COMPETENCY 1
CORE CONCEPTS

SKILL 1.1 Terminology, principles, concepts, and applications of the basic sciences as related to motor skills and movement activities *(e.g., anatomy and physiology, exercise physiology, biomechanics and kinesiology, motor development and motor learning)*

Health-Related Components of Physical Fitness

There are five health-related components of physical fitness: cardiorespiratory or cardiovascular endurance, muscle strength, muscle endurance, flexibility, and body composition.

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Components of fitness

- Cardiovascular endurance: The ability of the body to sustain aerobic activities (activities requiring oxygen utilization) for extended periods.
- Muscle strength: The ability of muscle groups to contract and support a given amount of weight.
- Muscle endurance: The ability of muscle groups to contract continually over a period of time and support a given amount of weight.
- Flexibility: The ability of muscle groups to stretch and bend.
- Body composition: The body is composed of many types of tissue, including bone, muscle, organ tissue, and fat. Lean body mass (LBM) is the non-fat tissue. Of the tissue tested via calipers, hydrostatic weighing, or another method, the key is that lean body mass is the majority and fatty tissue is the minority of the body. The two times in a person's life that the body is supposed to gain fat cells are during gestation/infancy and, for females, during puberty. Teachers of young students are not encouraged to dwell on body fat percentage, and measuring children could send the wrong message. As girls and boys pass puberty and are looking toward a healthy life, tread lightly when testing body fat. In certain classes, like an independent fitness and weight loss class, teaching the students about testing body fat might be important in the curriculum. If body fat is tested, it should be done at the beginning and the end of the semester class. For teen boys, obesity is defined as a body fat percentage of 25% or greater. For teen girls, it is 32% or greater.

Body mass index

Body Mass Index (BMI) is used by doctors and insurance companies as an easy way to test for obesity. It is a flawed test because it relies only on height and weight. Someone who is not fat but extremely fit and muscular could be considered obese by this test. It is, however, a reality that employers and insurance companies—as well as some standards for excellence in fitness education awards and grants—use this formula, so the teacher should know what BMI is and how to check it.

BMI = (weight in pounds) × 703/height in inches.

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Below is the general chart that doctors and insurance companies use.

Category	Number Range
Underweight	18.5
Normal	18.5–24.9
Overweight	25–29.9
Obese	30+

In an independent fitness class or a class focused on lifestyle change, it would be a good project to calculate BMI and LBM and compare the two. Do both tests have the same result, or is the student considered healthy by one and not healthy by the other? Explain the differences in the tests. This is also a good cross-curricular mathematics project.

Wellness

Wellness has two major components: Understanding the basic human body functions and knowing how to establish for and maintain personal fitness. Wellness includes developing awareness and knowledge of how certain everyday factors, stress, and personal decisions can affect one's health. Teaching fitness needs to go along with skill and activity instruction. Life-long fitness and the benefits of a healthy lifestyle need to be part of every PE teacher's curriculum. Cross-discipline teaching and teaching thematically with other subject matter in classrooms would be the ideal method to teach health to adolescents.

Wellness for overall health is the main concern of modern physical education in public schools. No longer are we just training the athletes to perform; we are also teaching the entire population of students to maintain a sense of wellness and health for life. We are lifestyle trainers, not just physical trainers.

Major Muscles and Bones; Functional Movement

Muscles

Shoulders

- Deltoids: Move the arm from rotator cuff; triangular-shaped muscles that cover the shoulders and move the arm in all directions.

Arms

- Biceps brachii (front of upper arm): Control the eccentric movement of arm (bends the elbow)
- Triceps brachii (back of upper arm): Control the concentric movement of arm (extends the upper arm)

Legs

- Quadriceps (front of upper leg): Control the eccentric movement of the thigh (extends the leg from knee to hip).
- Hamstrings (back of upper leg): Control the concentric movement of thigh (aids in bending the knee from the rear of the leg).
- Gastrocnemius (back of lower leg—calves): Aids in ankle and knee movement.
- Gluteus maximus (buttocks): The main gluteal muscle aiding in hip movement. Other hip-moving muscles include gluteus medius, gluteus minimus, and sacro iliac.

Chest

- Pectoralis major: Aids in deltoid and latissimus dorsi movement; main chest muscle; protects the ribcage and major organs.

Back

- Latissimus dorsi: A large back muscle; aids in deltoid and pectoralis movement as well as core movement; protects the rib cage from the back.

Waist

- Rectus abdominis: The largest stomach muscle, stretching from ribs to hips. This muscle aids in all waist movement, stability, and protection of abdominal organs. Other abdominals include obliques (sides) and transverse (wraps the lower abdominals). All abdominals work together to aid in all body movement.

Motor development

Development of motor skills begins as the human body begins to move in utero. Infancy and toddlerhood in normal development show beginnings of movement and development of muscles for proper function of the body. As the child gets older, the muscles should begin to develop. For example, a child will go from crawling to walking to running to jumping to leaping to skipping to jumping rope. Each person is different, and each child's development will go at a different pace. However, early childhood (from toddlerhood to kindergarten) is a vital phase to introduce the major movements of the body so that the child can continue to work on his or her development.

Movement is controlled by the frontal lobe of the brain. Delay in this part of the brain will impact the child's development of basic movement patterns. Muscles are designed to work in the specific functions listed earlier in this section, so a child's practice of functional movement will impact the development of each specific muscle group. Also, an injury to a bone or muscle as an infant or toddler could delay function of a specific muscle group or could show imbalance in pairs or groups of muscles. For example, a child who breaks a leg bone at the time when he or she is learning major muscle function might learn an alternate way to move, which could lead to larger muscles on one side of the body and atrophy of the other side.

Whereas fitness classes used to focus on straight squats and walking lunges for the leg muscles, now fitness classes should use bending and lifting, lateral movement, and stretching and reaching to develop the system of muscles used to do specific tasks.

Modern exercise focuses more on the natural way the body moves, or the function of the musculoskeletal system. Modern school fitness programs should address the way the muscles are designed to move and coordinate programs around everyday use of the muscles. Of course, all exercises should be done with attention to safety: Children should never lift beyond their capabilities, and they should never twist in a way that would endanger ligaments or tendons (such as the delicate knee area). In previous years, injury was a problem because students were not taught the true functions of the muscles. Now, programs should be in place to teach true functional movement to greatly reduce any chance of injury in and out of the classroom.

SKILL 1.2 Principles of biomechanics and kinesiology as they relate to motor skills and movement patterns *(e.g., summation of forces, center of gravity, force/speed relations, torque)*

Summation of Forces

Many muscles and muscle systems work together to create one simple movement at the right time. For example, when watching a baseball pitcher throw the ball, his movement includes his abdominals pulling in, leg muscles contracting and

releasing to move his foot, pectoralis and latissimus dorsi muscles to begin arm movement, elbow flexion to pull the arm in, deltoid muscles to move the shoulder, and all arm muscles in conjunction with chest, back, and abdominal muscles to release the ball. All of this has to occur at a given time and space for the ball to be thrown the way the pitcher wants it to be thrown.

Center of Gravity

If we did not feel centered in our own bodies, we would be pulled easily to the ground by the force of Earth's gravity. With every movement, the body must adjust its center (mainly the core and lower back) to keep us upright or in our desired position.

Force/Speed Relations

The amount of force our muscles use for a given movement directly or indirectly relates to the speed of that movement. Going back to the baseball pitcher example, the speed of his muscle contractions in his leg, chest, back, arm, and abdominals will directly impact the speed of the final movement, which directly impacts the speed of the release of the ball and the ball's speed over the plate.

Torque

TORQUE is rotational force. The amount of force a person uses to rotate a muscle group will impact the output of force. Using the pitcher as an example, he uses rotator muscles (abdominals and back muscles) to turn his body and then the rotator cuff of his shoulder to release the pitch.

TORQUE: rotational force

SKILL 1.3 **Movement concepts** *(e.g., body awareness, spatial awareness, effort, relationship)*

Concept of Body Awareness Applied to Physical Education Activities

BODY AWARENESS is a person's understanding of his or her own body parts and the capability of their movements.

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Instructors can assess body awareness by watching students play a game of "Simon Says" and asking the students to touch different body parts. You can also instruct students to form their bodies into various shapes, such as moving from straight to round or twisted, and to fit into differently sized spaces.

In addition, you can instruct children to touch one part of their bodies with another. Also, they could be asked to use various body parts to do activities like stamping their feet, twisting their necks, clapping their hands, nodding their heads, wiggling their noses, snapping their fingers, opening their mouths, shrugging their shoulders, bending their knees, closing their eyes, bending their elbows, or wiggling their toes.

Concept of Spatial Awareness Applied to Physical Education Activities

SPATIAL AWARENESS: the ability to make decisions about an object's positional changes in space

SPATIAL AWARENESS is the ability to make decisions about an object's positional changes in space. In short, it is the awareness of three-dimensional position changes in space.

Developing spatial awareness requires two sequential phases:

1. Identifying the location of objects in relation to one's own body in space
2. Locating more than one object in relation to each other

Concept of Effort Qualities Applied to Physical Education

EFFORT QUALITIES: the qualities of movement that apply the mechanical principles of balance, time, and force

EFFORT QUALITIES are the qualities of movement that apply the mechanical principles of balance, time, and force. Effort awareness is the application of this knowledge.

- Balance: Activities for balance include having children move on their hands and feet, lean, move on lines, and balance and hold shapes while moving. Modern equipment, such as balance balls, is effective in training to balance on unstable surfaces.
- Time: Activities illustrating the concept of time can include having children move as fast as they can and as slow as they can in specified, timed movement patterns.
- Force: Activities illustrating the concept of force can include having students use their bodies to produce enough force to move them through space. They can also paddle balls against walls and jump over objects of various heights.

SKILL 1.4 **Exercise physiology** *(e.g., components of health-related fitness; components of skill-related fitness; fitness guidelines such as frequency, intensity, time/duration, type/mode; principles of exercise such as specificity, overload, progression; roles of body systems in exercise; short-term and long-term effects of physical training; nutrition as related to exercise; fitness; metabolic response to exercise)*

Functions of Excercise

In general, exercise is used for two functions: health and skill. In health-related fitness, the person is concerned with metabolic function, cardiorespiratory benefit of the exercise, and/or muscle development or hypertrophy. In skill-related exercise, the exerciser is more concerned with learning a muscle-memory skill in a particular sport or activity.

Types of exercise

- Cardiorespiratory: Strengthens heart and lungs
- Body Composition: Increases LBM and/or decreases fatty tissue
- Agility: Skill-related for functional movement; the ability to change the direction of the body rapidly and with ease
- Coordination: Skill-related to train muscles to work together
- Balance: Trains muscles to keep body in alignment
- Muscle strength: Increases fast-twitch muscle tissue
- Muscle endurance: Increases slow-twitch muscle tissue
- Flexibility: Trains muscle to lengthen
- Power: Trains explosive movement

Role of Exercise in Health Maintenance

The health risk factors improved by physical activity include cholesterol levels, blood pressure, stress-related disorders, heart diseases, weight and obesity disorders, early death, certain types of cancer, musculoskeletal problems, mental health, and susceptibility to infectious diseases. The following chart is a list of physical activities that can reduce some of these health risks.

ACTIVITY	HEALTH-RELATED COMPONENTS OF FITNESS	SKILL-RELATED COMPONENTS OF FITNESS
Aerobic Dance	Cardiorespiratory, body composition	Agility, coordination
Bicycling	Cardiorespiratory, muscle strength, muscle endurance, body composition	Balance
Calisthenics	Cardiorespiratory, muscle strength, muscle endurance, flexibility, body composition	Agility
Circuit Training	Cardiorespiratory, muscle strength, muscle endurance, body composition	Power
Cross Country Skiing	Cardiorespiratory, muscle strength, muscle endurance, body composition	Agility, coordination, power
Jogging/Running	Cardiorespiratory, body composition	
Rope Jumping	Cardiorespiratory, body composition	Agility, coordination, reaction time, speed
Rowing	Cardiorespiratory, muscle strength, muscle endurance, body composition	Agility, coordination, power
Skating	Cardiorespiratory, body composition	Agility, balance, coordination, speed

OVERLOAD PRINCIPLE: involves exercising at an above-normal level to improve physical or physiological capacity

SPECIFICITY PRINCIPLE: overloading a particular fitness component

Basic Training Principles

The **OVERLOAD PRINCIPLE** involves exercising at an above-normal level to improve physical or physiological capacity (a higher than normal workload).

The **SPECIFICITY PRINCIPLE** is overloading a particular fitness component. In order to improve a component of fitness, you must isolate and specifically work on a single component. Metabolic and physiological adaptations depend on the type of overload; hence, specific exercise produces specific adaptations, creating specific training effects. Specificity does not mean that a person can spot train, that is, lose body fat on a particular spot on the body.

The **PROGRESSION PRINCIPLE** states that once the body adapts to the original load/stress, no further improvement of a component of fitness will occur without an additional load.

There is also a **REVERSIBILITY-OF-TRAINING PRINCIPLE**, which states that all gains in fitness are lost with the discontinuance of a training program.

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Modifications of Overload

We can modify overload by varying frequency, intensity, and time. Frequency is the number of times we implement a training program in a given period (e.g., three days per week). Intensity is the amount of effort put forth or the amount of stress placed on the body. Time is the duration of each training session. A modern study shows that increasing frequency and intensity reduces the need to overload the muscle with heavy weights. When used properly, functional exercise and minimal equipment show muscular results equivalent to overloading and may be more acceptable in physical education environments.[1]

Target Heart Rate Zone

The target heart rate (THR) zone is a common measure of aerobic exercise intensity. Participants find their THR and attempt to raise their heart rates to the desired level for a certain period of time. There are three ways to calculate the target heart rate:

1. Maximum oxygen uptake, which is 60% to 90% of functional capacity.
2. Karvonean formula = [Maximum heart rate (MHR) − resting heart rate (RHR)] × intensity + RHR.

   MHR= 220 − age.

   Intensity = Target heart range (which is 60% − 80% of MHR − RHR + RHR).

   THR = (MHR − RHR) × 0.60 + RHR to (MHR − RHR) × 0.80 + RHR
3. Cooper's formula: THR = (220 − age) × 0.60 to (220 − age) × 0.80.

The important part about heart rate is that no two people are alike. A teacher cannot assume that the formula will work for all students, especially when students have different chemical make-ups, fitness levels, sizes, and energy levels. The rate of perceived exertion (RPE) level is very important in physical exercise. The teacher needs to spend some time talking about what different zones feel like.

- Level 1–2: Do you feel like you are sitting still and totally relaxed?
- Level 3–4: Do you feel like you are taking a stroll?
- Level 5–6: Is your heart pumping, but you are not breathless?
- Level 7–8: Do you feel like you are working your hardest without feeling out of control?
- Level 9–10: Do you feel like you cannot talk because you cannot get enough air?

In a physical fitness class, students should feel like they are at levels 1–2 when they are sitting still, listening to instructions. They should feel that they are warming up or getting energized in levels 3–4. Most of their work is in levels 5–8, depending on the activity. Students should not feel levels 9–10 in a PE class. If they do, they should be directed to reduce intensity slowly, but not to stop suddenly, as this can cause syncope (that is, loss of consciousness).

It is possible for highly trained athletes who are working to improve their skills to feel levels 9–10 in a very high-intensity sport activity, but the 9–10 feeling should be no more than 30 seconds at a time and should be done in intervals. Appropriate interval training greatly increases endurance in very fit athletes. This kind of training is not for burning fat and calories, but for increasing their threshold of comfort and ability. This type of training is *not* for the public school physical education class.

Principles of Overload, Progression, and Specificity Applied to Improvement of Health-Related Components of Fitness

Cardiorespiratory fitness

- Overloading for cardiorespiratory fitness:
  - Frequency = minimum of 3 days/week
  - Intensity = exercising in target heart rate zone
  - Time = minimum of 30 minutes
- Progression for cardiovascular fitness:
  - Begin at a frequency of 3 days/week and work up to no more than 6 days/week
  - Begin at an intensity near THR threshold and work up to 80% of THR
  - Begin at 30 minutes and work up

- Specificity for cardiovascular fitness:
  - To develop cardiovascular fitness, you must perform aerobic (with oxygen) activities for at least fifteen minutes without developing an oxygen debt. Aerobic activities include, but are not limited to, brisk walking, jogging, bicycling, and swimming.

Muscle strength and endurance

- Overloading for muscle strength:
  - Frequency = every 48 hours for each trained muscle group (avoiding working the same muscle group 2 days in a row to avoid fatigue). Working a muscle group in a general way, not to fatigue or high intensity, is acceptable on a daily basis.
  - Intensity = 60% to 90% of assessed muscle strength.
  - Time = 3 sets of 8–15 reps, or one set to fatigue per exercise.
- Progression for muscle strength:
  - Every other day per trained muscle group. Strength training can occur every day, but a fatigued muscle group must take 24 days off to recover and rebuild.
  - Begin near 60% of determined muscle strength and work up to no more than 90% of muscle strength.
  - Begin with 1 set with 10–15 reps and work to multiple sets or reduce to one set of fatiguing the muscle.
- Specificity for muscle strength:
  - To increase muscle strength for a specific part or parts of the body, you must target that or those part or parts of the body.

Flexibility

- Overloading for flexibility:
  - Frequency = after each day of exercise, after fatigue of a muscle or muscle group, or during exercise in a mind–body exercise segment, such as yoga or Pilates skills
  - Intensity = stretch muscle to comfort, not to pain or to stress other muscles
  - Time = truly stretching a muscle takes more time than we have in a day, but brief (8 second) stretches can be effective in relieving muscle tightness and in keeping the muscle from cramping or shortening

- Progression for flexibility:
  - Sfter daily exercise
  - Begin stretching with slow movement as far as possible without pain, holding at the end of the range of motion (ROM) and work up to stretching no more than 10% beyond the normal ROM; breathe into deeper stretches
  - Begin with 1 set with 1 rep, holding stretches for 8 seconds
- Overloading to improve body composition
  - Frequency = daily aerobic exercise
  - Intensity = depends on the fitness ability of the student
  - Time = 30–90 minutes per day
- Progression to improve body composition:
  - Begin daily
  - Begin a low aerobic intensity and work up to a longer duration (see cardiorespiratory progression)
  - Begin low-intensity aerobic exercise for 30 minutes and work up to 90 minutes
- Specificity to improve body composition:
  - Increase aerobic exercise and decrease caloric intake

Principles and Activities for Developing Aerobic Endurance

AEROBIC: conditioning or exercise that requires the use of oxygen to derive energy

The term **AEROBIC** refers to conditioning or exercise that requires the use of oxygen to derive energy. Aerobic conditioning is essential for fat loss, energy production, and effective functioning of the cardiovascular system. Aerobic exercise is difficult to perform for many people, and participants must follow certain principles and activities in order to develop aerobic endurance.

Tips that aid in developing and building aerobic endurance include working out for extended periods at the target heart rate, slowly increasing aerobic exercises, exercising for three or four times per week, and taking adequate rest to help the body recover.

When a person is breathless, he or she has moved into the anaerobic threshold. Anaerobic activity changes the way the body processes energy and is not used for weight loss. Anaerobic activity, when used with a trained professional, can help the exerciser improve cardiovascular and respiratory strength. However, most typical students should not be allowed to be in this zone for more than a few seconds because their bodies cannot recover quickly. A high-endurance athlete would be able to handle the anaerobic threshold in short bursts (30 seconds) and need to be advised and guided by a professional.

Relationship Between Human Growth and Development and Appropriate Physical Activity

Understanding the rate of the developmental growth process that occurs during adolescence will help educators understand growth and development norms. It will help them identify early-maturing or late-maturing students. The age when the puberty growth spurt occurs and the speed with which adolescents experience puberty vary greatly within each gender. This can affect participation in physical activity and sports. If the instructor pays attention to the varying body sizes and maturity stages of the students, forming teams in co-educational classes can easily accommodate the needs of both genders' changing maturities.

Starting in middle school and continuing into high school, it is perfectly acceptable for boys and girls to participate in non-contact physical activities together. These activities rely on lower-body strength and agility (e.g. capture the flag, ultimate Frisbee, running). In more physical activities that require upper body strength, coaches should form teams based on individual skill levels to prevent injury. Matching teams evenly based on skill and maturity is important. This ensures that individual skill level deficiencies are not as apparent and the activity remains fun for all participants. Teachers need to monitor and adjust physical activities as necessary to ensure a positive, competitive experience. Appropriate activities would include individual or partner badminton or tennis matches and team competitions such as flag football.

Biological and Environmental Influences on Gender Differences in Motor Performance

The differences in motor performance between males and females result from certain biological and environmental influences. Generally, people perceive males as stronger, faster, and more active than females. This higher activity level can stem from childhood behaviors influenced by certain environmental factors. The superior motor performance results largely from the biological makeup of males versus females.

In most cases, the male body contains less fat mass and more muscle mass than the female body. In addition, the percentage of different types of muscle differs between males and females. Males have more fast-twitch muscle fibers, allowing for more short duration, explosive movements, such as jumping and sprinting. Hormones and natural high-twitch muscle fibers make the male muscles develop differently from the female muscles, which is why the sexes are generally separated in sports.

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Slow-twitch muscle fibers that are more common in girls and young boys make endurance activities easier. Long distance running, aerobic dance, and isometric

body work are generally easier for girls. Girls' bodies change through puberty; their hips become wider and some fatty tissues increase. Girls should be encouraged, not discouraged, to exerciseat this time as body consciousness becomes an issue.

Certain environmental factors also contribute to the gender differences in motor performance. As children, boys tend to be more physically active. Society expects boys to participate in different sports and activities from girls. When not exposed to certain activities early on, many children lose the chance to try certain things. This is why male ballet dancers and female football players are very rare.

SKILL 1.5 Anatomy and physiology *(e.g., skeletal, muscular, nervous, circulatory, and respiratory systems)*

Musculoskeletal System

See specific muscles in Skill 1.1

BONES	
Skull	• Composed of cranium (head) and facial bones
Vertebral column—backbone	• Seven cervical vertebrae (neck) • Twelve thoracic vertebrae (middle back) • Five lumbar vertebrae (lower back)
Shoulder	• Clavicle – collarbone • Scapula – shoulder socket located on this bone
Thorax	• Sternum – breastbone • Ribs – twelve pairs, each attaching to the twelve thoracic vertebrae
Arm	• Humerus – upper arm; attaches to scapula to form shoulder joint • Ulna and radius – forearm

Continued on next page

Legs	• Femur – upper leg; largest bone in body • Tibia and fibula – lower leg • Patella – knee
Hip	• Ilium, ischium, and pubis

Structures, Locations, and Functions of the Three Types of Muscular Tissue

The main function of the muscular system is movement. There are three types of muscle tissue: skeletal, cardiac, and smooth.

SKELETAL MUSCLE is voluntary. These muscles are attached to bones and are responsible for their movement. Skeletal muscle consists of long fibers and is striated due to the repeating patterns of the myofilaments (made of the proteins actin and myosin) that make up the fibers.

CARDIAC MUSCLE is found in the heart. Cardiac muscle is striated like skeletal muscle. It differs from skeletal muscle in that the plasma membrane of the cardiac muscle causes the muscle to beat even when away from the heart. The action potentials of cardiac and skeletal muscles also differ.

SMOOTH MUSCLE is involuntary. It is found in organs and enables functions such as digestion and respiration. Unlike skeletal and cardiac muscle, smooth muscle is not striated. Smooth muscle has less myosin and does not generate as much tension as skeletal muscle.

SKELETAL MUSCLE: voluntary muscles that are attached to bones and are responsible for their movement

CARDIAC MUSCLE: muscle found only in the heart

SMOOTH MUSCLE: involuntary muscle that is found in organs and enables functions such as digestion and respiration

Mechanism of skeletal muscle contraction

A nerve impulse strikes a muscle fiber. This causes calcium ions to flood the sarcomere. Calcium ions allow adenosine triphosphatel (ATP) to expend energy. The myosin fibers creep along the actin, causing the muscle to contract. Once the nerve impulse has passed, calcium is pumped out and the contraction ends.

Movement of body joints

The axial skeleton consists of the bones of the skull and vertebrae. The appendicular skeleton consists of the bones of the legs, arms and tail, and shoulder girdle. Bone is a connective tissue. Parts of the bone include compact bone, wich gives strength; spongy bone, wich contains red marrow to make blood cells and yellow marrow in the center of long bones to store fat cells; and the periosteum, wich is the protective covering on the outside of the bone.

JOINT: a place where two bones meet

A **JOINT** is a place where two bones meet. Joints enable movement. Ligaments attach bone to bone. Tendons attach bone to muscle. Joints allow great flexibility in movement. There are three types of joints:

1. Ball-and-socket: Allows for rotational movement. An example is the joint between the shoulder and the humerus. Ball-and-socket joints allow humans to move their arms and legs in different ways.
2. Hinge: Movement is restricted to a single plane. An example is the joint between the humerus and the ulna.
3. Pivot: Allows for the rotation of the forearm at the elbow and the hand at the wrist.

Body Systems

Muscular system

The function of the muscular system is to provide optimal movement for the parts of the human body. The specific functions of each muscle depend on its location. In all cases, however, muscle action is the result of the action of individual muscle cells. Muscle cells are unique in that they are the only cells in the body that have the property of contractility. This gives muscle cells the ability to shorten and develop tension. This is extremely important for human movement.

Muscles are classified in three categories:

1. Skeletal: Muscles that attach to the bone
2. Smooth (visceral): Muscles that are associated with an internal body structure
3. Cardiac: Muscles that form the wall of the heart

Skeletal muscles are the only voluntary muscles, meaning they contract as initiated by the will of a person.

Smooth (visceral) and cardiac muscles are both involuntary muscles, meaning they are governed by nerve impulses found in the autonomic nervous system.

Skeletal and cardiac muscles are striated, or band-like, whereas visceral muscles are smooth.

Skeletal system

The skeletal system has several functions:

1. Support: The skeleton acts as the framework of the body. It gives support to the soft tissues and provides points of attachment for the majority of the muscles.
2. Movement: The majority of muscles attach to the skeleton and many of the bones meet (or articulate) in moveable joints, wich means that the skeleton plays an important role in determining the extent and kind of movements of which the body is capable.
3. Protection: Clearly, the skeleton protects internal organs from injury; this includes the brain, spinal cord, thoracic organs, bladder, and reproductive organs.
4. Mineral reservoir: Vital minerals are stored in the bones of the skeleton. Some examples are calcium, phosphorus, sodium, and potassium.
5. Hemopoiesis, or blood-cell formation: After a mother gives birth, the red marrow in specific bones produces the blood cells found in the circulatory system.

The human skeletal system is composed of 206 individual bones that are held in position by strong fibrous ligaments. These bones can be grouped into two categories:

1. Axial skeleton: 80 bones total (skull, vertebral column, thorax)
2. Appendicular skeleton: 126 bones total (pectoral, upper limbs, pelvic, lower limbs)

Endocrine system

The endocrine system is not a clearly defined anatomical system, but rather is composed of various glands that are located throughout the body. The main function of this system is to aid in the regulation of body activities by producing chemical substances known as hormones. Through a complicated regulation system, the bloodstream distributes hormones throughout the body. Each hormone affects only specific targeted organs.

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The primary endocrine glands are the pituitary, thyroid, parathyroids, adrenals, pancreas, and gonads. Additionally, the kidneys, gastrointestinal organs, and placenta exhibit endocrine activity, but to a lesser extent than the primary glands.