

muscular endurance: The capacity of a muscle, or a group of muscles working together, to maintain continued contractions against a low or moderate resistance.

myocardial infarction: A complete blockage of the blood flow to the heart—a heart attack.

myocardial ischemia: A partial disruption in blood flow to the heart.

myocardium: The heart muscle, or cardiac muscle.

myofibroblast: A type of cell that works to glue together the torn structures within an injury.

myotatic reflex: An automatic contraction within the muscle that is a response to a change in the length that is detected by muscle spindles.

naturopathic pain: A type of pain that relates to damage to the peripheral nerves or even to the central nervous system that manifests itself in contrasting ways—it could be sharp or numbing.

near-infrared interactance: A method of measuring body composition that uses a device that shines an infrared beam on the front of the arm, and the amount of light that bounces back from the bone is measured as an indication of the amount of fat present.

neuron: A cell that combines to form the nervous system and transmit information through both electrical and chemical means and is responsible for the estimated 70,000 thoughts we have each day.

neurotransmitter: A chemical that is responsible for conveying nerve impulses between neurons in the brain.

neutral spine: The natural, comfortable curve of your spinal alignment.

niyamas: Personal disciplines, such as cleanliness, contentedness, self-discipline, and self-study.

non-exercise activity thermogenesis (NEAT): The act of finding ways to introduce exercise into your daily routine.

occipital lobe: The back region of the brain that is responsible for the processing of visual information.

ossification: The buildup of calcium and magnesium salts that is deposited at a particular location, resulting in bone growth.

osteoarthritis: The form of arthritis that is caused by the degeneration of the hyaline cartilage, which is a key shock absorber on the end of bones when they come into contact with one another.

osteoblast cell: A cell that deposits mineral salts to promote new bone growth.

osteoclast cell: A cell that breaks down and absorbs old bone, allowing calcium, potassium, and phosphate compounds to be released from the bone into the bloodstream.

osteoporosis: A skeletal disease characterized by low bone mass and microscopic deterioration leading to increased susceptibility to fractures.

parietal lobe: The top region of the brain that is split into 2 sections, the right and left, and is concerned with spatial awareness on the right side and with language on the left side.

patella tendonitis: An inflammation below the kneecap that is usually noticed when walking down the stairs.

pericardium: The double-lined sheath in which the heart muscle is enclosed.

perimysium: The connective tissue that covers the bundles of muscle fibers that are found within the epimysium.

periosteum: The layer of connective tissue that coats the outer surface of bone and has a rich supply of blood vessels that provide nutrients for the growth phase and also for repair after injury.

peripheral fatigue: The point at which the protein filaments in the muscle fibers that are responsible for contraction cease to respond to neural stimulation. This is then combined with the depletion of glycogen stores in the muscle, so no fuel is available to prolong the exercise efforts.

peripheral heart action (PHA) training: An approach to circuit training that involves alternating upper- and lower-body exercises at stations next to each other. This format requires the blood to constantly shift oxygen-carrying blood from one part of the body to the next, leading to a greater calorie burn.

phagocytes: A type of cell that is attracted to the area of injury and absorbs the damaged cells that can no longer perform their functions.

physiology: The study of the interaction of the bones and muscles, along with the nerves, tendons, veins, arteries, heart, lungs, and thousands of complex systems working together to enable human beings to move and live.

piriformis muscle: A muscle located deep in the buttock that reaches from the pelvis, or sacrum, to the femur, or upper part of the thigh bone.

pituitary gland: The gland that controls the action of the kidneys.

plantar fasciitis: A strain of the connective band that maintains the longitudinal arch on the base of the foot, which is stretched basically every time the foot bears weight.

plantar flexion: Pointing the toes downward, toward the soles.

pneumonia: An infection that's transmitted by breathing in germs, which causes the alveoli to become filled with fluid and then inflamed, restricting the ability to transfer oxygen into the blood stream.

postural hypotension: The drop of blood pressure that occurs when standing up quickly from a sitting or lying position.

power: The ability to achieve optimal force development of the voluntary muscles—but in a minimal time period.

pranayama: Breathing exercises.

pratyahara: The detachment from worldly activities or withdrawal of the senses.

primary sensory cortex: The part of the brain that controls the sense of touch and is located within the parietal lobe.

pronation: The inward turning of the palms.

proprioception: The body's ability to know where it is in space.

proprioceptive neuromuscular facilitation (PNF): A stretching technique that works by using the body's nervous system to encourage extended lengthening of the muscles.

protraction: The act of extending a body part forward.

reaction speed: The ability to recruit selected neuromuscular responses with a minimal time delay.

reciprocal inhibition: The process in which one muscle relaxes to some degree if its cooperating pair contracts.

recovery: The ability of the human body to meet the demands of future activity. In physiological terms, it's a multifaceted concept that includes the lowering of the blood pressure, the return to normal of the cardiac cycle, the replenishment of blood glucose and muscle glycogen energy stores, and the replacement of key cellular enzymes that govern the use of fuel sources.

rectus abdominis: The most visible mobilizer that stretches from the xiphoid process, where the ribs meet at the sternum, and ribs 5 to 7 down to the pelvis through a sheath, or aponeurosis, that joins to the symphysis pubis.

relaxation: A practice that is primarily aimed at and also benefits the body.

relaxin: A hormone that has the effect of loosening the ligaments.

retraction: The act of pulling a body part backward.

rheumatoid arthritis: An inflammation of the lining of the joint capsule that spreads to cause erosion of the cartilage and bone, leading to pain and stiffness—often in multiple joints—and often to visible deformity of the joint.

rhomboid: One of 2 surface back muscles that begin at vertebra C7, go down to T5, and attach to the inner border of the shoulder blade. The major and minor rhomboids retract your shoulder blade.

rotation: Movement that can be inward or outward.

rotator cuff: The small group of muscles around the shoulder girdle that connect the upper arm to the shoulder blade.

sacroiliac joints: The point at which the 3 pelvis bones meet.

sacrum: Connects the spine to the pelvis through the 2 sacroiliac joints; the point at which your upper body meets your lower body.

samadhi: Absorption with the Divine, God, or the Absolute.

sciatica: A back condition characterized by pain or perhaps numbness in the buttocks and rear of the lower leg caused by inflammation that is usually a result of a rupture of an intervertebral disk that begins to impinge on the nerve fibers. Pain is particularly felt when bending forward.

scoliosis: A side-to-side curve in the spinal column that leads to an “S” or “C” shape rather than a straight line when viewing from the rear and is usually due to a congenital defect but can also be caused by incorrect posture.

segmental muscle: One of a group of deep back muscles—the deepest, in fact—that only link from one vertebra to the next rather than connecting several. The interspinalis assists in extending the spine, and the intertransversarii assist in bending to the side—although all the muscles in these groups have a very limited amount of force.

serratus anterior: A surface back muscle that is situated on the front surface of the scapula and links to the 8th and 9th ribs. It draws the shoulder blades forward.

sesamoid bone: A bone that is housed within tendons at points of high physical stress and tension.

short-term recovery: The type of recovery that occurs between sets of exercises or between intervals in a session.

sinus: A cavity in the bone of the skull that is connected to the nose and nasal hairs.

skinfold caliper: A device used to take measurements at the waist, the back, and the front and rear of the upper arm to determine body composition.

Readings from the 4 sites are added together, and tables give an equivalent body fat percentage for these sums.

slow-twitch fibers: Muscle fibers that are red in color and contain a high concentration of mitochondria. These muscles fibers are slow to contract, but also slow to fatigue, so they're ideally suited for activities of a lower intensity and a longer duration.

SMART goal: An exercise-related goal that is specific, measurable, achievable, realistic, and timed.

somatic pain: A type of pain that is relatively easy to identify because the injured party can usually point to the exact location, and it can hurt to touch.

somatosensory system: The system that relies upon the sensors in the skin and the muscles to relay information to the brain regarding pressure, touch, and the position of your limbs.

splenius muscle: A deep back muscle that attaches from cervical to thoracic vertebrae and is responsible for lifting your head when it's down.

stabilizer muscle: An abdominal muscle that works to fix body parts in place.

static stretching: The most common method of stretching that requires a gentle movement toward the end position that slowly lengthens the muscle. Then, you hold the point at which there's mild tension for between 15 and 30 seconds.

steady state: The point at which the rate of lactic acid production exactly matches the rate of clearance of it from the cells. It is an intensity that feels comfortable and sustainable for some time.

strength: The force effectiveness of a muscle or a group of muscles.

subcutaneous fat: The unnecessary amount of fat that presents a risk factor and is stored beneath the skin.

supination: The act of turning your palm upward.

supine hypotensive syndrome: A condition in which lying on the back can result in the weight of the baby resting on the main blood vessels, causing them to pinch, which could temporarily restrict the blood supply flowing back up to the heart and, in turn, the supply to the mother and baby as a whole.

symphysis pubis: The point at which the 2 pubic bones meet.

synovial fluid: A vital lubricant secreted by the inner layer of the synovial membrane that helps reduce friction at the joint but also provides nourishment for the articular cartilage, which covers the end of the bone.

synovial joint: A freely movable joint.

synovial membrane: The inner layer of the fibrous capsule.

systole: The stage of the cardiac cycle in which the pressure on the heart walls is at its peak.

systolic pressure: The pressure inside the arteries as the heart is pumping.

temporal lobe: The middle region of the brain that is split into 2 sections, the right and left, and is concerned with visual memory on the right side and with verbal memory on the left side.

tendon: A fibrous connective tissue that connects the muscles to the bones.

tibialis anterior: A muscle that is located on the front of the shin and is responsible for raising the toes as the leg swings forward to ensure that the heel touches down first when walking.

tidal volume: The amount of air taken in with each breath.

toe-off stage: The stage of walking at which the swing of the leg begins.

trabecular bone: The type of spongy bone that is located on the inside and is where the red bone marrow that produces blood cells can be found—also known as cancellous bone.

trachea: The windpipe.

training recovery: The type of recovery that occurs between workouts, races, or matches.

transversospinalis muscle: One of a group of deep back muscles—including the semispinalis, multifidus, and rotator muscles—that lies deeper than and is generally shorter than the erector spinae, but it performs almost an identical function in extending, lateral flexing, and rotating the spine.

transversus abdominis: A stabilizer muscle that runs from the thoracolumbar fascia of the back and the iliac crest through the lower 6 ribs and into the linea alba. It is responsible for pulling in, compressing the abdominal cavity, and creating pressure that splints the lumbar spine as a result.

trapezius: A surface back muscle that runs from the base of the skull and vertebra C1 down to T12, inserting into the clavicle, acromion, and scapula at the back. It can lift and lower to retract the shoulder blade.

triglyceride: A group of 3 fatty acid molecules found within specific fat cells known as adipocytes.

trimester: A period of time that lasts 3 months and is used to divide a woman's pregnancy into 3 stages.

turbulent flow: The white water you see around you and the bubbles you feel against your skin when you move in the water, caused by molecules rebounding from an object in all directions.

vasoconstriction: The process in which blood vessels decrease in diameter.

vasodilation: The process in which blood vessels increase in diameter.

vastus medialis: The part of the quadriceps that is closer to the center and that helps to pull the kneecap back in line.

ventricle: One of the 2 lower chambers of the heart.

vestibular system: The system that refers to sensors in the inner ear that respond to the position of your head, causing your brain to send a message to your body to correct itself when you're off center, for example, when you stumble.

visceral pain: A type of pain that is characterized by cramping, a deep ache, or a dull throbbing that could be constant or intermittent. It's often a referred pain, so it can be difficult to pinpoint.

visual system: The system that provides information to your brain regarding where the body is in space, how fast it's moving, and details about possible obstacles in the immediate environment by using depth perception and peripheral sight skills.

voluntary muscle: The type of muscle that is controlled consciously by the nervous system and is also known as skeletal muscle, due to its attachment to the skeleton, and striated muscle, due to its striped appearance.

xiphoid process: The point at which the ribs meet at the sternum.

yamas: Individual practices that make us better human beings and contribute to a better world, including truthfulness, non-stealing, non-harming, leading a godly life, and non-grasping.

yoga: Means "union" or "yoke" and can be described as a unique system of physical, mental, and maybe even spiritual development that was developed about 3000 years ago.

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