weekend 1:

anatomy

introduction to anatomy and physiology

what's inside?

introduction

This weekend will introduce the basics of the complex world of anatomy and physiology. We talk about different layers in the body and how they function, and which terms we use to describe a movement. We will also discuss the principles of flexibility.

Why would we learn anatomy and physiology? To understand how the body is built up, to understand how the body functions and to become more aware. The most important reason however, is so we can practice yoga in a safe way, so we can avoid injuries.

Anatomy is about the body **structure** and the relationship between different body parts. Physiology is about the body **function**, or how the body works.

learning objectives

After this weekend, students should be able to:

- use a vocabulary of appropriate terminology to effectively communicate information related to anatomy and physiology,
- observe and recognize anatomical differences,
- explain the basics of our limitations of flexibility in relation to the different structures in our body.

1. theory: building vocabulary

1.1 body/organ systems

Integumentary:

- skin, nails, hair

Skeletal and muscular:

- bones, cartilage, tendons, ligaments, (fascia)
- skeletal-, cardiac-, smooth muscles

Nervous and endocrine:

Circulatory

- cardiovascular, lymphatic

Respiratory:

- O2 en CO2

Digestive:

- digestive tract and glands

Urinary:

- kidneys and urinary tracts

Reproductive:

- womb and testes

1.2 the anatomical position

Mountain pose. This is our reference point for the discussion of movement; every movement is away from or toward this basic position. We also use this term to describe where structures lie in relation to certain landmarks on the body.

- Anterior: toward the front of the body
- Posterior: toward the back
- Superior: higher than or above (cranial: toward the head)
- Inferior: lower than or below (caudal: away from the head)
- Distal: refers to limbs, toward the tips
- Proximal: refers to limbs, toward the root
- Medial: closer to the midline of the body
- Lateral: away from the midline of the body
- Longitudinal: vertically, along the body
- Transverse: horizontally, across the body
- Ventral: on the front of the body
- Dorsal: on the back of the body
- Superficial: towards the body surface
- Deep: inside the body

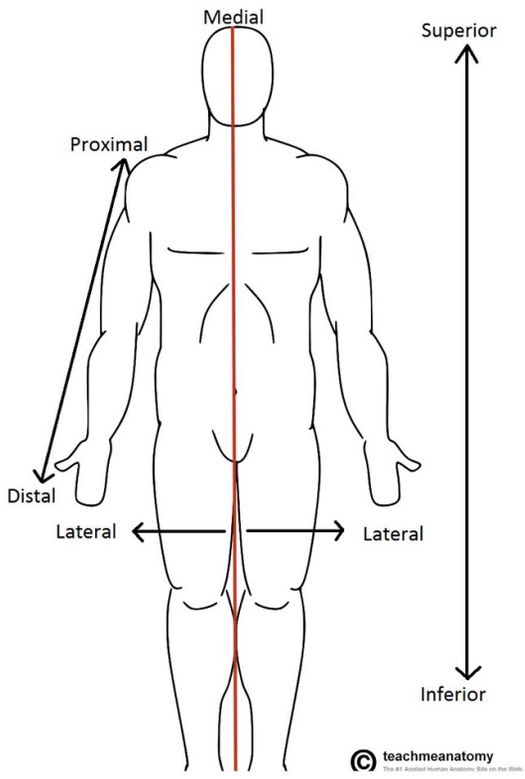


Image from http://teachmeanatomy.info

1.3 movement terms

Descriptions of movement using a common language. Remember that most movements are combinations of different movements.

- Flexion: decreasing, or closing an angle, compared to the anatomical position
- Extension: increasing, or opening an angle, moving toward the anatomical position

  Example: biceps/triceps, quadriceps/hamstrings

- Abduction: moving away from the plumb line/center line of the body
- Adduction: moving towards the plumb or center line of the body

  Example: shoulder, abduct/adduct, flex/extend, hyperextend

- Medial or internal rotation: turning toward the middle or plumb line
- Lateral or external rotation: turning away from the middle or plumb line

  Example: shoulder and hip

- Circumduction: circular movement of the limb that combines abduction, flexion, adduction and extension

  Example: shoulder and hip

- Pronation: forearm: rotation of the forearm so the palm faces inward, backward or downward; foot (also called eversion): rotation of the foot so the sole faces laterally outward
- Supination: forearm: rotation of the forearm so the palm faces outward, forward or upward; foot (also called inversion): rotation of the foot so the sole faces medially inward

  Example: forearm, foot

1.4 movements anatomical planes

- Sagittal plane: flexion, extension
- Transverse plane: rotation, pronation, supination
- Coronal/frontal plane: abduction, adduction

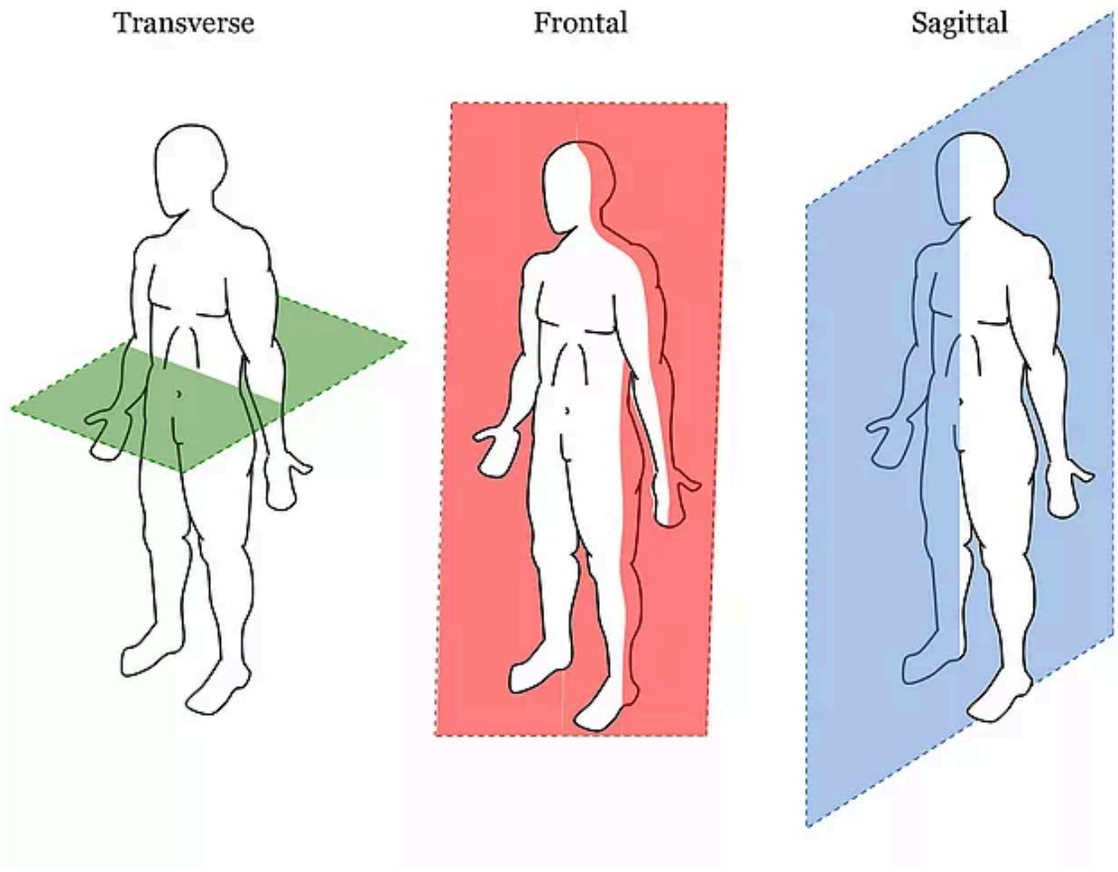


Image from http://www.interactive-biology.com

1.5 skeletal system

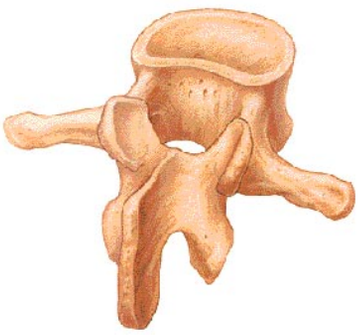
Bone: main supporting tissue of the body.

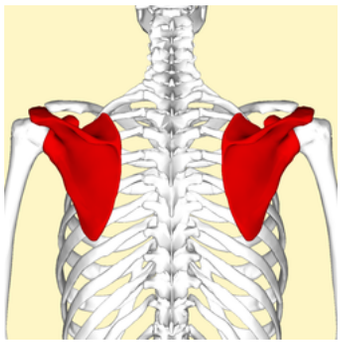
Important functions:

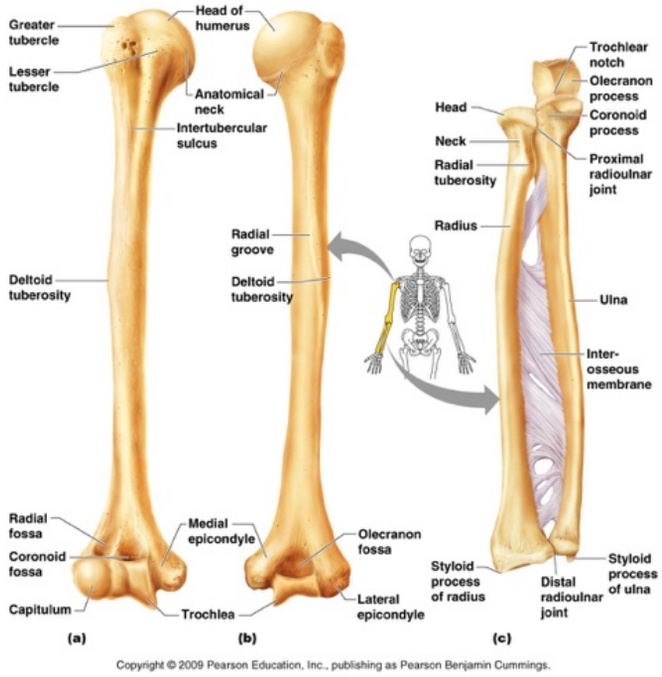
- support
- protection
- transmission of forces/movement

Form and shape reflect the function of the bone: leverage/protection/weight bearing. In general:

- Long: leverage
- Short: weight bearing
- Flat: protection and a place for broad muscles to attach







Cartilage: resilient and smooth elastic tissue, covering and protecting the ends of the long bones at joints, and a structural component of the rib cage, the ear, the nose, the bronchial tubes, the intervertebral discs, and many more other body components. It is not as hard and rigid as bone, but it is stiffer and less flexible than muscle. Cartilage is classified in three types: elastic cartilage, hyaline cartilage and fibrocartilage.

The articulating surfaces of the bones in a joint are covered by hyaline cartilage. Hyaline cartilage has a very low coefficient of friction, resists wear and tear, is somewhat elastic and can be compressed slightly.

Tendons: connects a muscle to a bone.

- origin: usually the most proximal place where the tendon connects the muscle to the bone.
- insertion: usually the most distal place where the tendon connects the muscle to the bone.

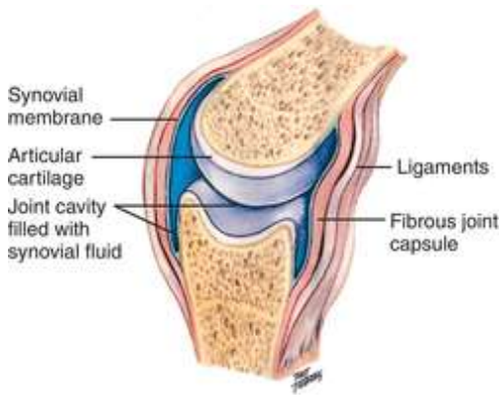
Ligaments: connects a bone to a bone. Where muscles and tendons generally move joints, joint capsules and ligaments stabilize joints. Ligaments tend to limit the range of movement that a joint can undergo, to protect the joint.

Fascia: a fascinating substance and has recently become recognized as an important contributor to our health, wellbeing and flexibility. It is found all over the body: it surrounds and penetrates our muscles; it surrounds and supports our organs; helps to guide the alignment of our blood vessels and nerves; it is the home for fat cells. Fascia has several other functions, and we are discovering more as time goes on.[1]

Joints: Specialized regions where bones are connected by soft tissues, allowing our range of motion to be safe and possible. Leslie Kaminoff considers a joint to be a marriage, hopefully a perfect balance between mobility and stability.

The highly moveable joints are called synovial joints; they share many properties:

- wherever bones come into contact with each other they are covered by hyaline cartilage,
- the areas between de bone ends are bathed in synovial fluid. There is no blood supply.

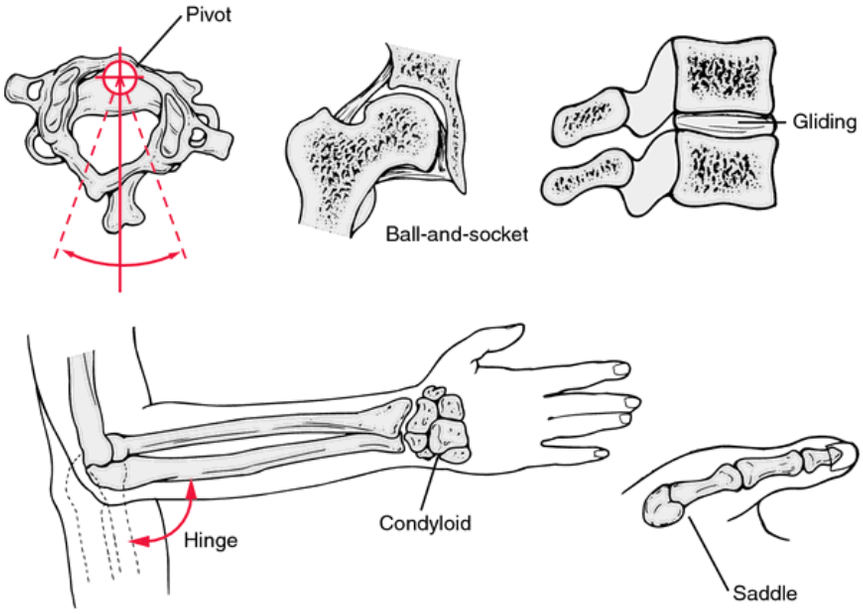


source: https://medical-dictionary.thefreedictionary.com/Synovial+joints

[1] Clark, B. Your body, your yoga, p. 41

- Synovial membrane surrounds this space, the outside of a fluid filled balloon
- Thick, strong membrane surrounds this, called the joint capsule.

Examples of these synovial joints names are descriptive of the structure: ball and socket (shoulder/hip), hinge (knee/elbow/finger), ellipsoid (radiocarpal), saddle (thumb), hinge (elbow/finger), pivot (cervical vertebra 1-2), gliding (sacroiliac).



1.6 movement of the muscles

Skeletal muscles produce movement by pulling on the bones at the joint. It is important to remember that most movement occurs because of the opposite actions of two sets of muscles. In general, muscles attach at two places. When muscles contract and shorten, they move these two points closer together. When muscles lengthen out, these points of attachment move farther apart.

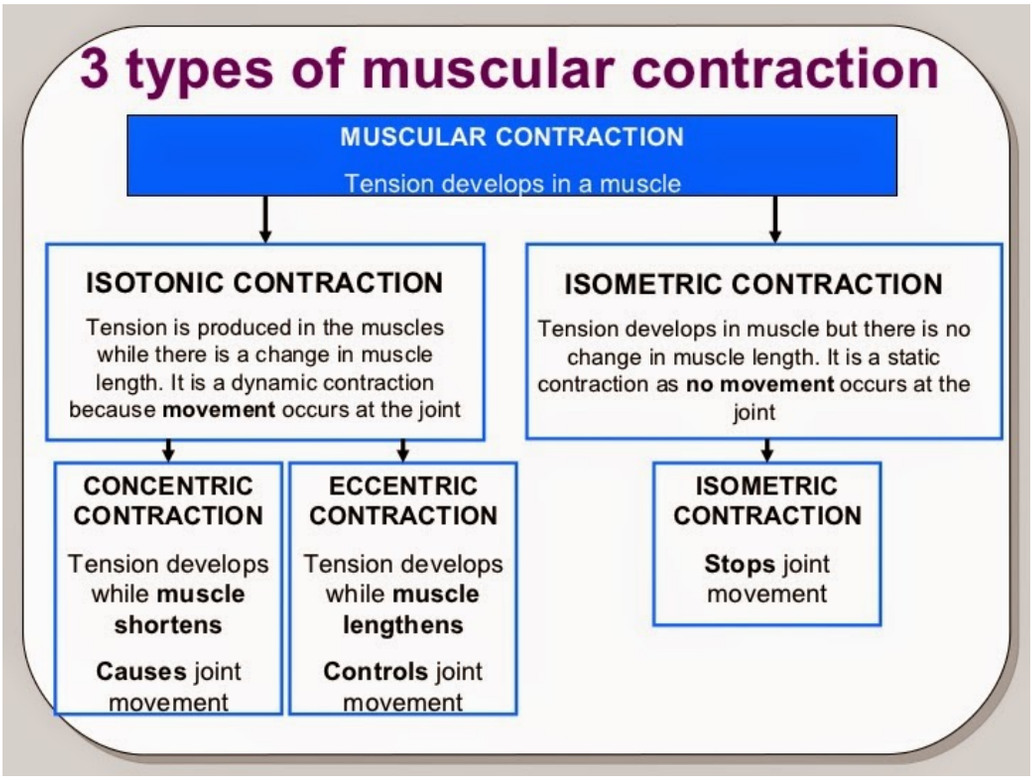
In any action something contracts, or shortens, and something releases, or lengthens. BOTH are active movements.

These muscle group pairs are called agonists and antagonists.

- Agonists: the muscle that contract to produce a certain action in the joint.
- Antagonists: the muscle that relaxes while the agonist contracts.

Types of muscle contraction:

- Isometric: "same length": No motion in the joint but the muscle generates tension. (Example: Down dog in the holding phase)
- Isotonic: "same tone": There is motion at the joint but the load (weight) does not change. The tension is constant (example: chaturanga).
- If there is isotonic contraction, it is either:
    - Concentric: contracting, usually against gravity (example: the quadriceps while stretching from chair to standing)
    - Excentric: contracting, usually with gravity. (example: the quadriceps while lowering down into chair)



2. fascia

Fascia is the soft tissue component of the connective tissue system inside the human body. It surrounds and penetrates muscles, bones, organs, nerves, blood vessels, and other structures of the body. Fascia is an interconnected, three-dimensional web of tissue that extends from head to toe, front to back, and interior to exterior. It is responsible for maintaining structural integrity, providing support, protection, shock absorption and acting as a home for sensory neurons. Fascia plays an essential role in intercellular communication.

After an injury, fascia creates an environment for tissue repair. Fascia can also refer to dense plane like fascial sheets (such as the tensor fascia lata or iliotibial band) as well as joint and organ capsules, ligaments and other fibrous collagenous tissues. Simply put, fascia is a fibrous and gelatinous body-wide web that provides structure, protection, repair, and body sense. It is the interconnected soft tissue scaffolding that gives your body form and shape.

Fascia (in Latin means "band' or 'bundle") tissue is among other fibers comprised of collagen and elastic fibers. This is the white, stringy, translucent, sticky tissue that you see when you cut up a piece of meat for example. Next to collagen and elastic fibers it also contains fluids. Fluids that provide a slick type environment that permits motion. In other words; fluids allow your body structures to move around and among one another. Healthy tissues are pliable: they can bend but don't break.

That brings us to another very important aspect of fascia. Fascia is not only responsible for form and shape, but it also allows your body to morph into different shapes. This is due to the viscoelasticity of fascia. When you choose to hold one position constantly, your body starts to re-form to that shape. Imagine sitting in a plump position behind your office desk, for 8 hours a day, 5 days a week, year in year out what that does to your body form. But every downside has a upside. When you negatively change your shape and structure over time because of poor posture it may be positive when you use bodywork or yoga to change and correct poor tissue shape and structure. When you do yoga, you induce local stretch into stiff and overtightened tissues and therefore improve the flow of their fluids. Fascia is divided into 3 categories:

Superficial fascia

This type of fascia lies just beneath your skin. It forms a continuous layer surrounding the whole body like a body stocking. It adheres very strongly to the inside of the skin and also binds very strongly to the layer of deep fascia along its inner surface. This layer of superficial fascia has its own nervous, vascular and lymphatic supply and can be considered as an organ itself.

Although it is mostly soft fatty tissue, it has a fine matrix of stronger connective tissue running through it. This contains elastic fibers, which can stretch, and collagen fibers, which are inelastic but have great tensile strength. Together, this give it a soft and

pliable texture which is also very tough and resistant to overstretching forces. The health and condition of this layer is important in enabling the body to move freely. Acting like a body stocking if it is in poor condition or damaged, it could have a restricting effect on movement.

Deep fascia

The deep fascia is a single three-dimensional structure which envelops every muscle, bone, nerve, organ and cell in the body, connecting them all together and holding everything in place.

Loose fascia

Loose fascia refers to fascia that cannot be categorized as either superficial or deep. It is found as an intervening connecting layer between layers of deep fascia and between superficial fascia and deep fascia. It can be web-like or more like a membrane. Loose fascia permits the motion of slide & glide all over your body.

3. going deeper

Repeat, repeat, repeat

Make sure you know and can use all the movement terms, movements planes and muscle movements. Also, have basic knowledge of the different body structures and joints.