

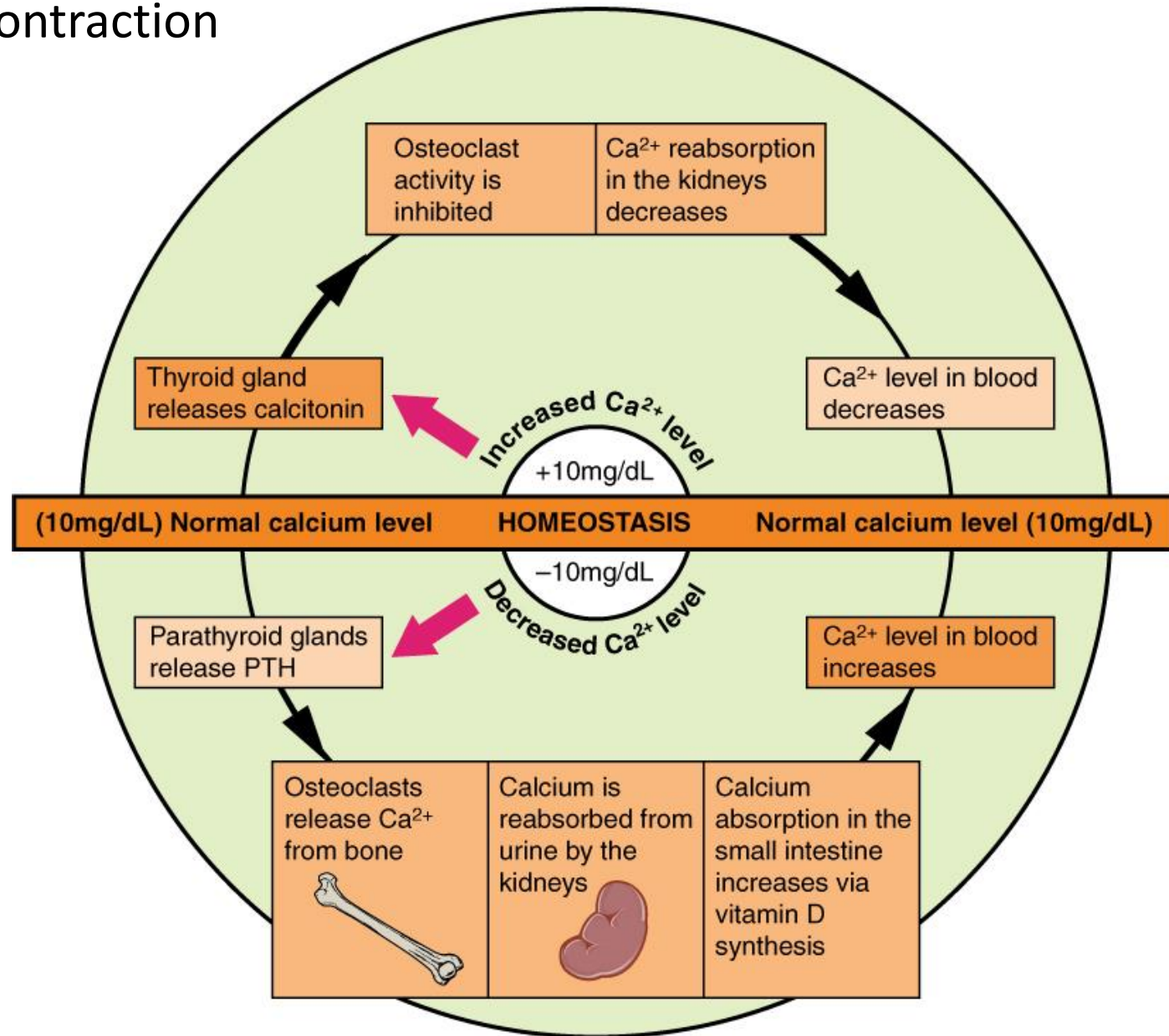
Bone, skeleton and interaction with
others Body system, skeletal disorder

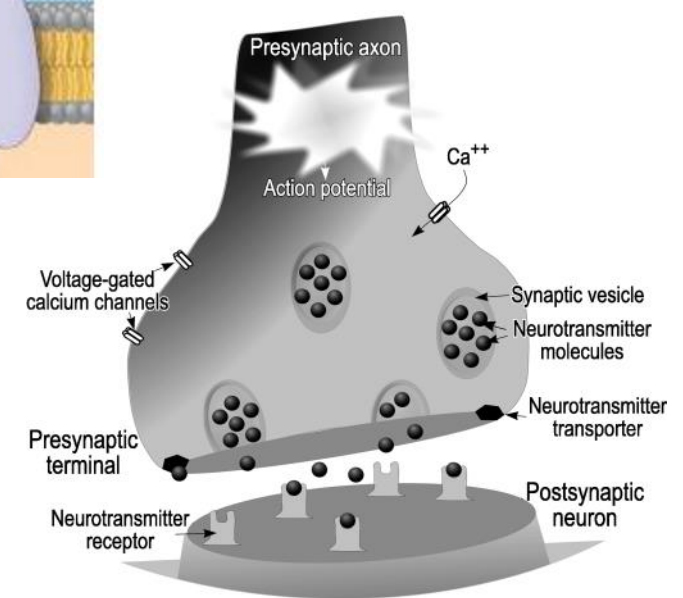
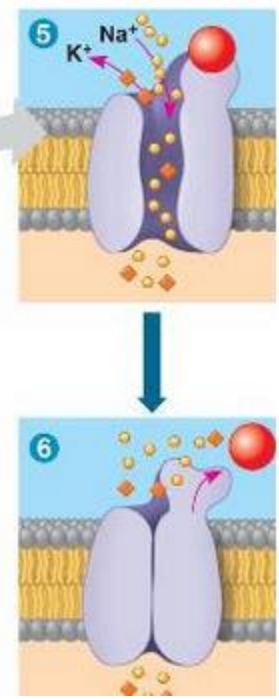
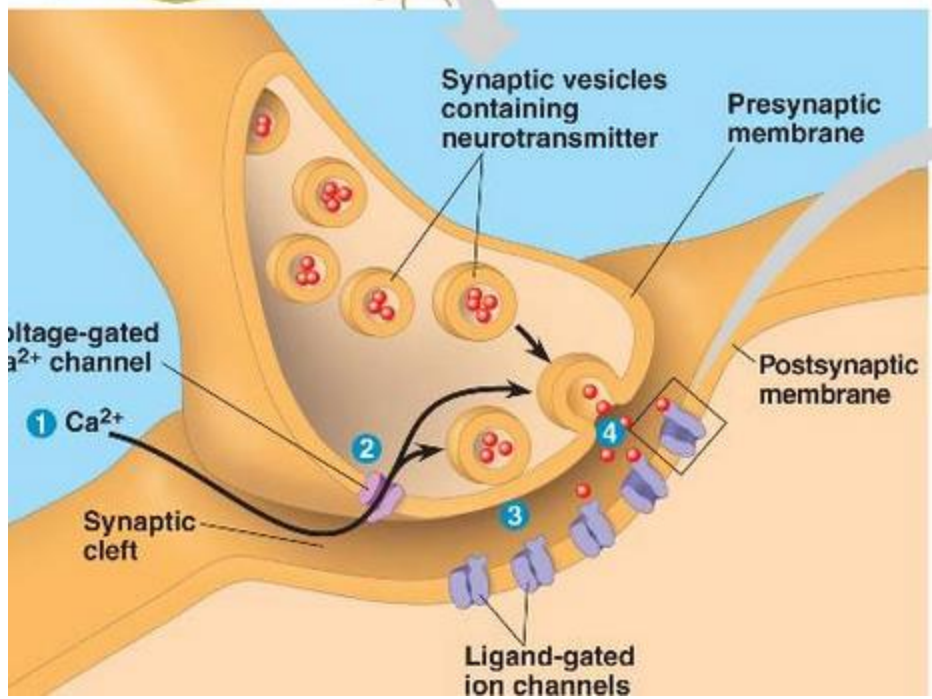
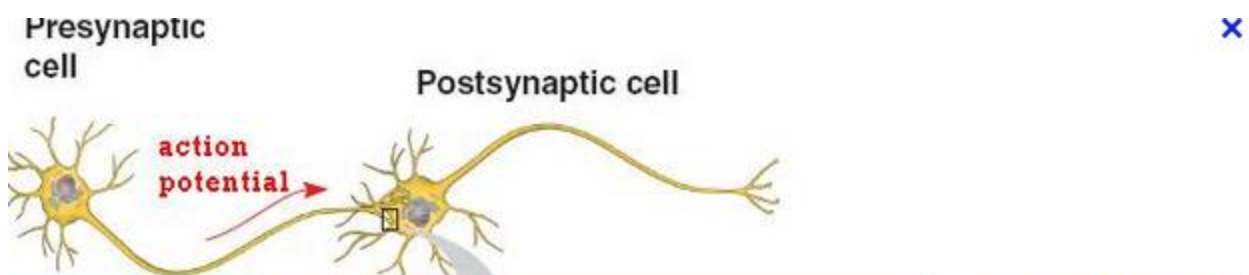
Musculoskeletal system interaction



- Muscles attach to the bones, serves as a lever for body movement
- Bone calcium may be released as needed to maintain blood levels required for muscle contraction
- The muscles stabilize movable joint

Homeostasis blood calcium and muscle contraction



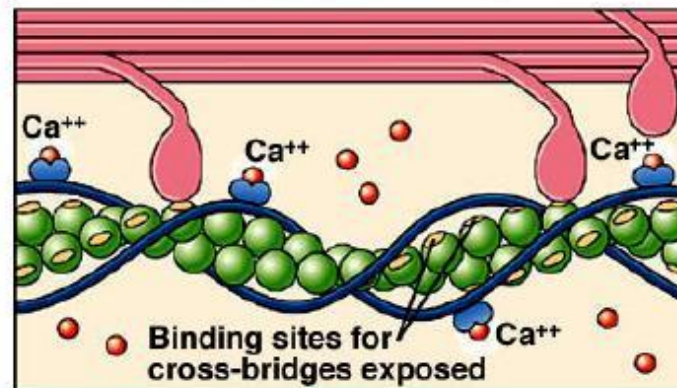
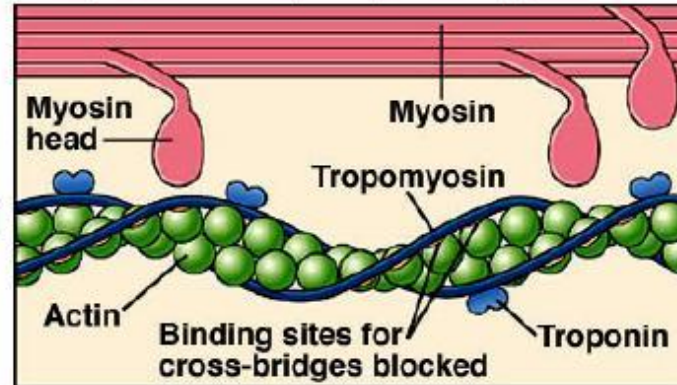


Calcium and impuls conduction

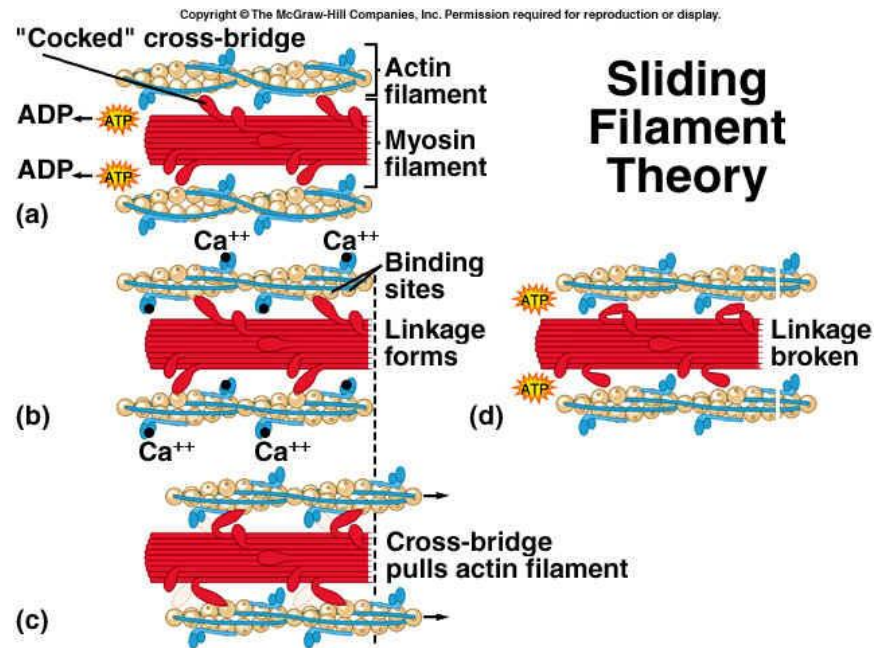
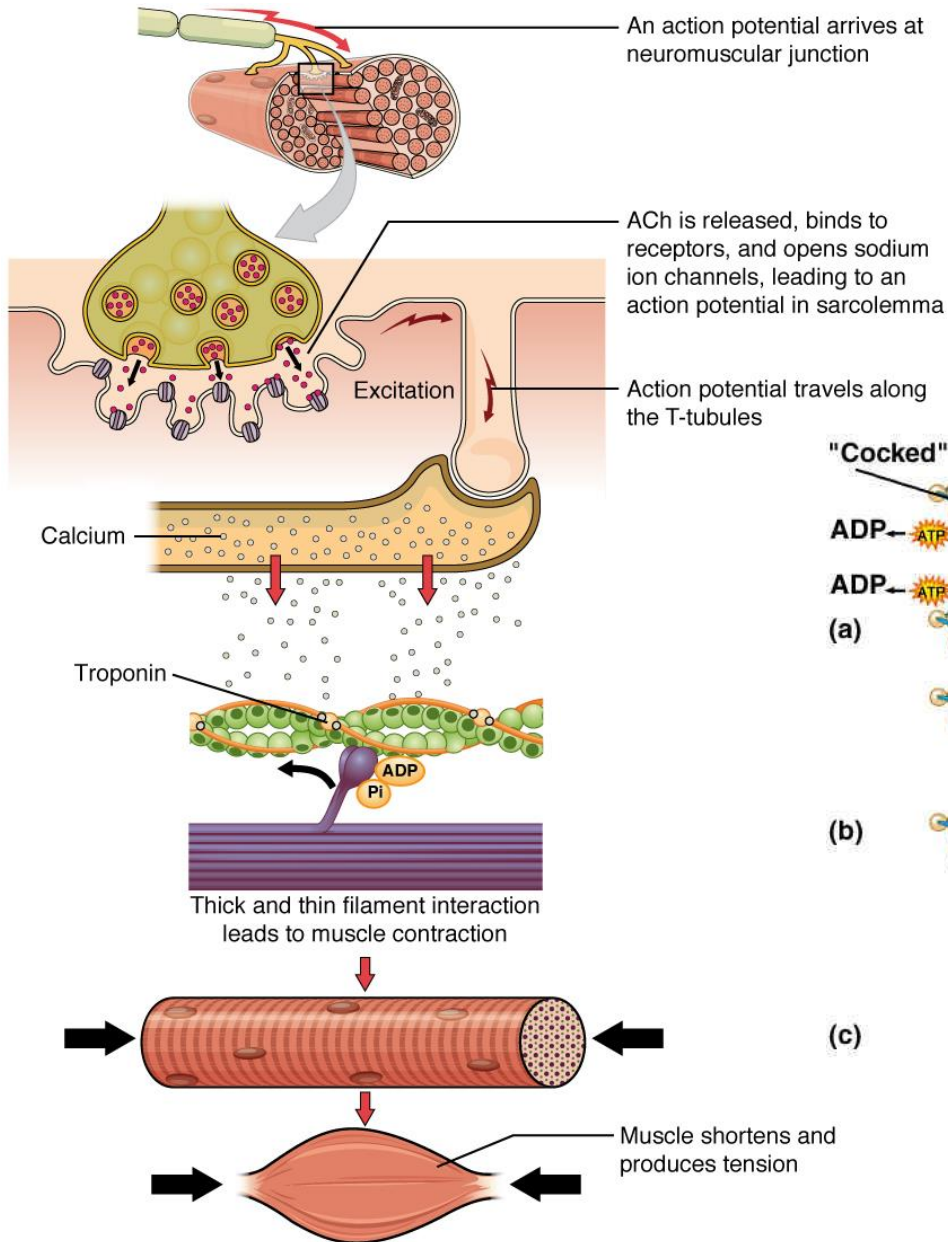
Calcium in presynaps, in reticulum sarcoplasmic

Role of Calcium in Muscle Contraction

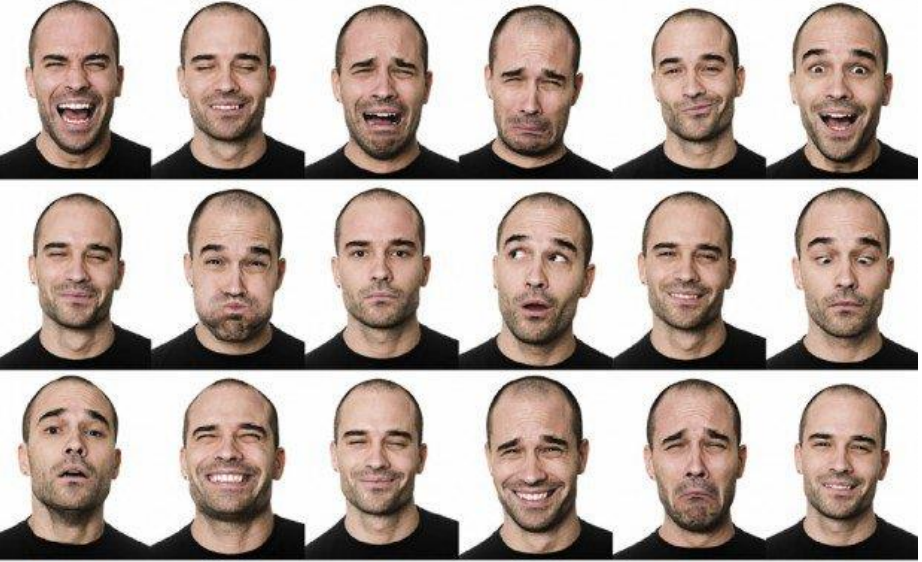
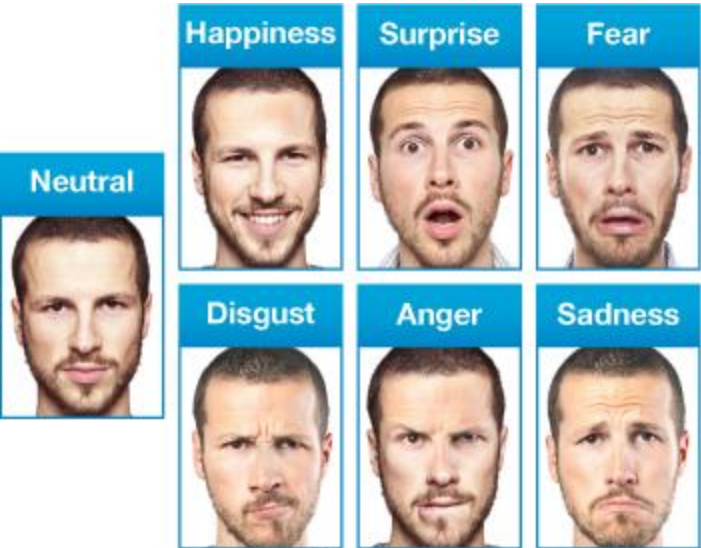
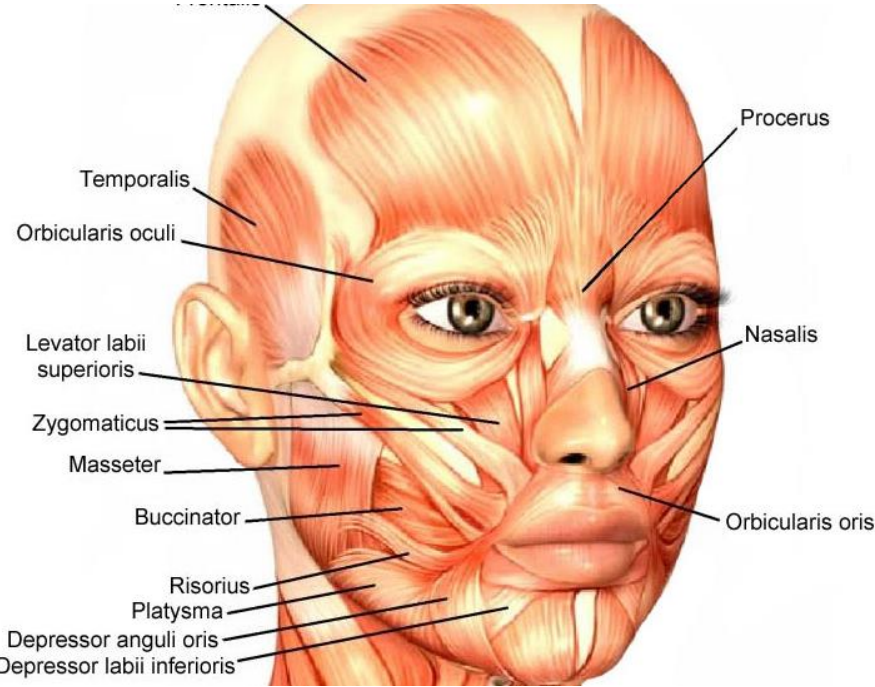
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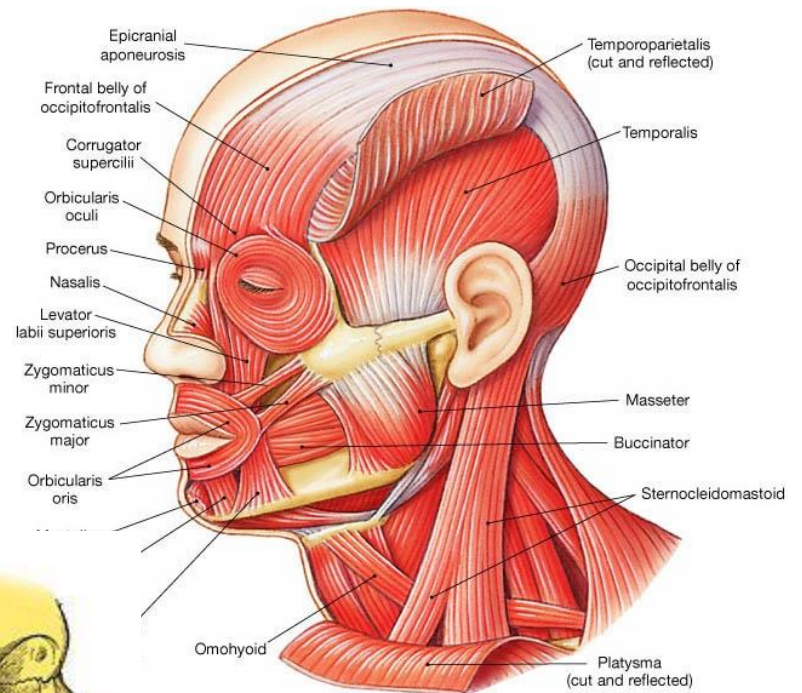
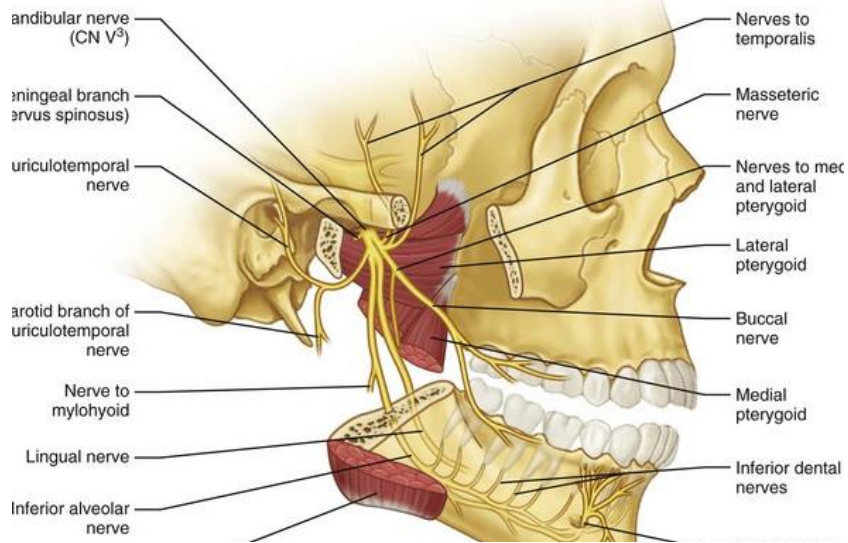


calcium ion in muscle contraction



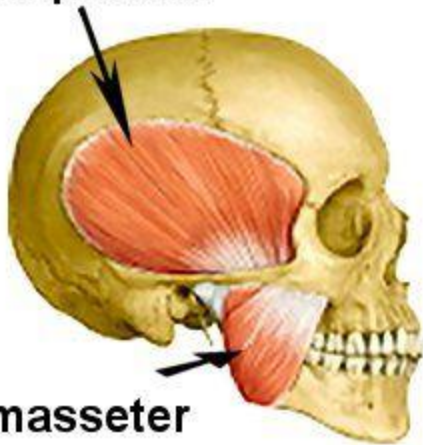
Facial muscle, facial expression (emotion)



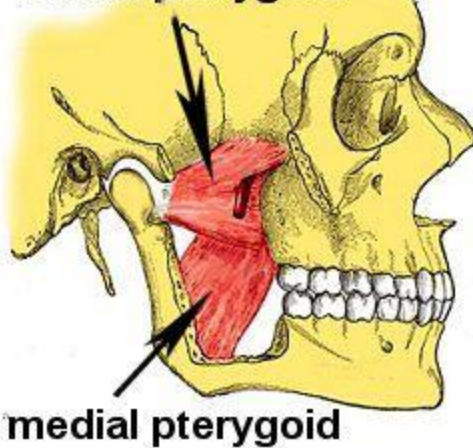


(a) Lateral view

temporalis

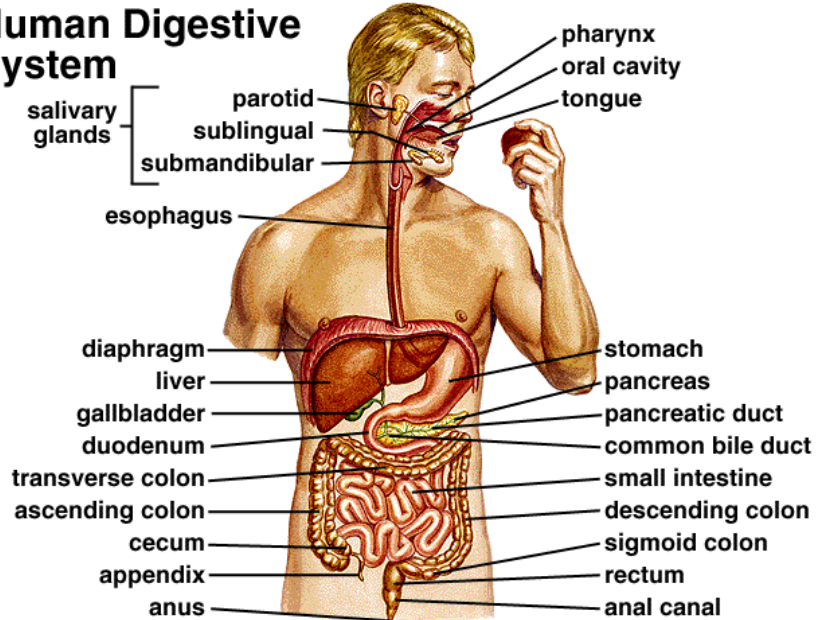


lateral pterygoid



Mastication muscles

Human Digestive System



Digestive system

Facial bones have sockets for teeth

Bones of the rib cage and pelvic protect organs including the stomach, liver, and intestine

Bones store dietary calcium and phosphorus

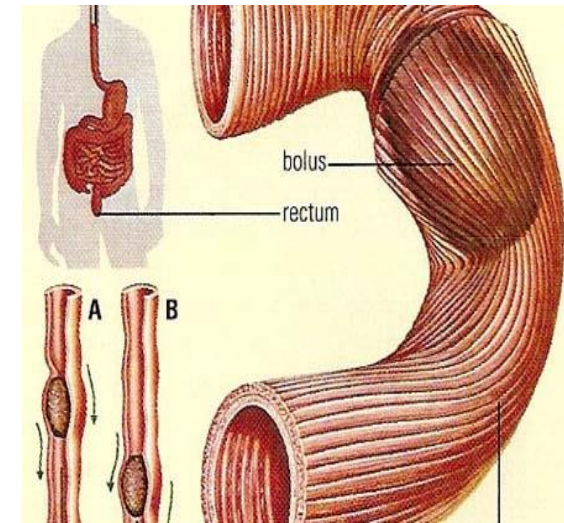
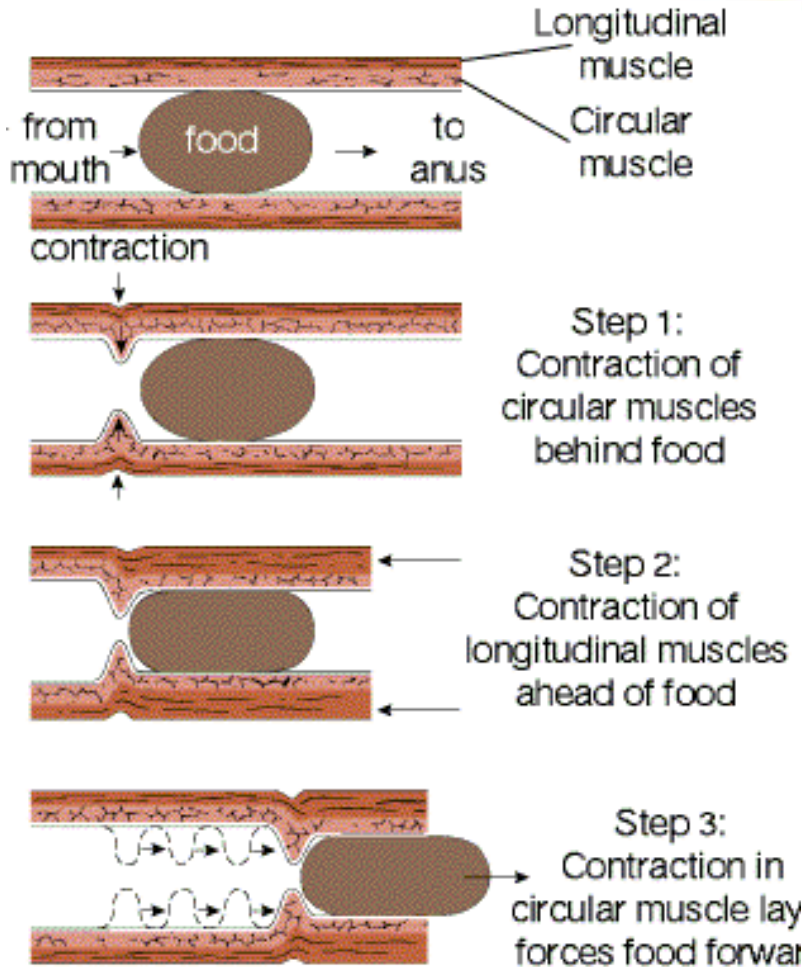
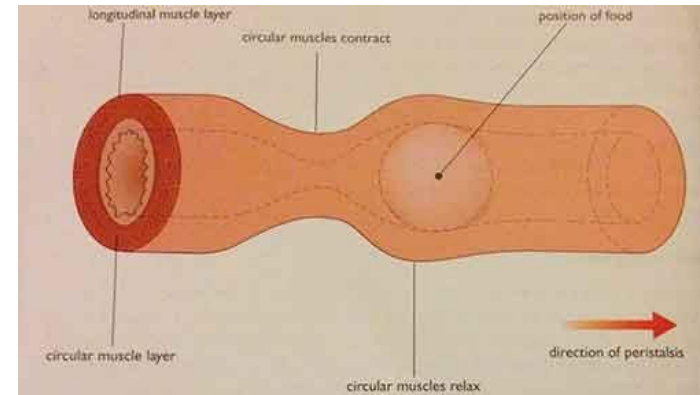
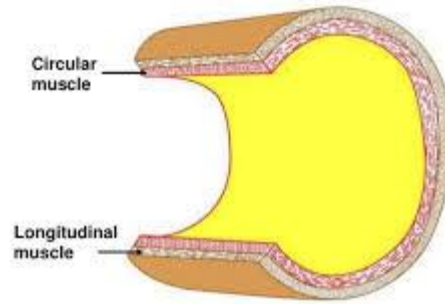
Abdominal muscle support many digestive organs.

Other skeletal muscle operate in chewing and swallowing

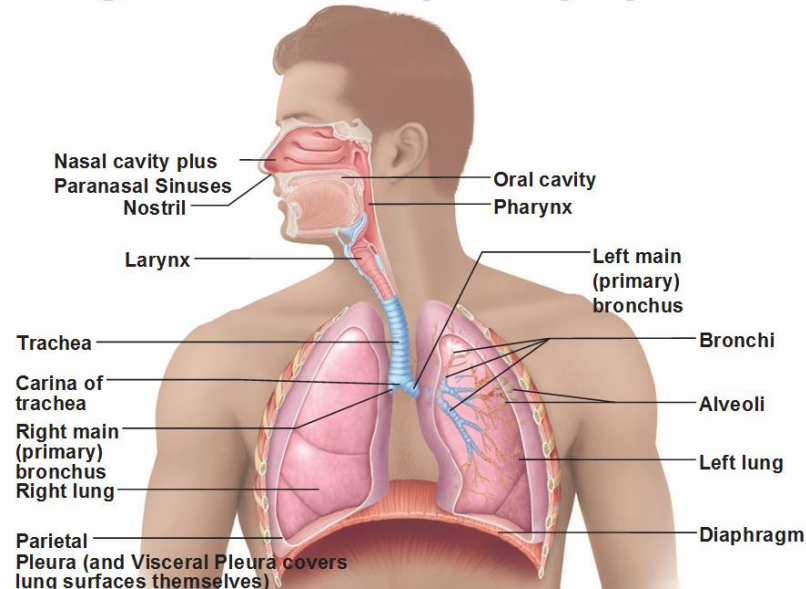
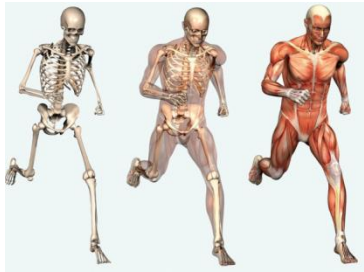
Contraction of smooth muscle move material through the system

Peristalsis movement

Part of the gut wall



Organs of the Respiratory System



Respiratory system

The rib cage and sternum protect the lungs.

Muscles used in breathing attach to the ribs and associated cartilages

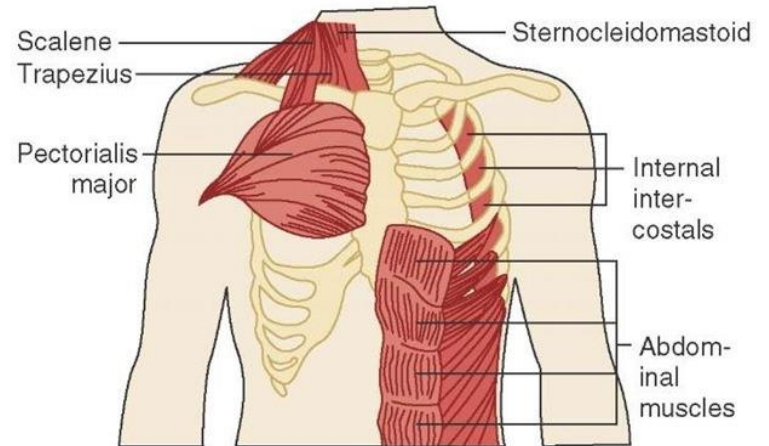
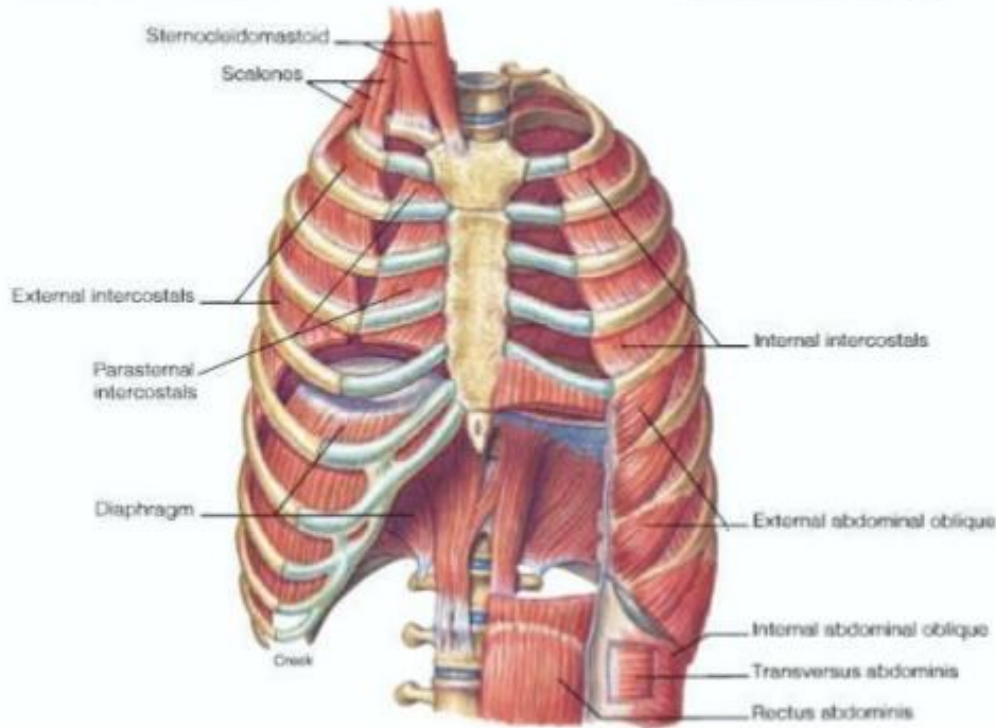
The diaphragm and skeletal muscle attached to the ribs function in breathing and help clear airways by coughing

Smooth muscle in airways allows changes in air flow to and from the lungs

MUSCLES OF RESPIRATION

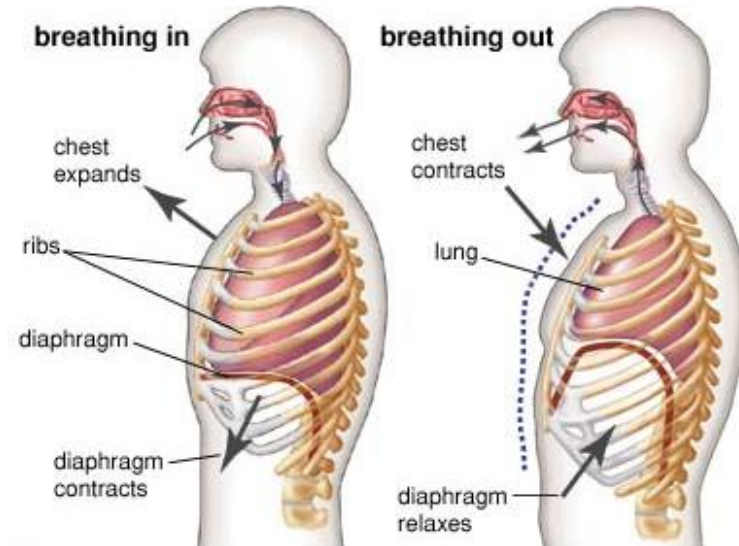
Muscles of inspiration

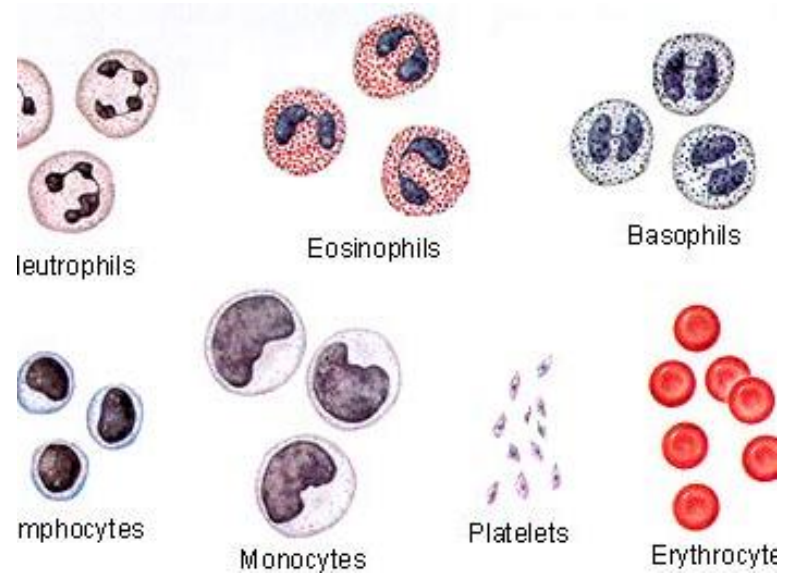
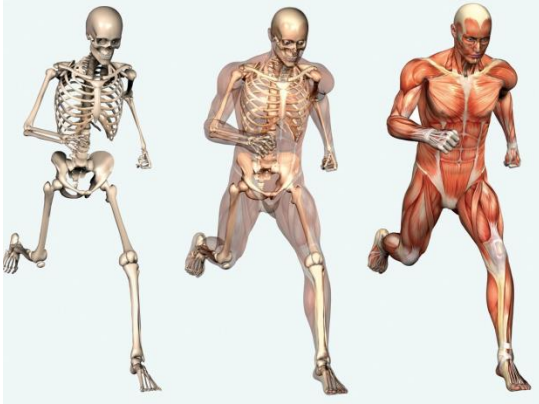
Muscles of expiration



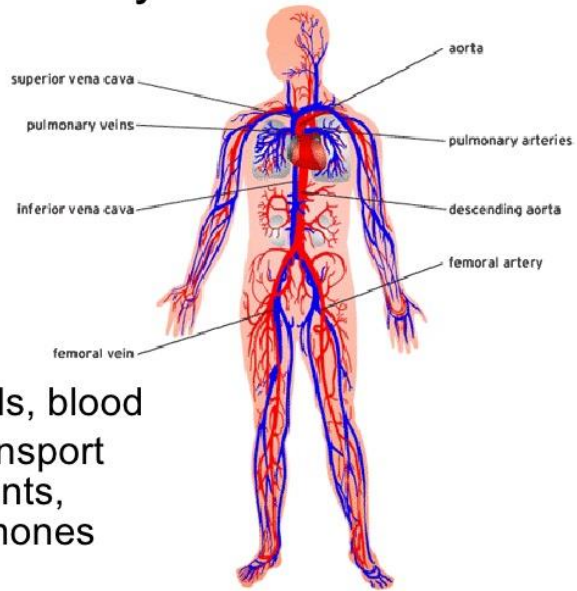
breathing in

breathing out





Cardiovascular System



- Heart, vessels, blood
- Function: transport gases, nutrients, wastes, hormones

Bone calcium is available for heart contraction that pump blood

All types of blood cells form in red bone marrow

Contraction of heart muscle pump blood

Smooth muscle in blood vessel allows adjustments in blood flow in different body regions

Contraction of leg muscles helps return blood to the heart

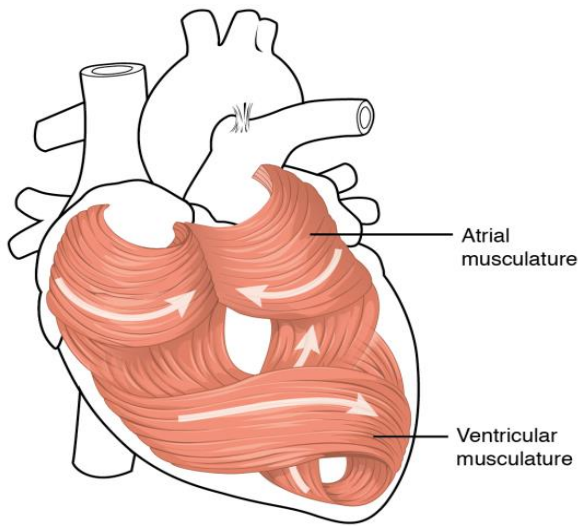
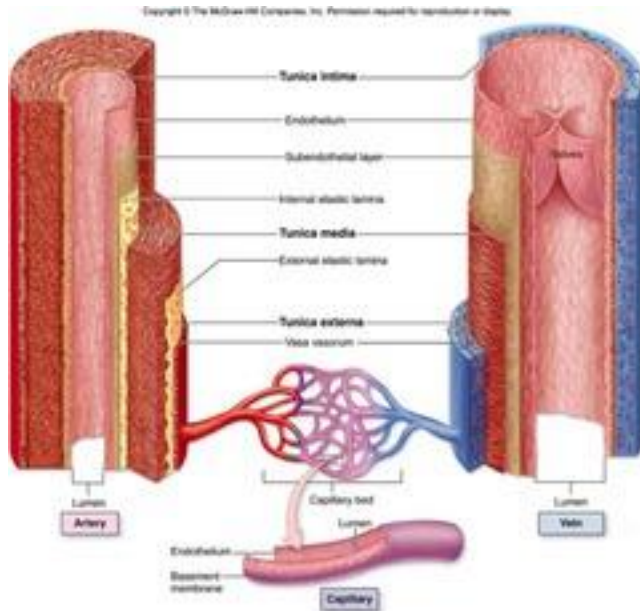
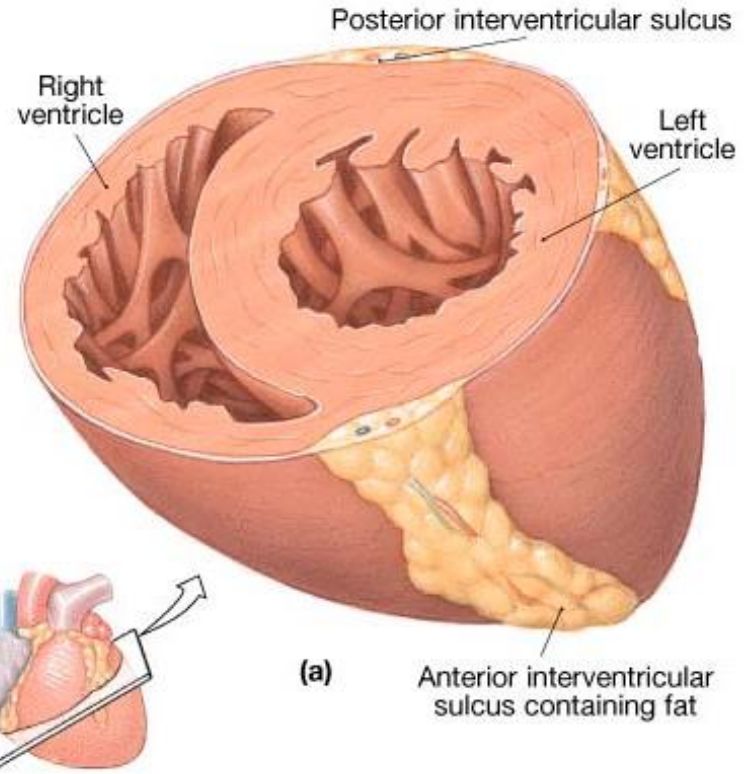


FIGURE 20-5
Structural Differences between the Left and Right Ventricles.
(a) Diagrammatic sectional view through the heart, showing the relative thicknesses of the two ventricles. Note the pouchlike shape of the right ventricle and the mass of the left ventricle.



Heart muscle and tunica muscularis of vessel

Circulating blood distributes heat produced by active skeletal muscle

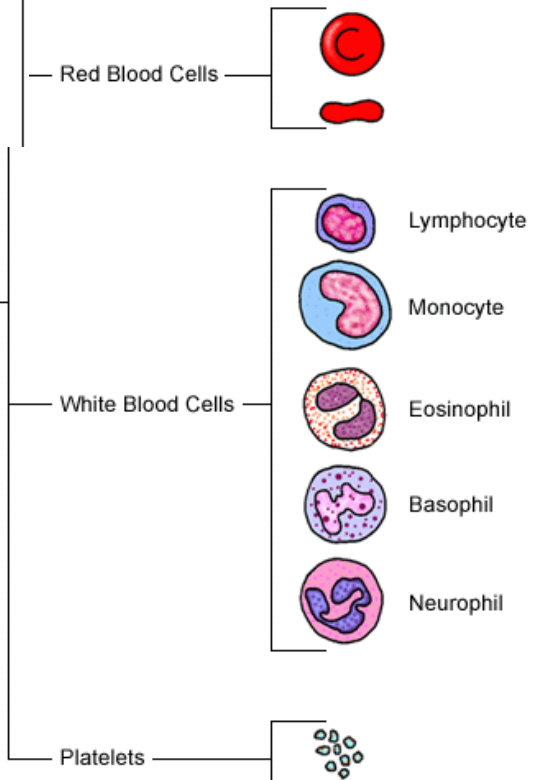
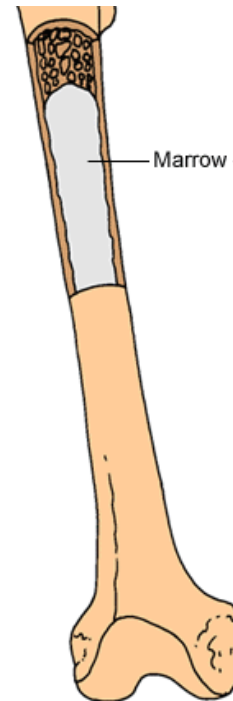
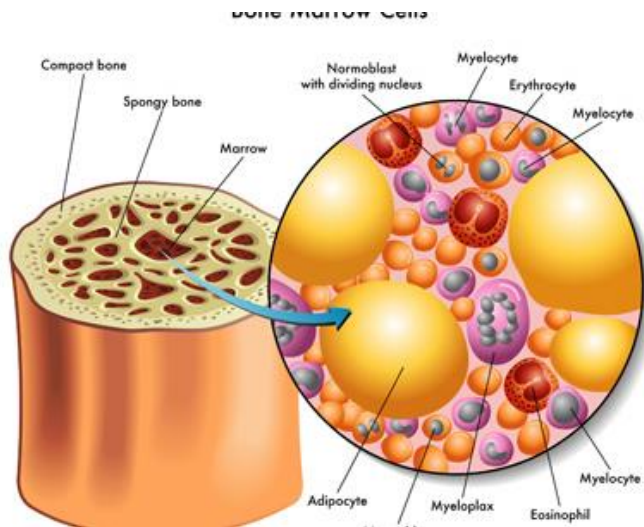
Contraction of leg muscles help returns venous blood to the heart

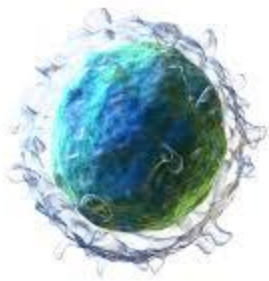
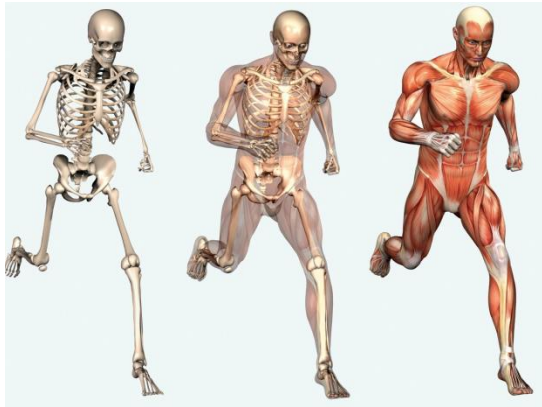
Red

- In a child, the medullary cavity of nearly every bone is filled with red marrow
- By adulthood, red marrow is limited to the skull, vertebrae, sternum, ribs, part of the pelvic (hip) girdle, and the proximal heads of the humerus and femur
- Gets its color from the abundance of red blood cells
- Hemopoietic (blood forming) tissue
- All types of blood cells are produced here

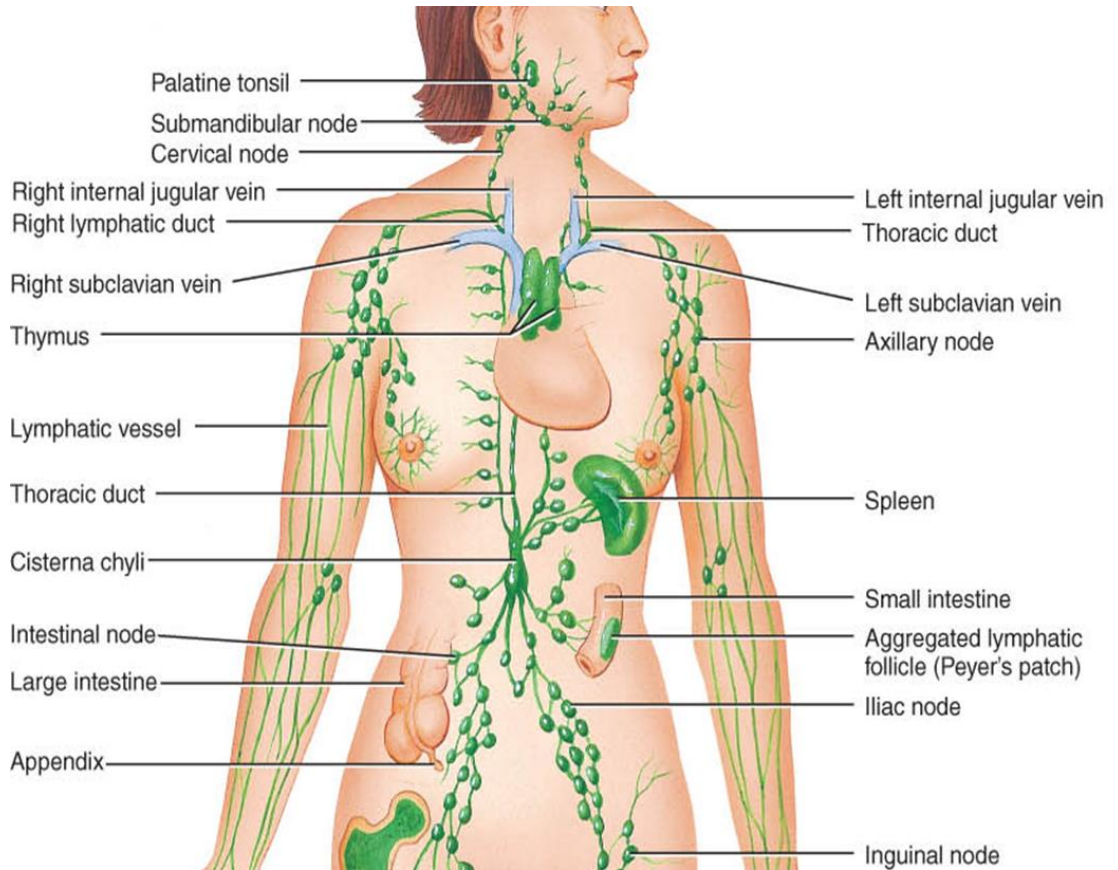
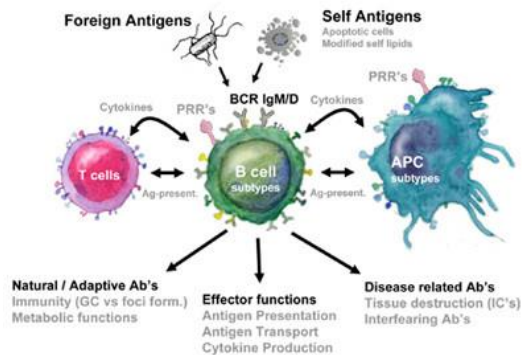
Yellow

- With age, red bone marrow is gradually replaced by fatty yellow marrow
- No longer produces blood
- In a severe chronic anemia, it can transform back into red marrow and begin producing blood again





Lymphocyte
B cell

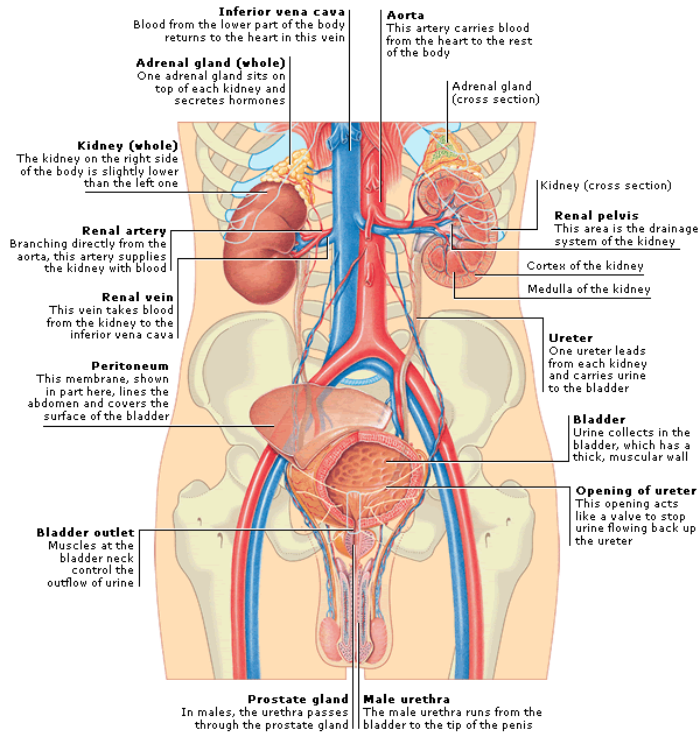


Lymphatic system and immun

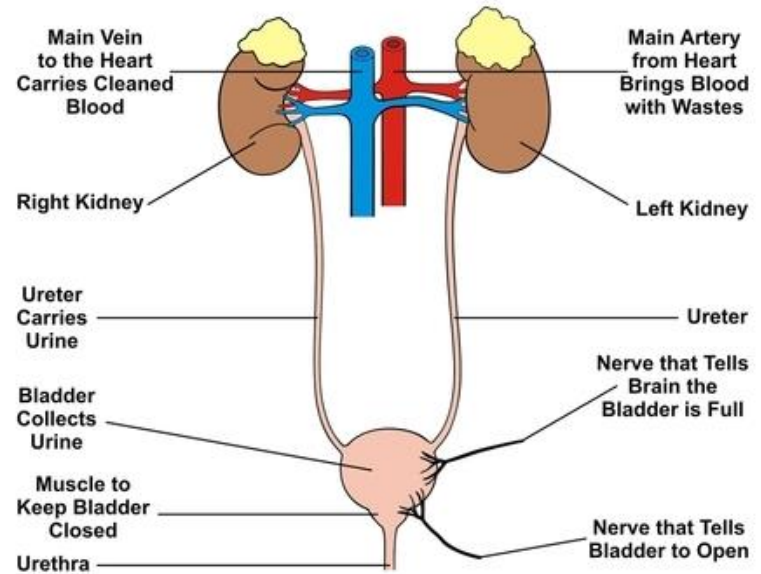
white blood cells that function in body defenses fom in red bone marrow

Blood pumped by the herat picks nup inhaled oxygen from lungs and delivers carbon dioxide to the lungs to be exhealed

Smooth muscle forms the wall of lymphatic system vessels. Skeletal muscle helps support lymph nodes in various parts of body



URINARY SYSTEM

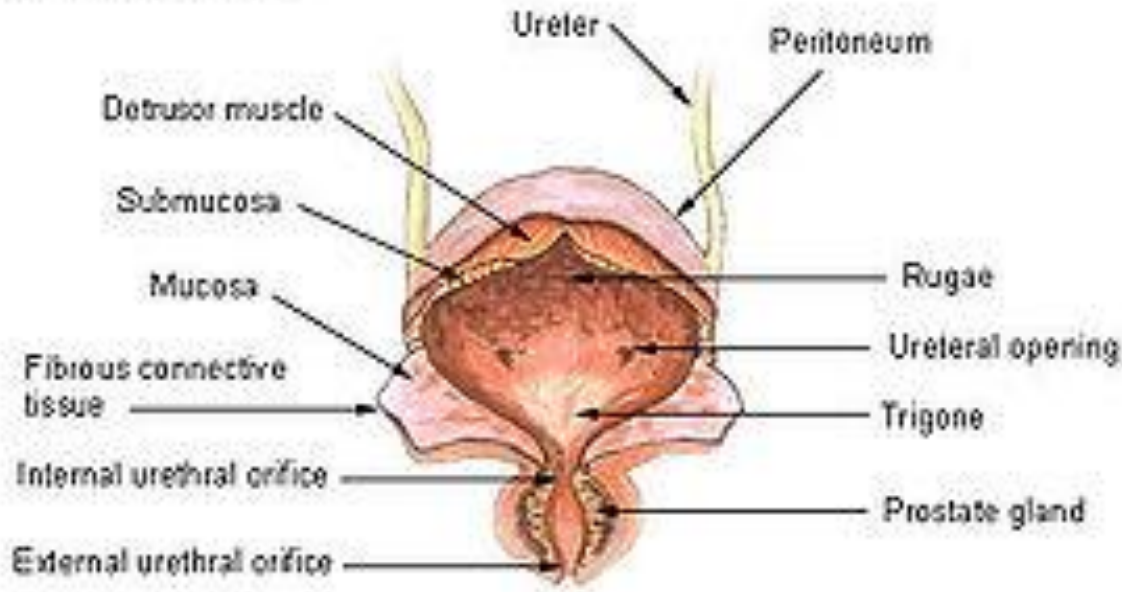


The ribs cage partially protects the kidneys, the pelvis helps protect the bladder

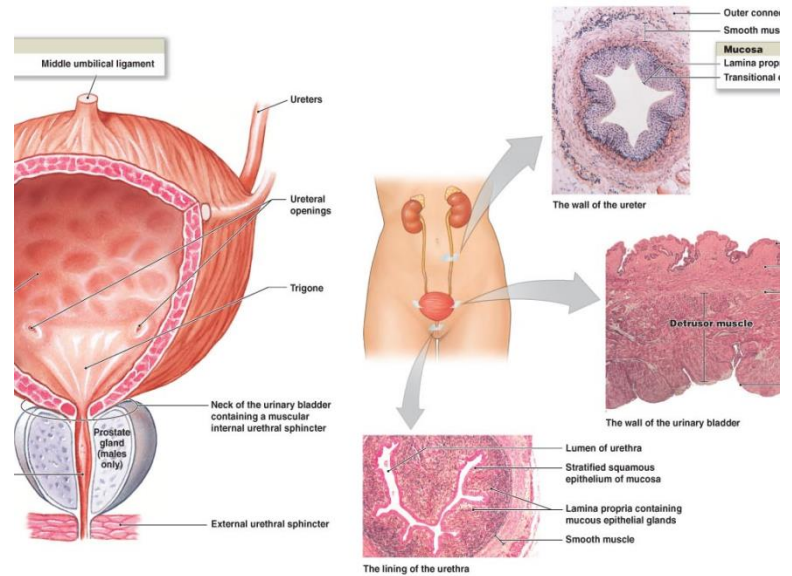
Abominal muscles have support the kidneys and bladder

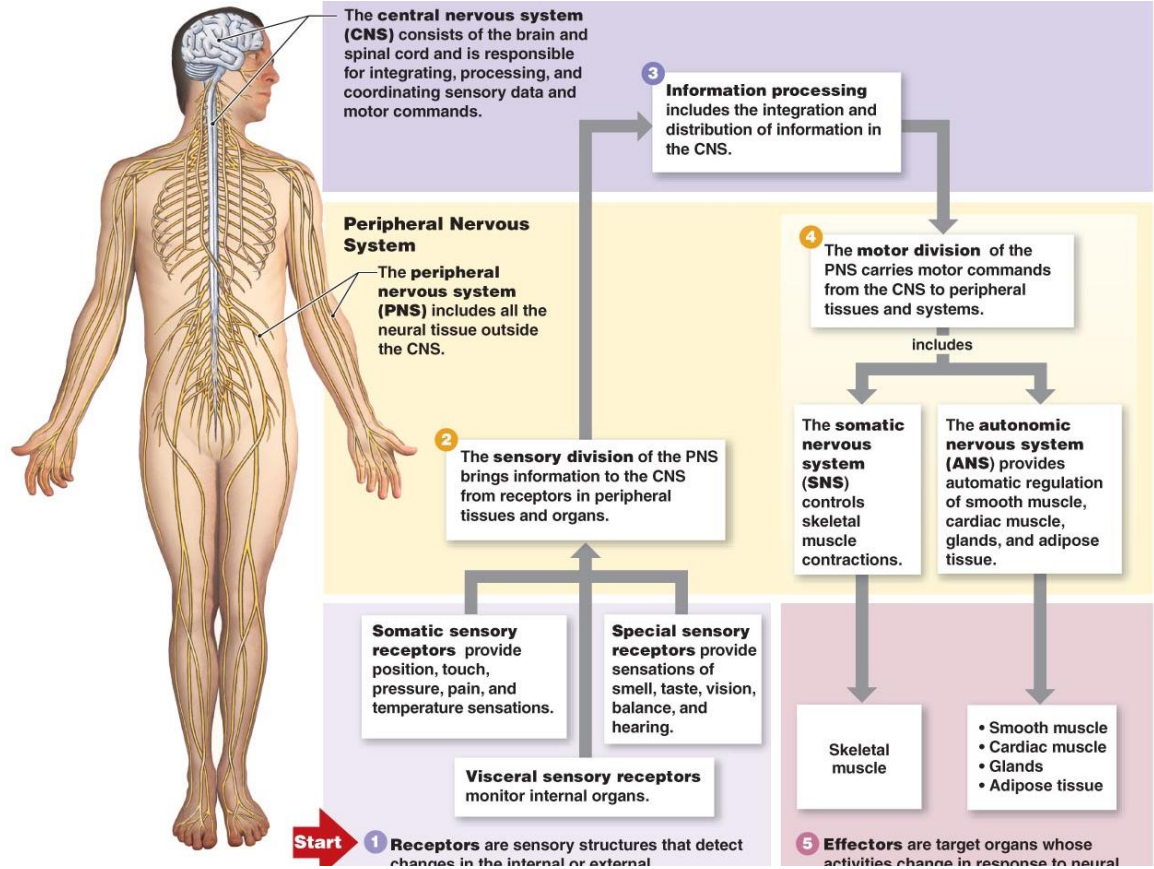
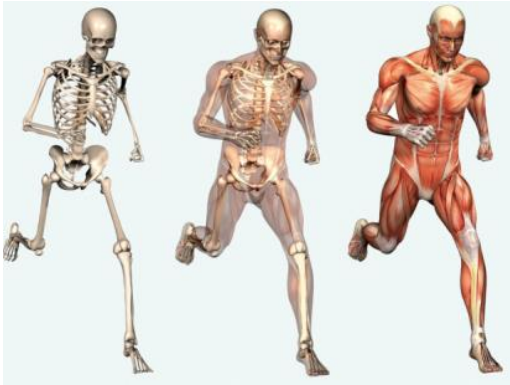
Smooth muscle in the bladder is trong and stretchable enough to store urine, its contraction move urin out of the body

Urinary Bladder



Musculus detrussor of urinary bladder





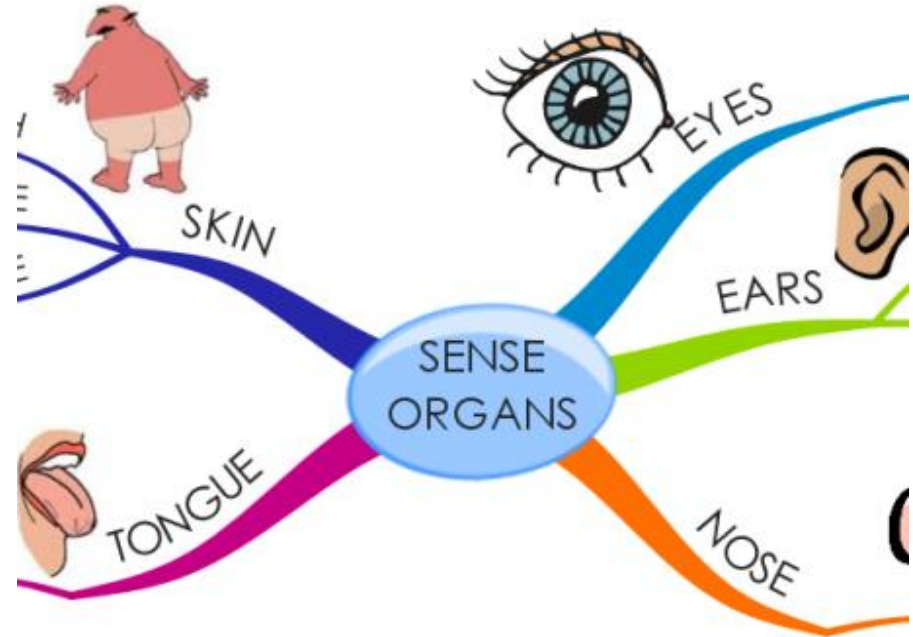
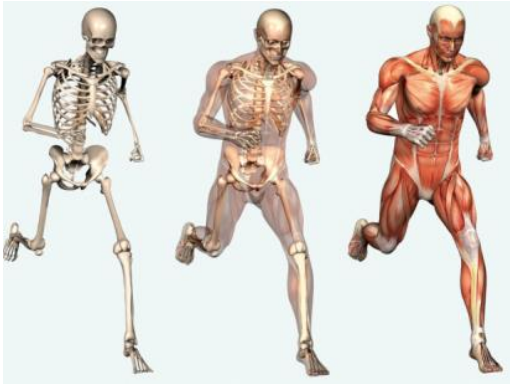
Nervous system

The skull protects the brain, the vertebrae the spinal cord.

Bone calcium stores may be released to maintain blood level required for transmission impulses

All types of muscle tissue respond to nerve impulses to carry out a wide variety of body functions.

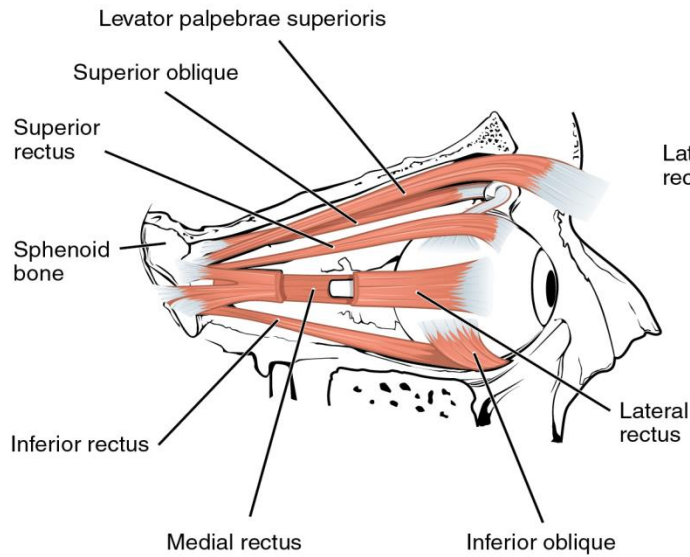
Skeletal muscle help support the spine and head



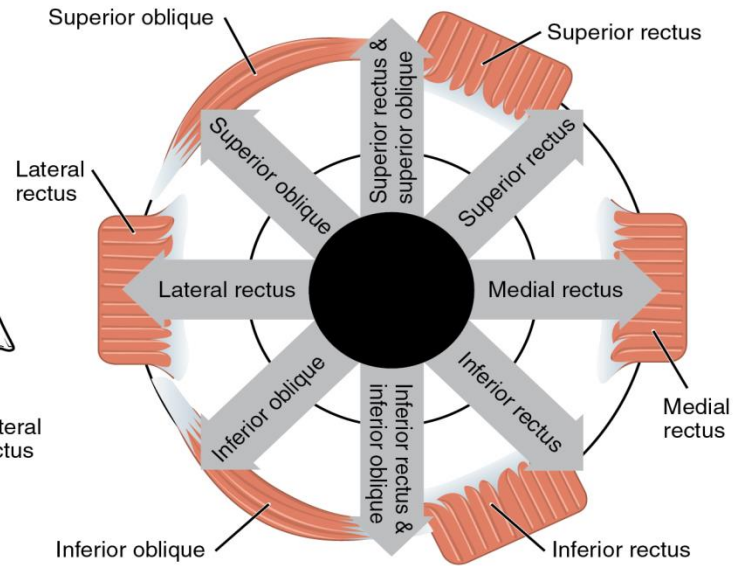
Skull and facial bones surround and protect sensory organs in the head.

Skeletal muscles move the eyes and contain sensory receptors that provide information about change in body position

Bone calcium stores may be released to maintain blood level required for transmission impulses

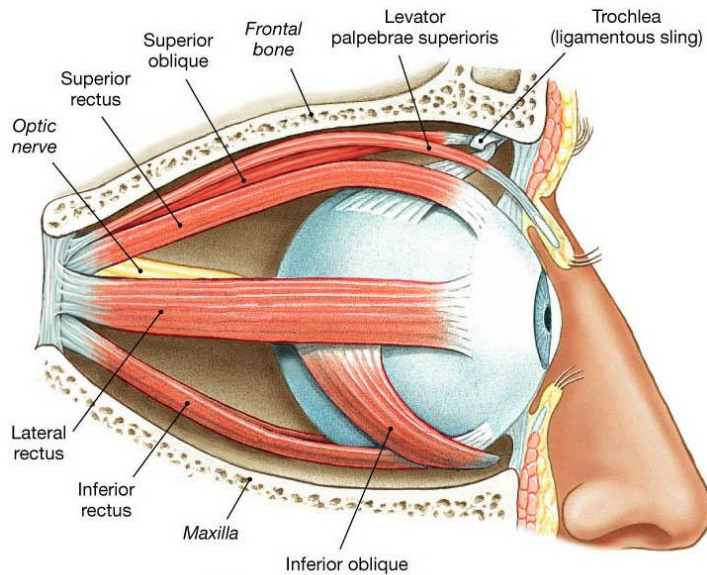


(a) Right eye (lateral view)

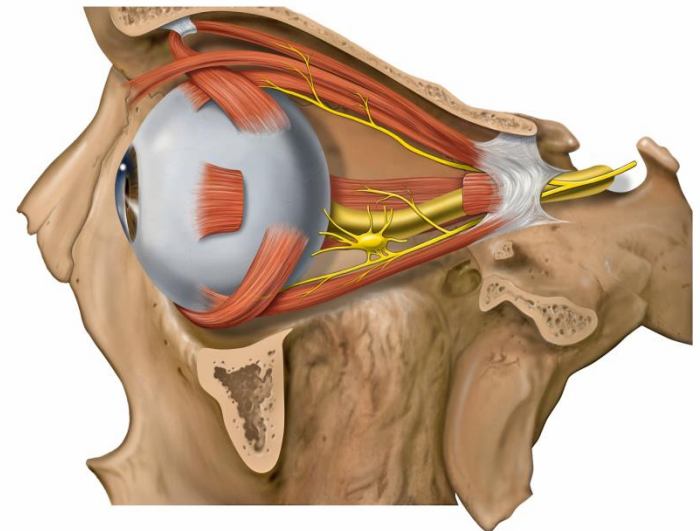


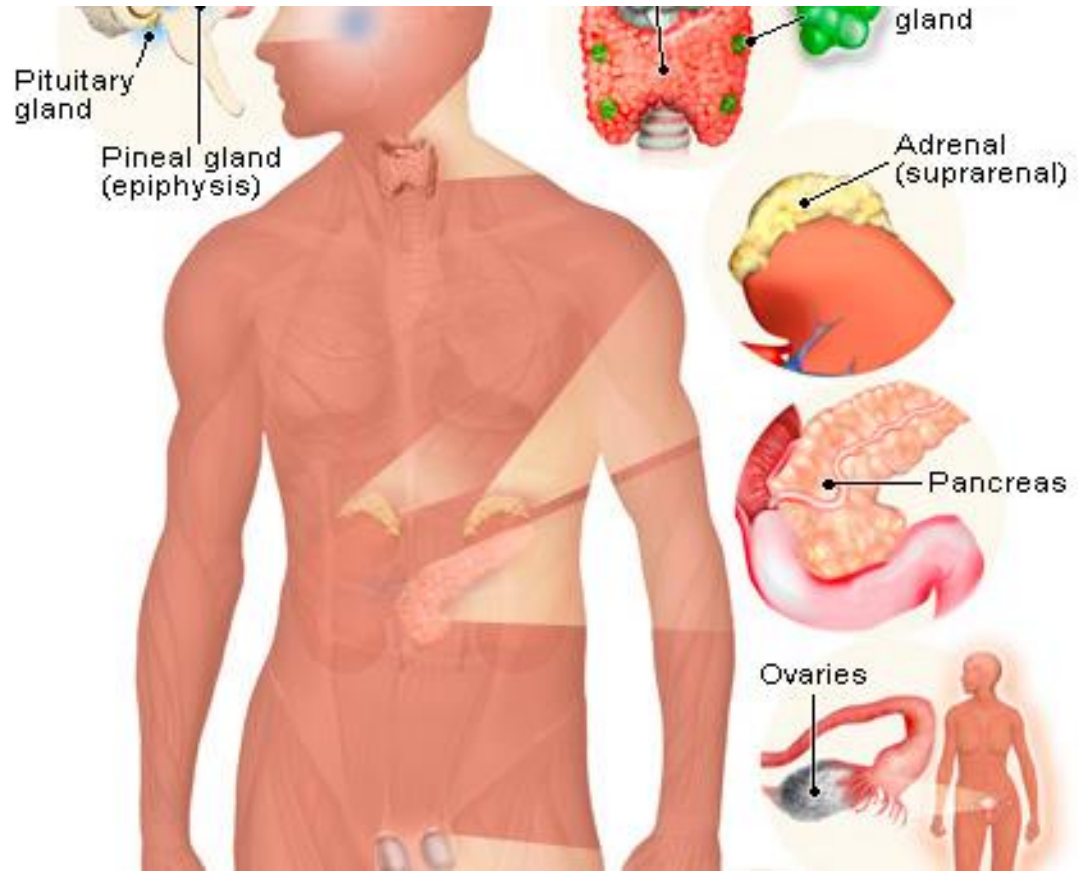
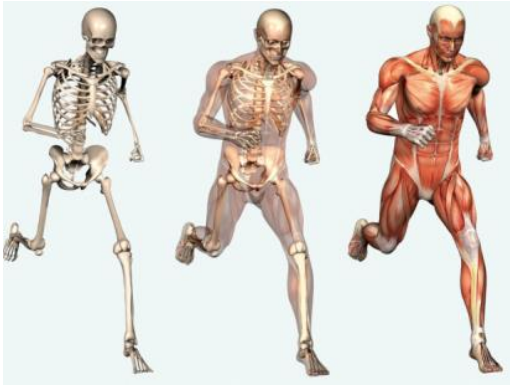
(b) Right eye (anterior view)

Cavum orbitae and eye ball



(a) Lateral surface, right eye



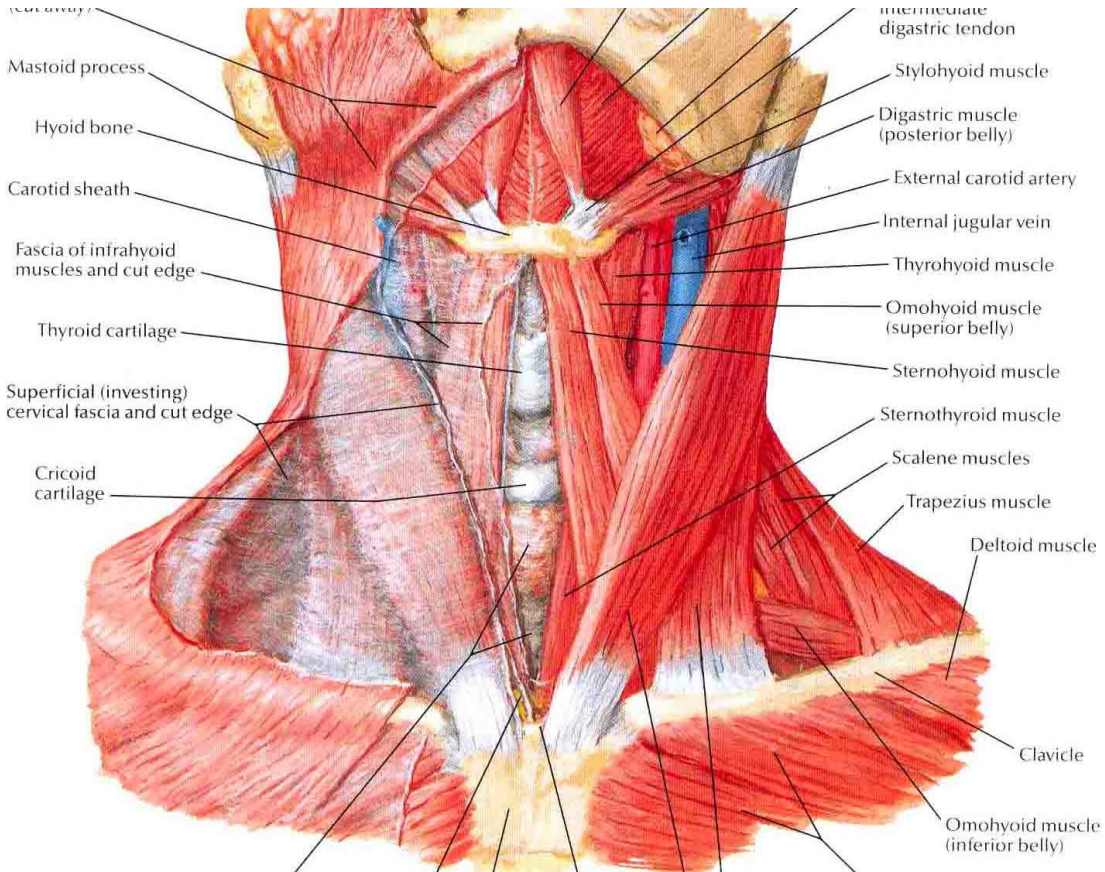
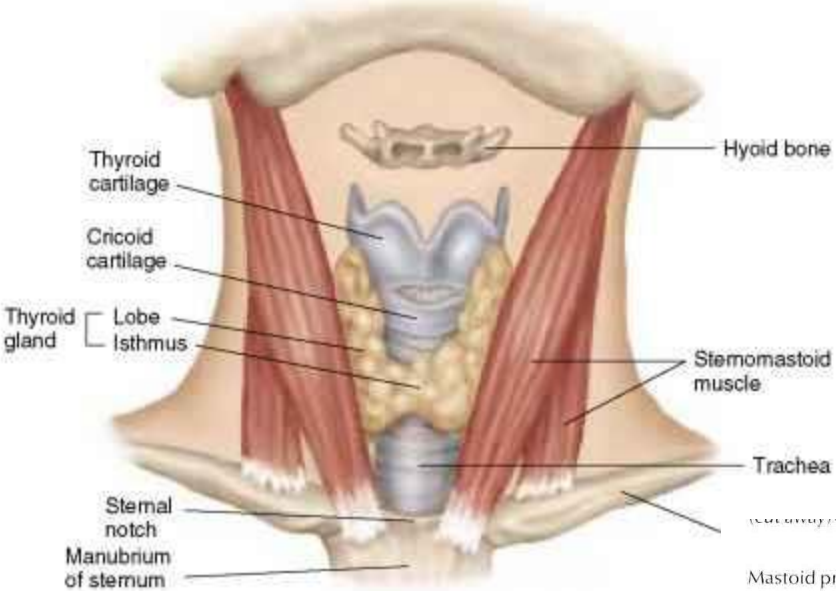


Endocrine system

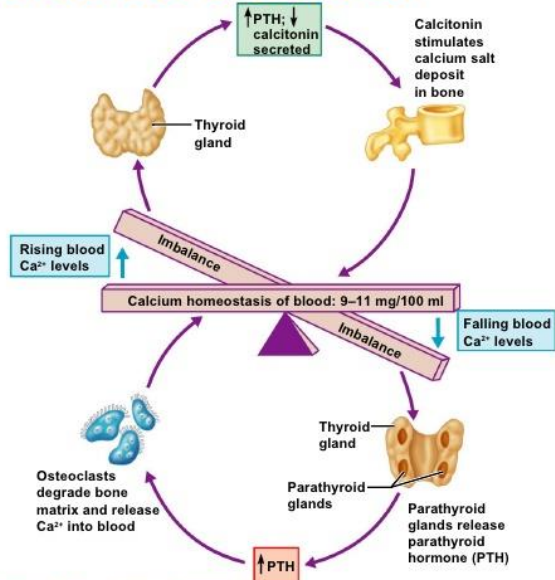
Calcium may be released as needed to maintain blood level required for the formation and secretion of hormone

Skeletal muscles help support the endocrine organs as the pancreas and thyroid glands

Thyroid gland location

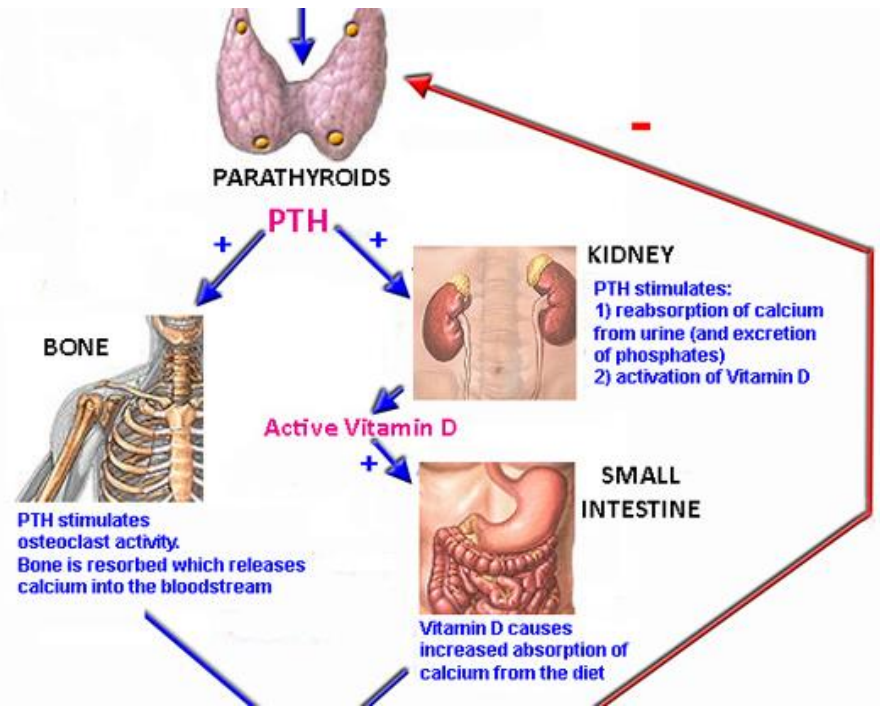


Hormonal Control of Blood Ca

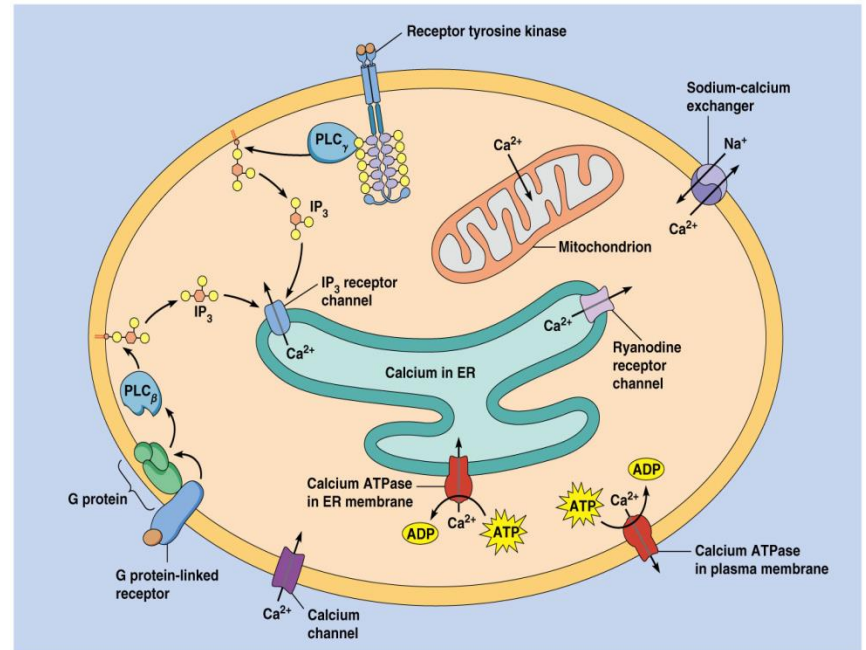
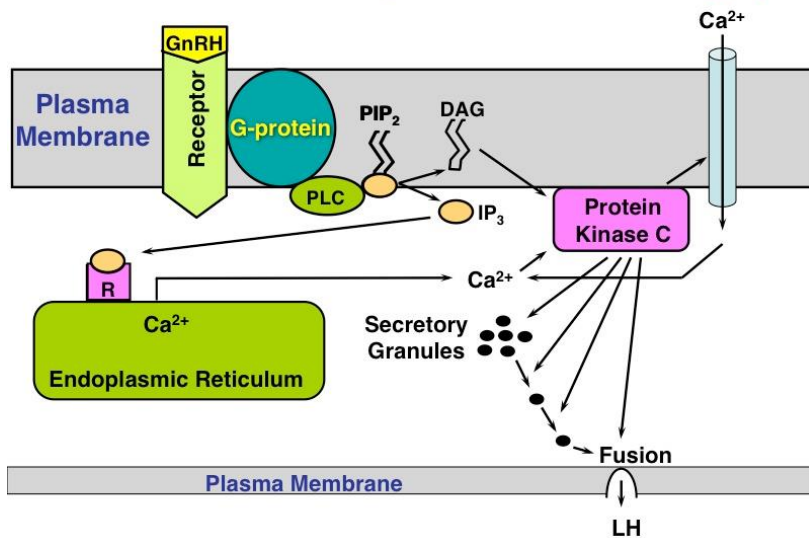


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Figure 6.11



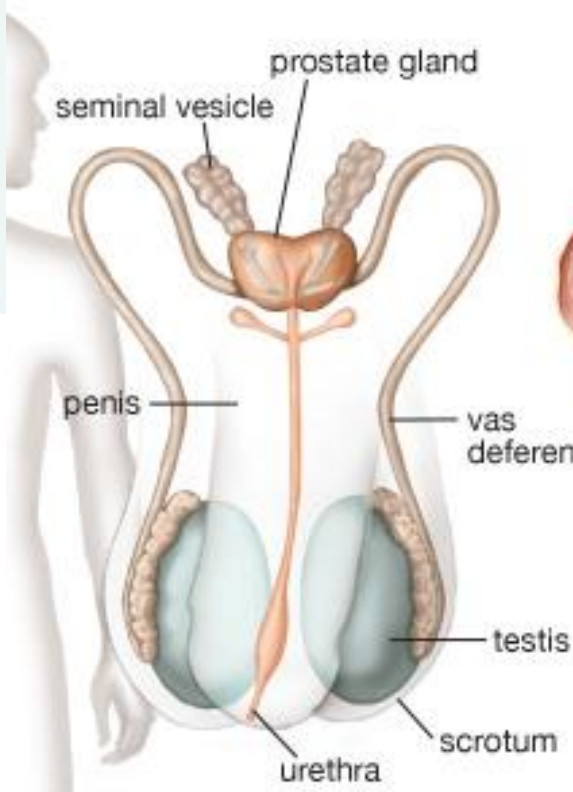
Protein Hormones (Ca^{2+} Second Messenger)



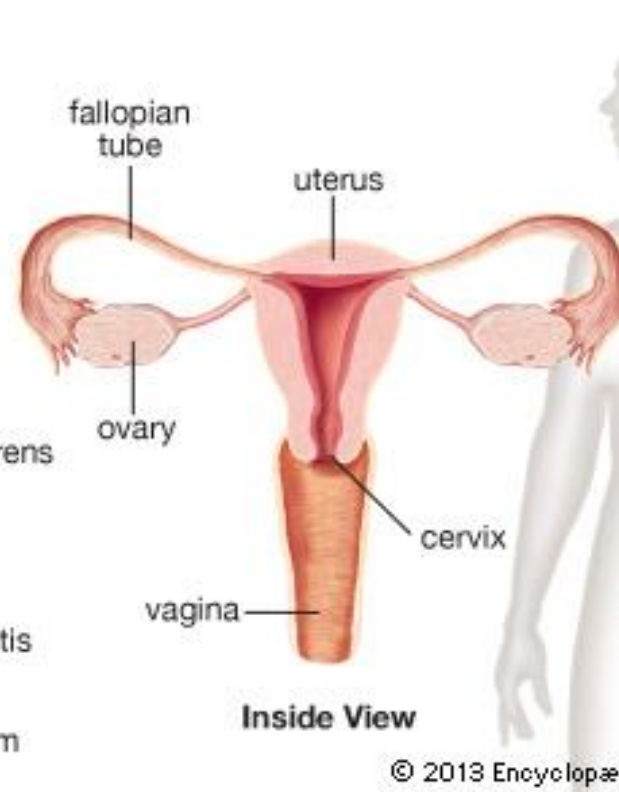
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Male Reproductive System



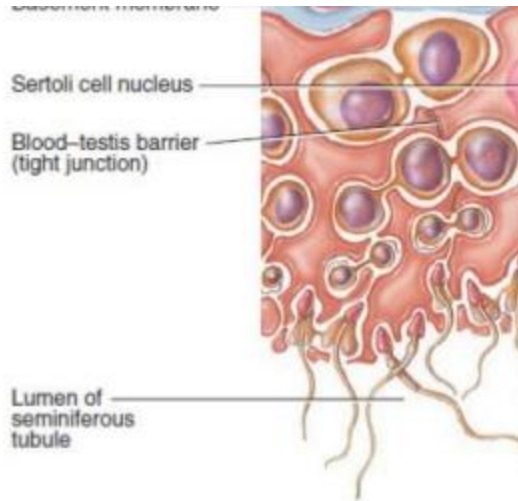
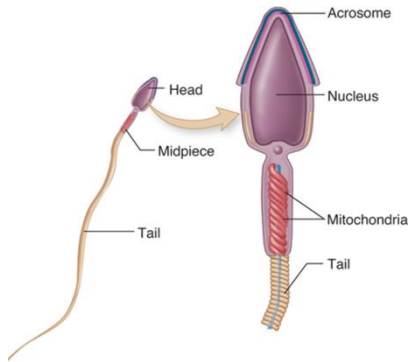
Female Reproductive System



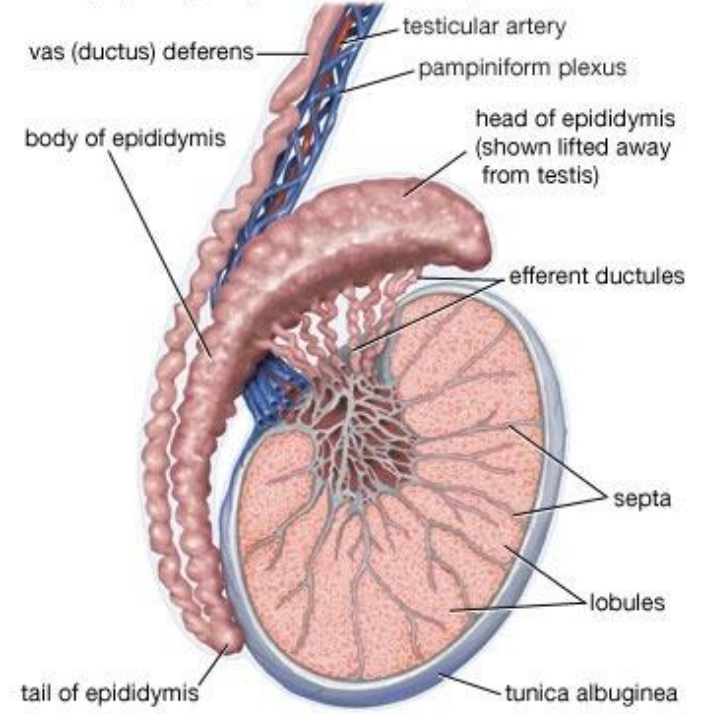
Pelvic bones protect female reproductive organs and associated glands in males

Calcium is available to help nourish a fetus and for milk production in a nursing mother

Smooth muscle contraction moves eggs and sperm, contraction of smooth muscle in the uterus expels a fetus during childbirth and assists with shedding of uterus lining (menstruation)



Testis, epididymis, and vas (ductus) deferens

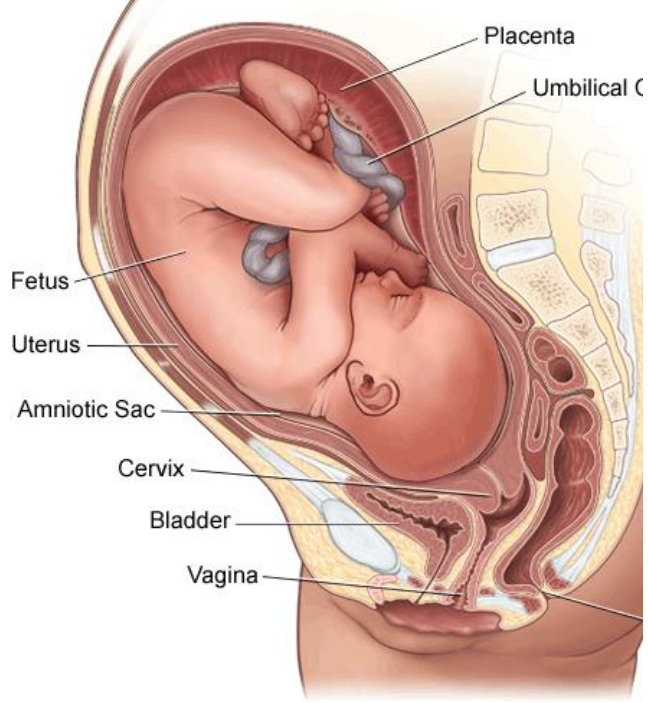


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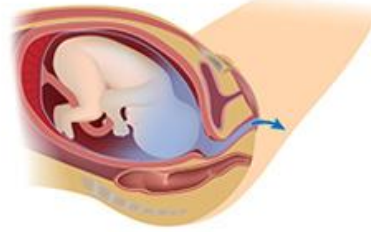
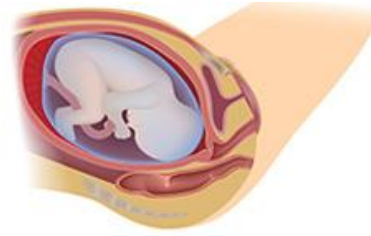
- Fungsi : Tempat terjadinya Spermatog

Sperm movement

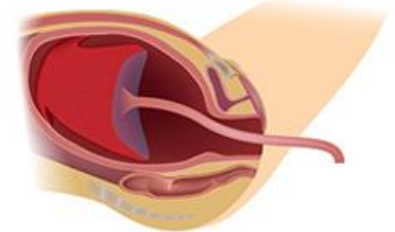
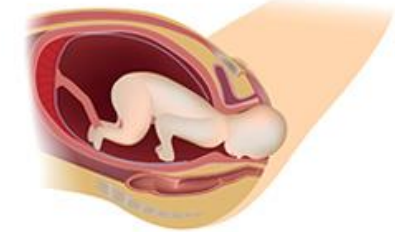
Fetus in Utero



Stages of Childbirth



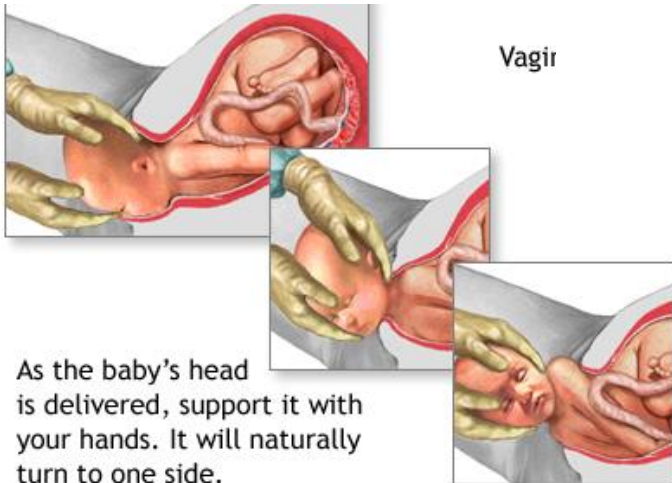
Fetal expulsion



Cervical dilatation

Delivery of placenta

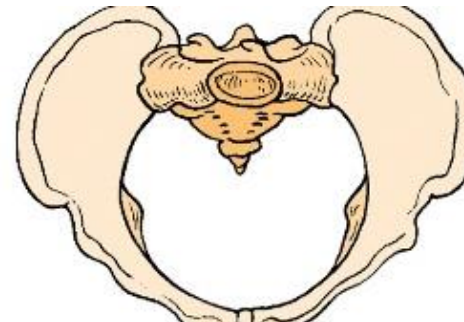
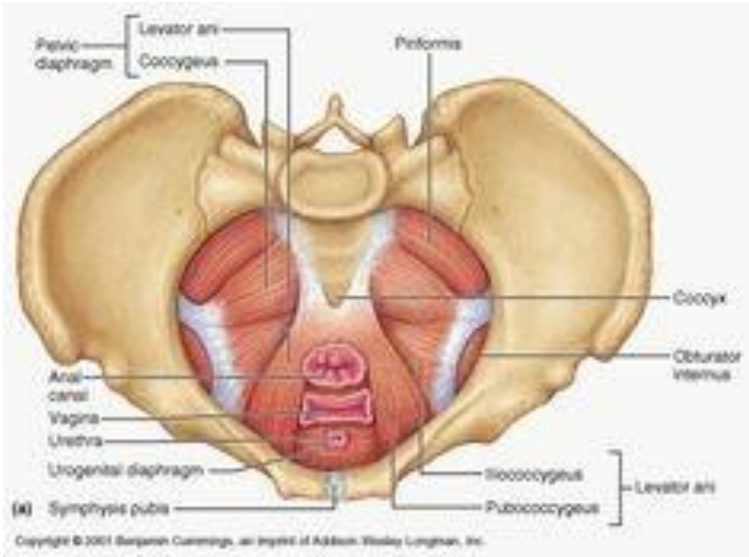
Vagir



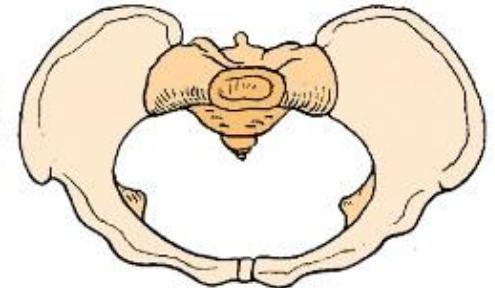
As the baby's head is delivered, support it with your hands. It will naturally turn to one side.

ADAM

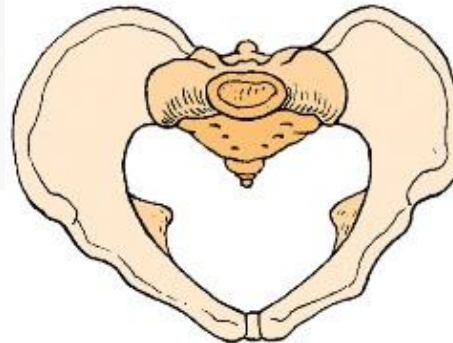




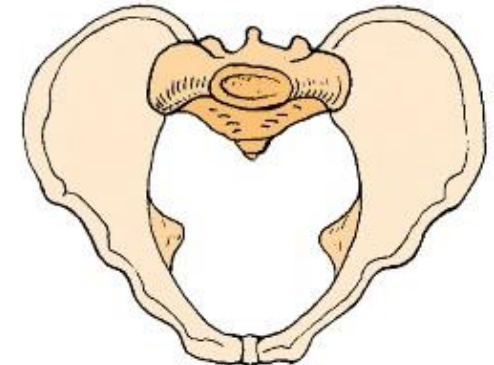
Gynecoid



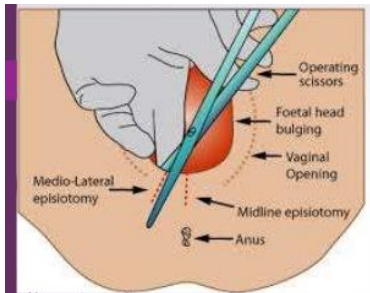
Platypelloid



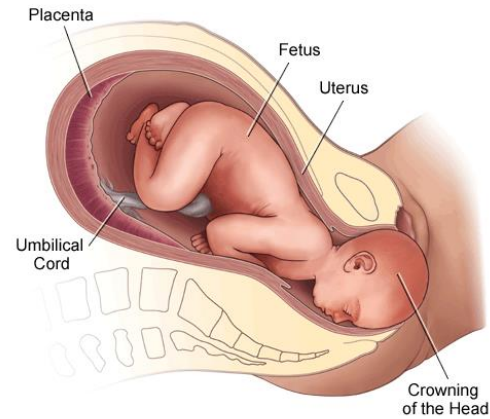
Android



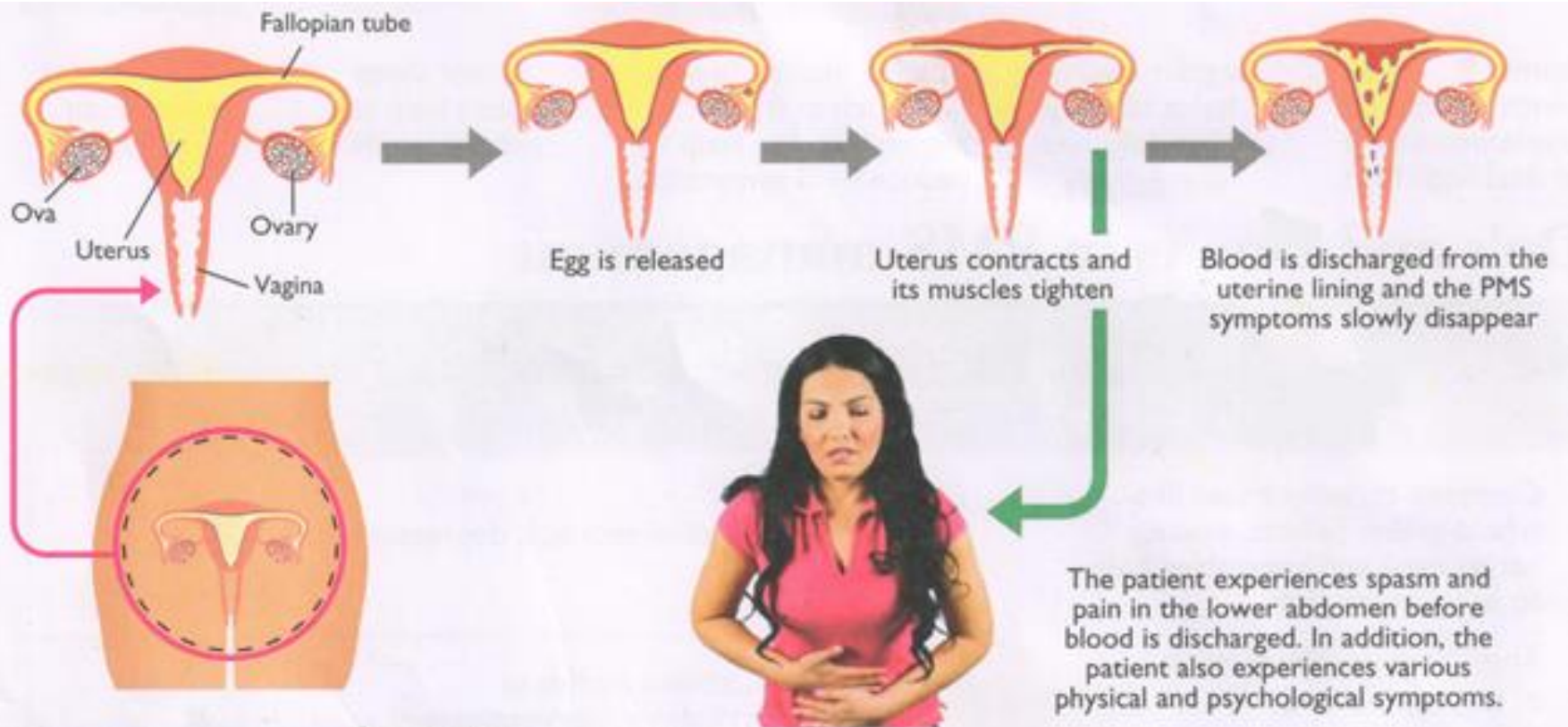
Anthropoid



Delivery of the Baby

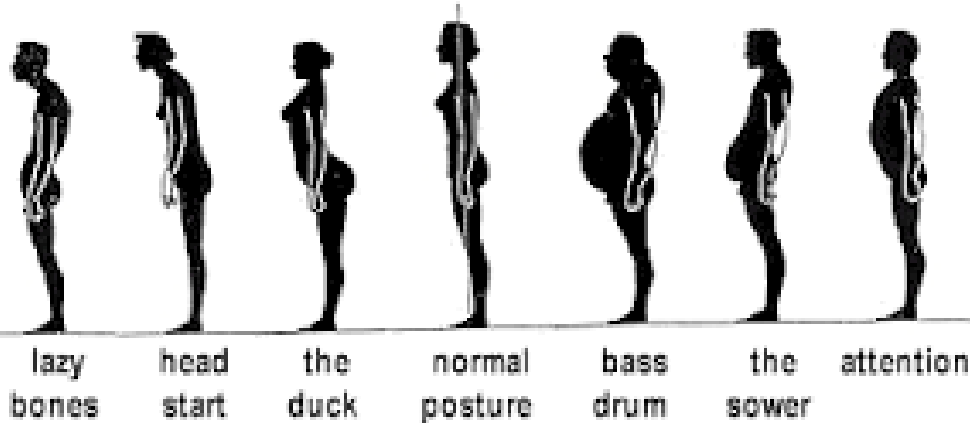
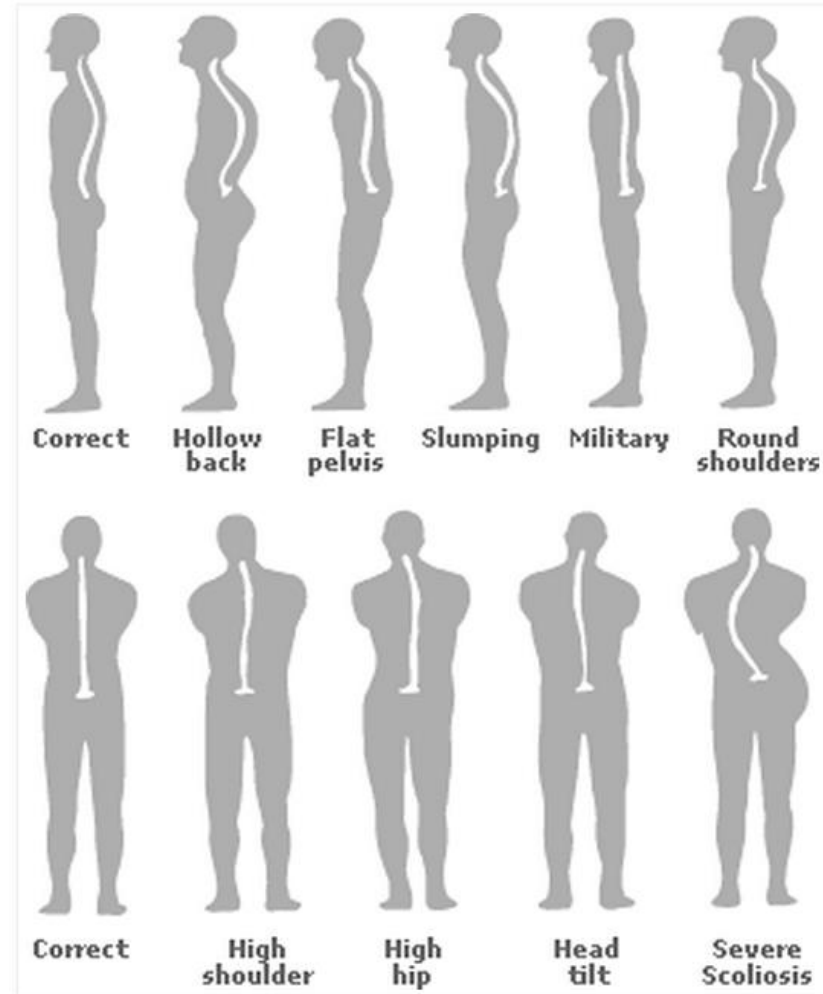
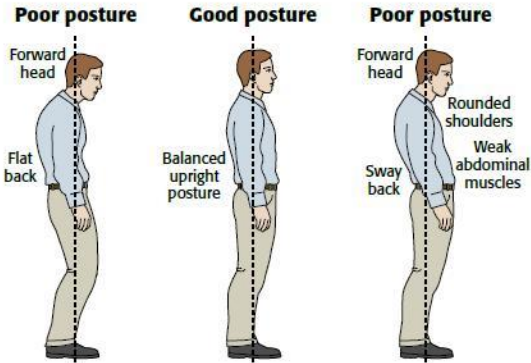
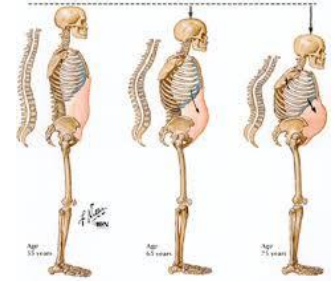


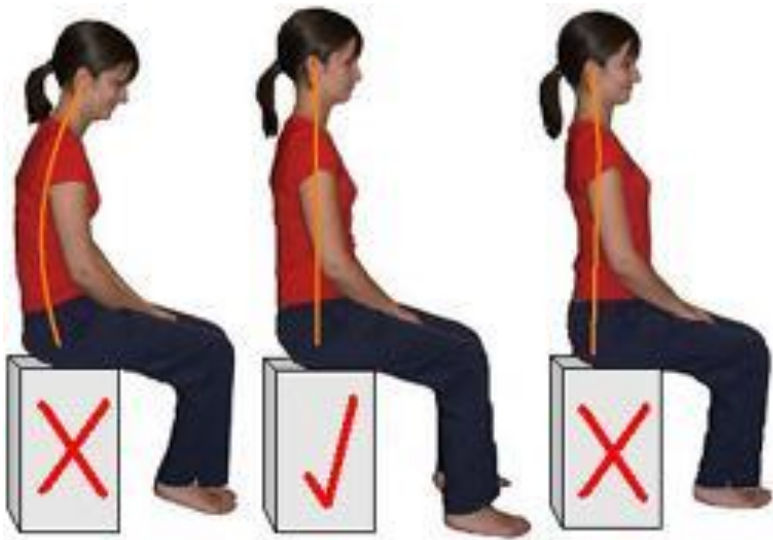
Symphysis pubis



Premenstrual syndrome

Posture disorder





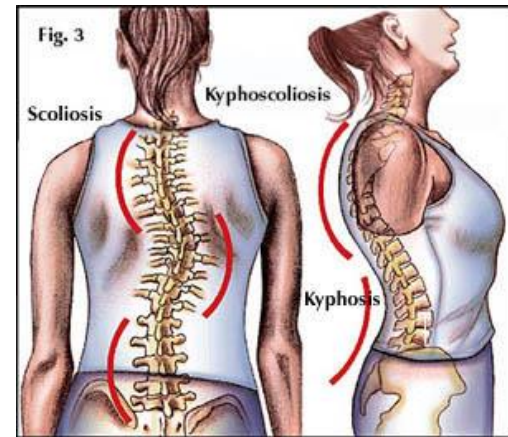
Posture ▶ High heels push the center of mass in the body forward, taking the hips and spine out of alignment.

Pressure High heels may make legs look longer, but as the heel height goes up, so does the pressure on the forefoot.

Pressure increases on forefoot when wearing:

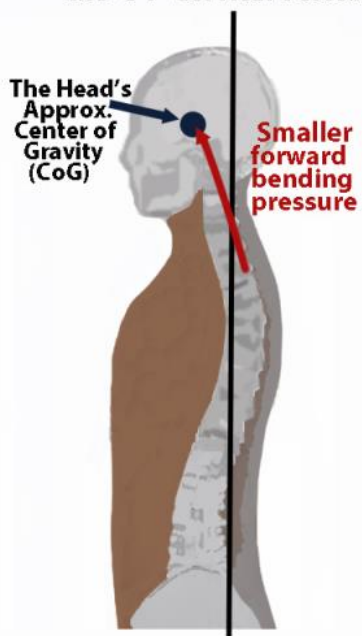
3-inch heels	+76%
2	+57%
1	+22%

CORRECT **ALTERED**

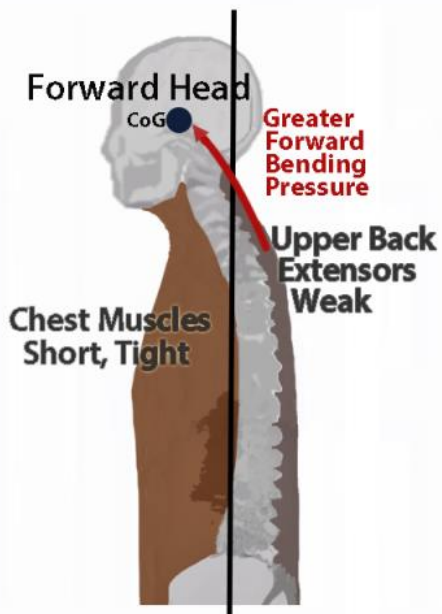


Upper Body in 4 Main Types of Standing Posture

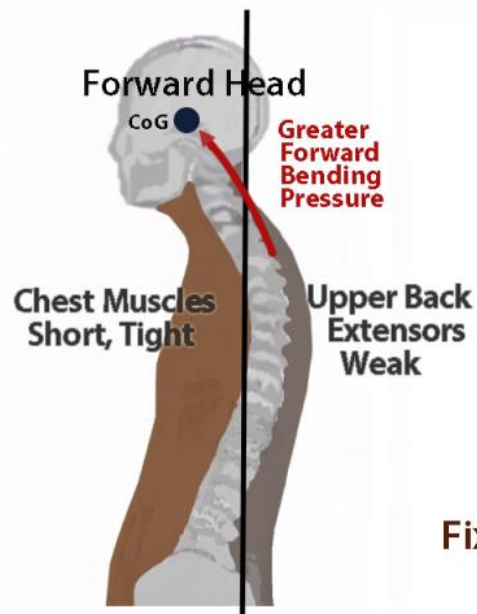
Approx. Plumb Line through the C-7 Cervical Vertebra



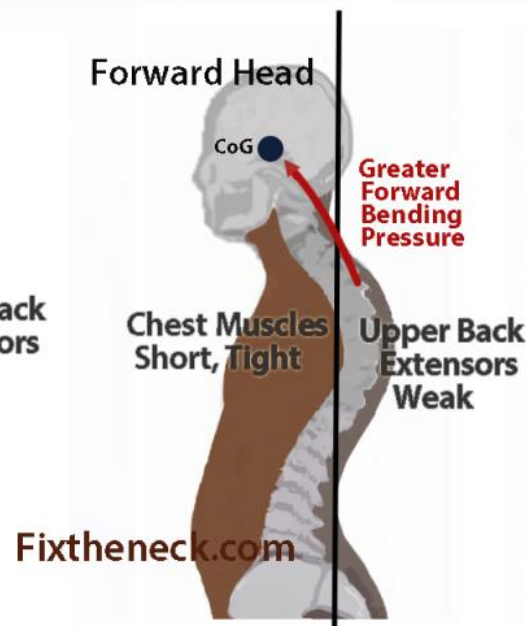
Balanced Posture



Flat Back



Swayback



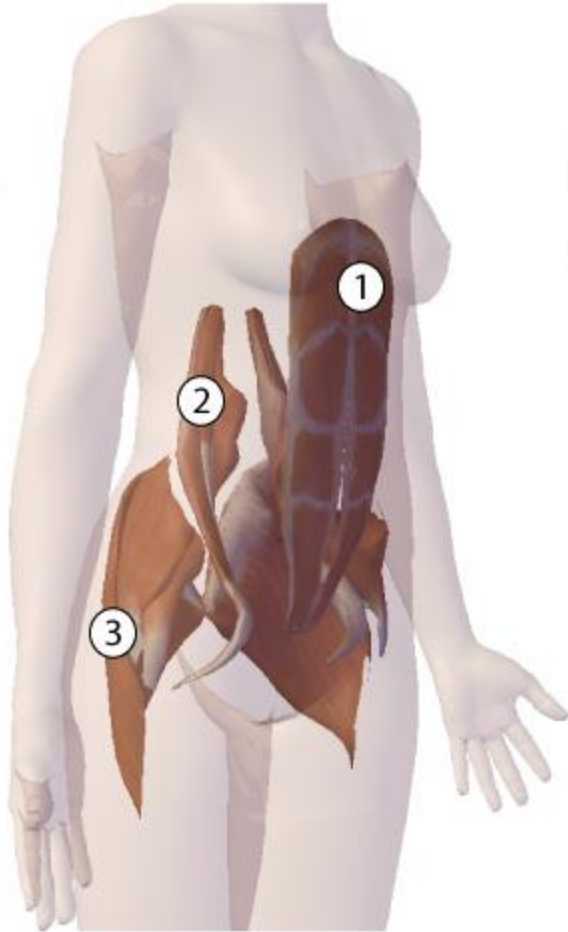
Kyphotic-Lordotic

MUSCLES AFFECTED BY FLAT BACK POSTURE

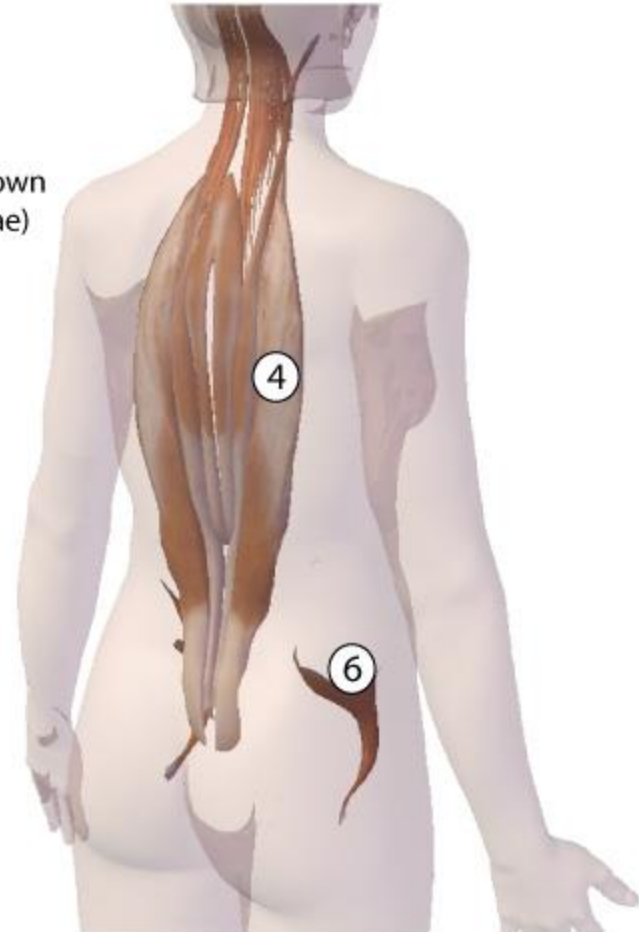
TIGHT/OVERACTIVE

INHIBITED/WEAKENED

1. Normal or tight rectus abdominus
2. Psoas
3. Glutei (buttock)



4. Back Extensors
5. Multifidus (not shown between vertebrae)
6. Iliacus



Effect of Pelvic Tilt and Hip/Knee Hyperextension on Lower Body Posture



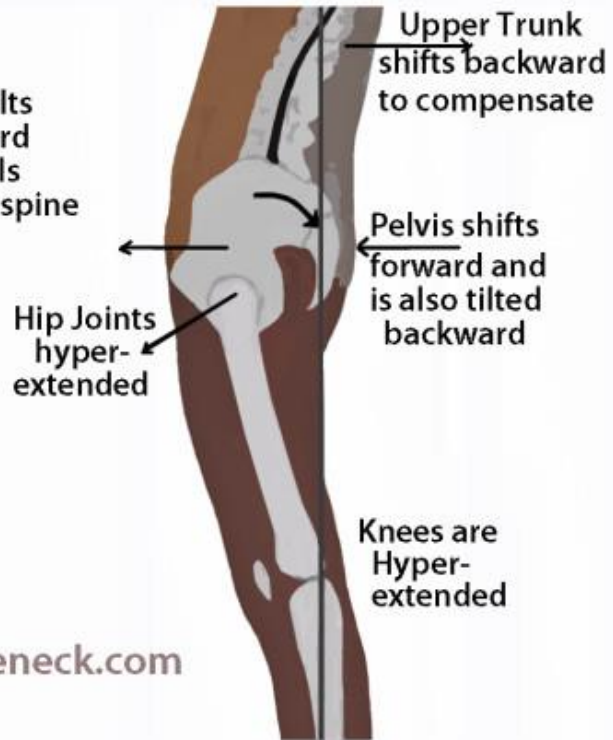
Pelvis tilts forward and pulls lumbar spine into lordosis

**Anterior Pelvic Tilt
Lordotic Back**



Pelvis tilts backward and pulls lumbar spine flat

**Posterior Pelvic Tilt
Flat Back**



fixtheneck.com

**Forward Shifted Pelvis
Swayback**



**Neutral Pelvic Tilt
Balanced Posture**

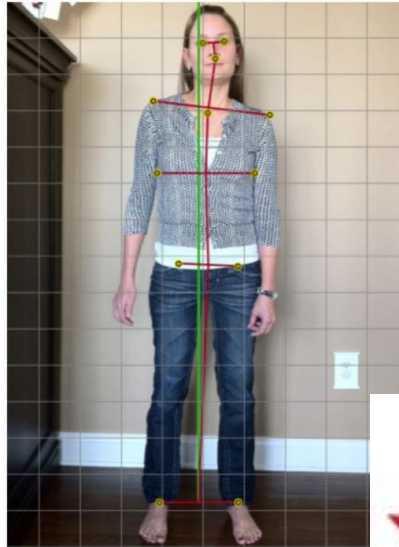
Normal



Abnormal



Your Posture from Front



Diagnose and correction

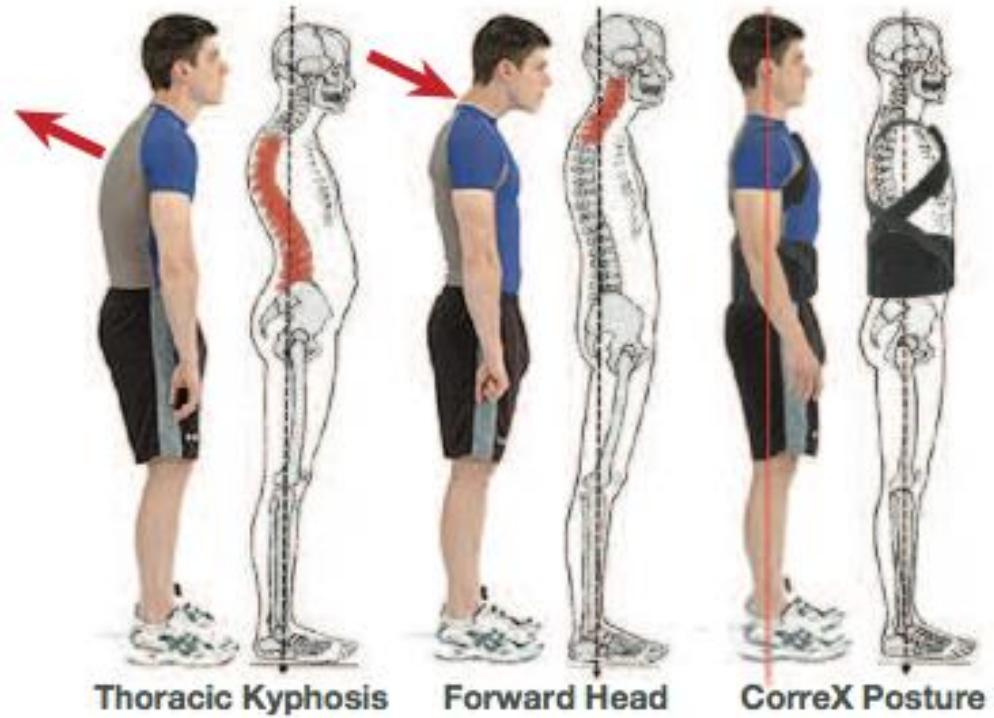
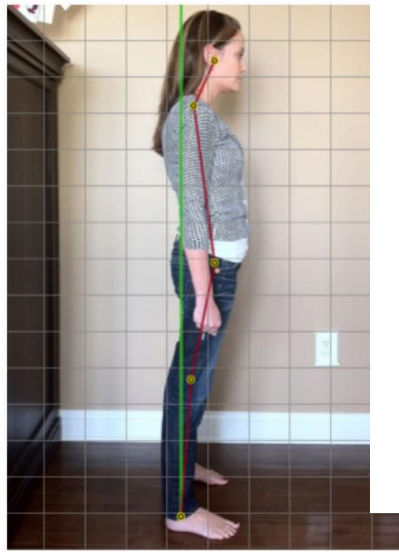
Normal



Abnormal



Your Posture from Side



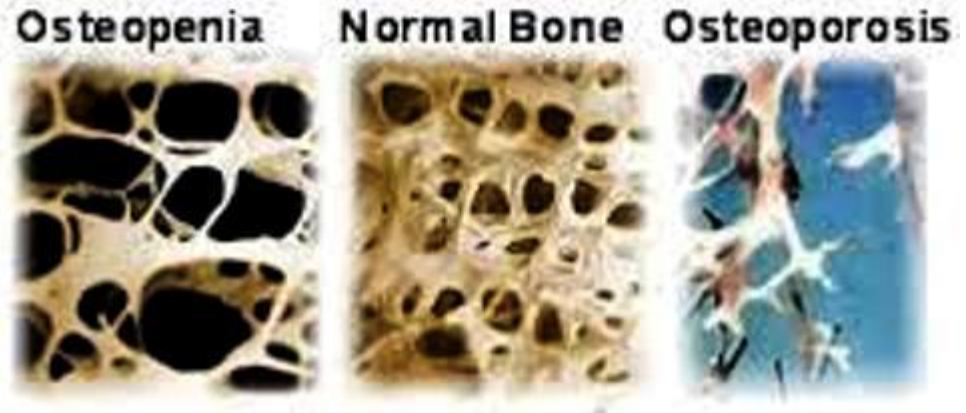
Thoracic Kyphosis

Forward Head

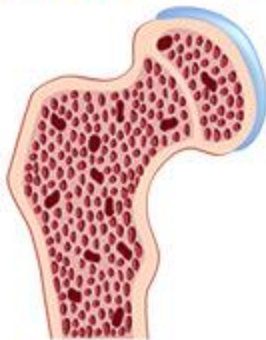
CorreX Posture

osteoporosis

STAGES OF OSTEOPOROSIS

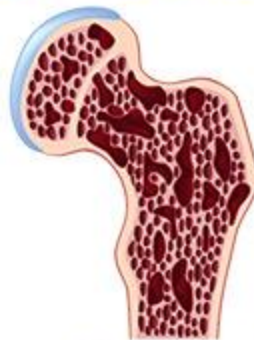


Osteopenia and Osteoporosis: The Difference



Osteopenia

Bone density has begun to dwindle, but is not yet considered dangerous.



Osteoporosis

Bone density levels become critical and frequent fractures are likely.



- **Osteopenia**

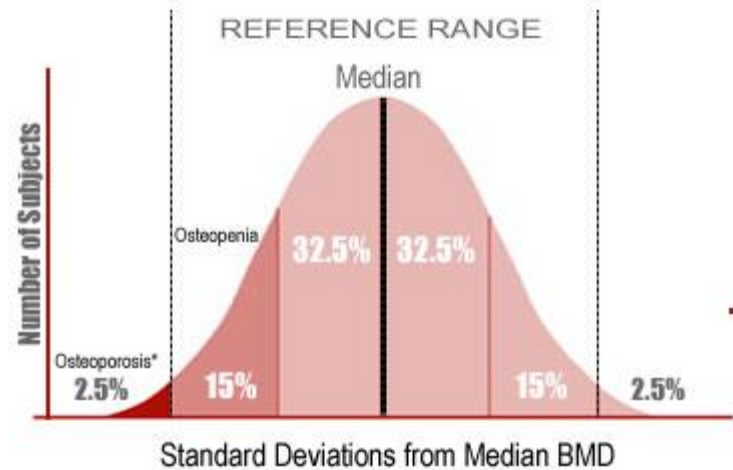
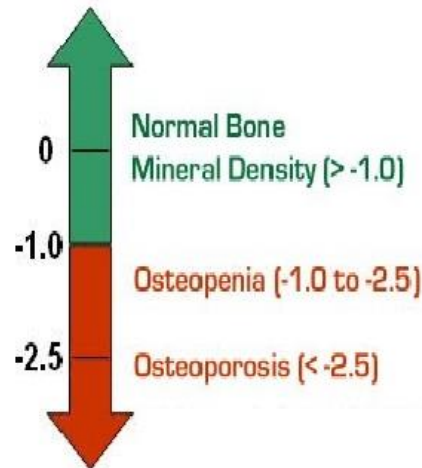
- Inadequate ossification that naturally occurs as part of the aging process
- Starting between the ages of 30 and 40:
 - Osteoblastic activity slows and osteoclastic activity increases

- **Osteoporosis**

- Loss of bone mass that impairs normal function and can lead to more fractures
- More common in women and accelerates after menopause
 - Due to a decline in circulating estrogens

Osteoporosis & Osteopenia

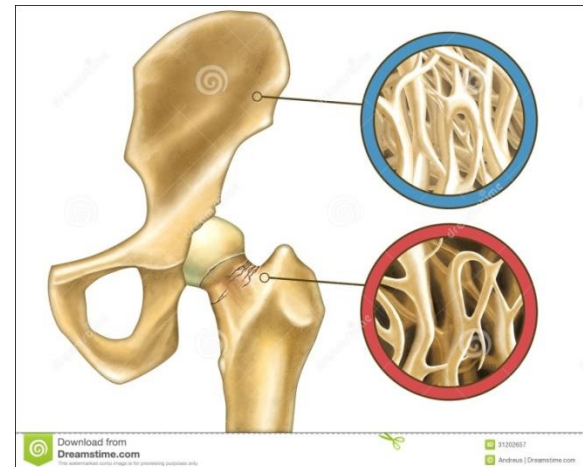
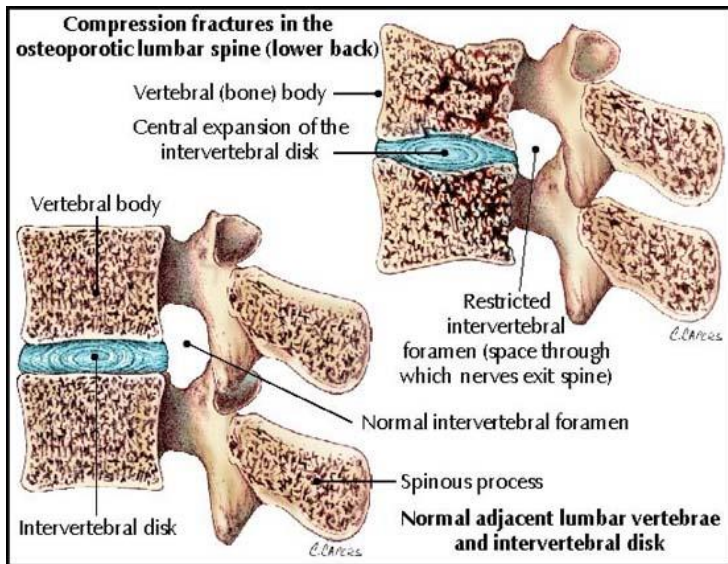
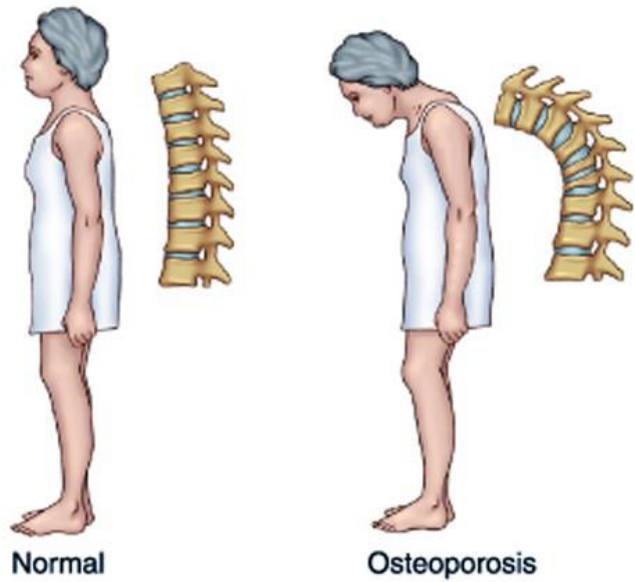
- Normal BMD within 1 standard deviation of young adult mean
- Osteopenia - BMD between 1 & 2.5 standard deviations below young adult mean
- Osteoporosis - BMD 2.5 standard deviations below young adult mean



Percentages refer to percentage of total subjects
 *T score between -2 and -2.5 refers to osteoporosis with a fracture.

Table 1. WHO Diagnostic Categories of Bone Mineral Density.

Diagnostic Category	Criterion
Normal	A value for BMD or BMC that is within 1.0 SD of the reference mean for young adults
Low bone mass (osteopenia)	A value for BMD or BMC that is more than 1.0 but less than 2.5 SD below the mean for young adults
Osteoporosis	A value for BMD or BMC that is 2.5 SD or more below the mean for young adults
Severe osteoporosis (established osteoporosis)	A value for BMD or BMC that is 2.5 SD or more below the mean for young adults in combination with one or more fragility (low-trauma) fractures.



Body Height > normal

- Gigantisme : excessive somatotrophin hormon in growing phase
- Acomegaly: excessive somatotrophin hormon in adult
- Eunochoid: testesectomy at child, testosteron lowest

Normal body height (cm)

male

- Dwarf : <130
- Very short:130-149.9
- Short:150-159.9
- Submedium:160-164.9
- Medium:164-166.9
- Supramedium:167-169.9
- Tall:170-179.9
- Very tall:180-199.9
- Giant:>200

female

- Dwarf : <121
- Very short:121-139.9
- Short:140-148.9
- Submedium:149-152.9
- Medium:153-155.9
- Supramedium:156-158.9
- Tall:159-167.9
- Very tall:168-186.9
- Giant:>187

Gigantisme

- **Gigantism**, also known as **giantism** (from Greek γίγας *gigas*, "giant", plural γίγαντες *gigantes*), is a condition characterized by excessive growth and height significantly above average.
- In humans, this condition is caused by over-production of growth hormone in childhood resulting in persons between 2.13 m (7 feet or 84 inches) and 2.74 m (9 feet or 108 inches) in height.



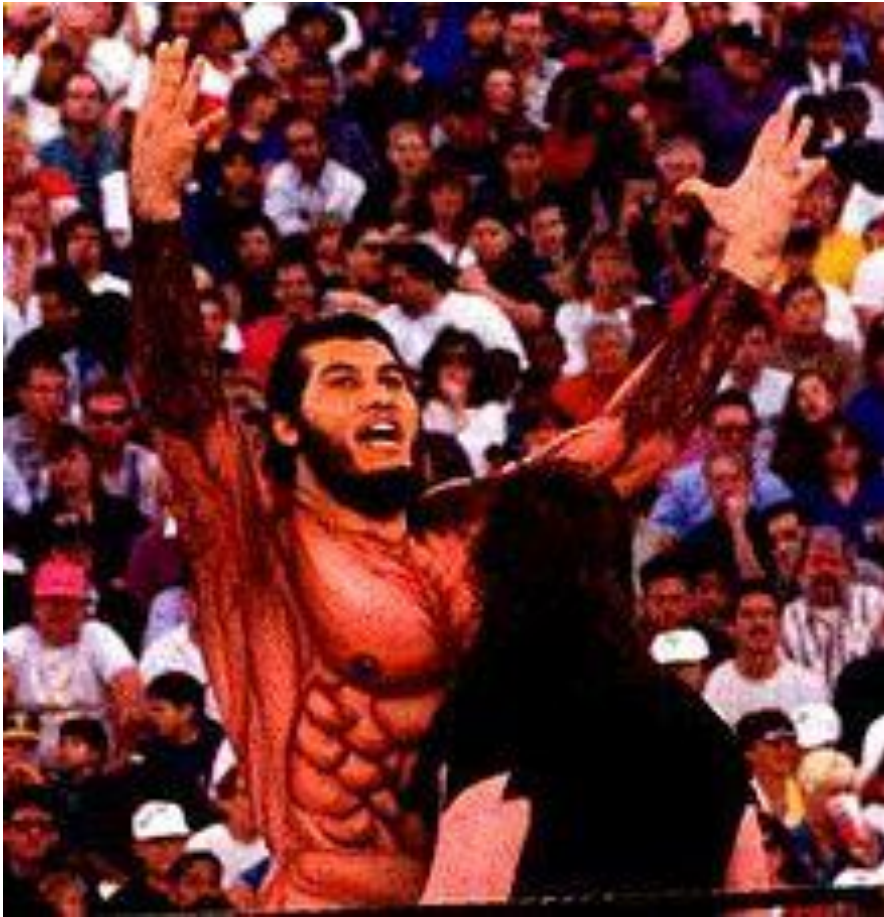
- Giantess Anna Swan with her parents



- Robert Wadlow the tallest man known to have lived (2.72 metres or 8 feet 11 inches) with his father, Harold Wadlow (1.82 metres or 6 feet 0 inches)

giantisme

- The term is typically applied to those whose height is not just in the upper 1% of the population but several standard deviations above mean for persons of the same sex, age, and ethnic ancestry.
- The term is seldom applied to those who are simply "tall" or "above average" whose heights appear to be the healthy result of normal genetics and nutrition.
- Gigantism is usually caused by a tumor on the pituitary gland of the brain.
- It causes growth of the hands, face, and feet.
- In some cases the condition can be passed on genetically through a mutated gene.
- Other names somewhat obsolete for this pathology are hypersoma (Greek: *hyper* over the normal level; *soma* body) and somatomegaly (Greek; *soma* body, genitive *somatos* of the body; *me-gas*, gen. *megalou* great).

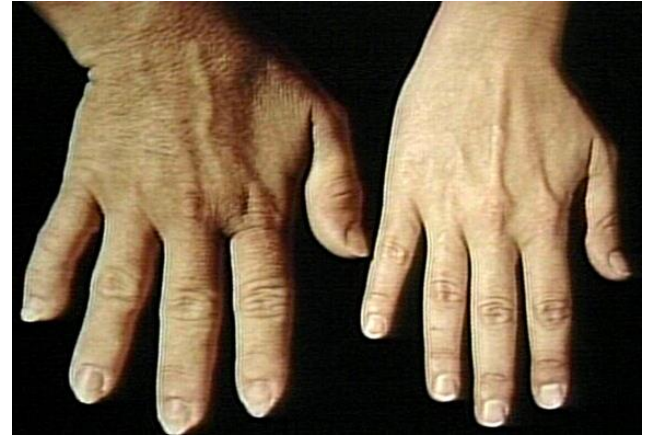


- Giant Gonzales (1966–2010) was a wrestler with gigantism, like wrestlers Andre Rene Roussimoff and Dalip Singh
- In this photo, Gonzalez, in "muscle" design attire, stands in front of 2.08 m (6 ft 10 in) tall rival "The Undertaker".

Acromegaly

- **Acromegaly** (,ækrə'megəli; from Ancient Greek *ἄκρος* *akros* "extreme" or "extremities" and *μεγάλος* *megalos* "large") is a syndrome that results when the anterior pituitary gland produces excess growth hormone (GH) after epiphyseal plate closure at puberty
- A number of disorders may increase the pituitary's GH output, although most commonly it involves a tumor called pituitary adenoma, derived from a distinct type of cell (somatotrophs).
- Acromegaly most commonly affects adults in middle age, and can result in severe disfigurement, complicating conditions, and premature death if unchecked.
- Because of its pathogenesis and slow progression, the disease is hard to diagnose in the early stages and is frequently missed for years until changes in external features, especially of the face, become noticeable.
- Acromegaly is often associated with gigantism
- Mandibular overgrowth leads to prognathism, maxillary widening, teeth spacing and malocclusion

Acromegaly



Acromegaly

- Features that result from high level of GH or expanding tumor include:
- Soft tissue swelling visibly resulting in enlargement of the hands, feet, nose, lips and ears, and a general thickening of the skin.
- Soft tissue swelling of internal organs, notably the heart with attendant weakening of its muscularity, and the kidneys, also the vocal cords resulting in a characteristic thick, deep voice and slowing of speech
- Generalized expansion of the skull at the fontanelle
- Pronounced brow protrusion, often with ocular distension (frontal bossing)
- Pronounced lower jaw protrusion (prognathism) with attendant macroglossia (enlargement of the tongue) and teeth spacing
- Hypertrichosis, hyperpigmentation, and hyperhidrosis may occur in these patients. Acrochordon (skin tags); Carpal tunnel syndrome

Eunochoid

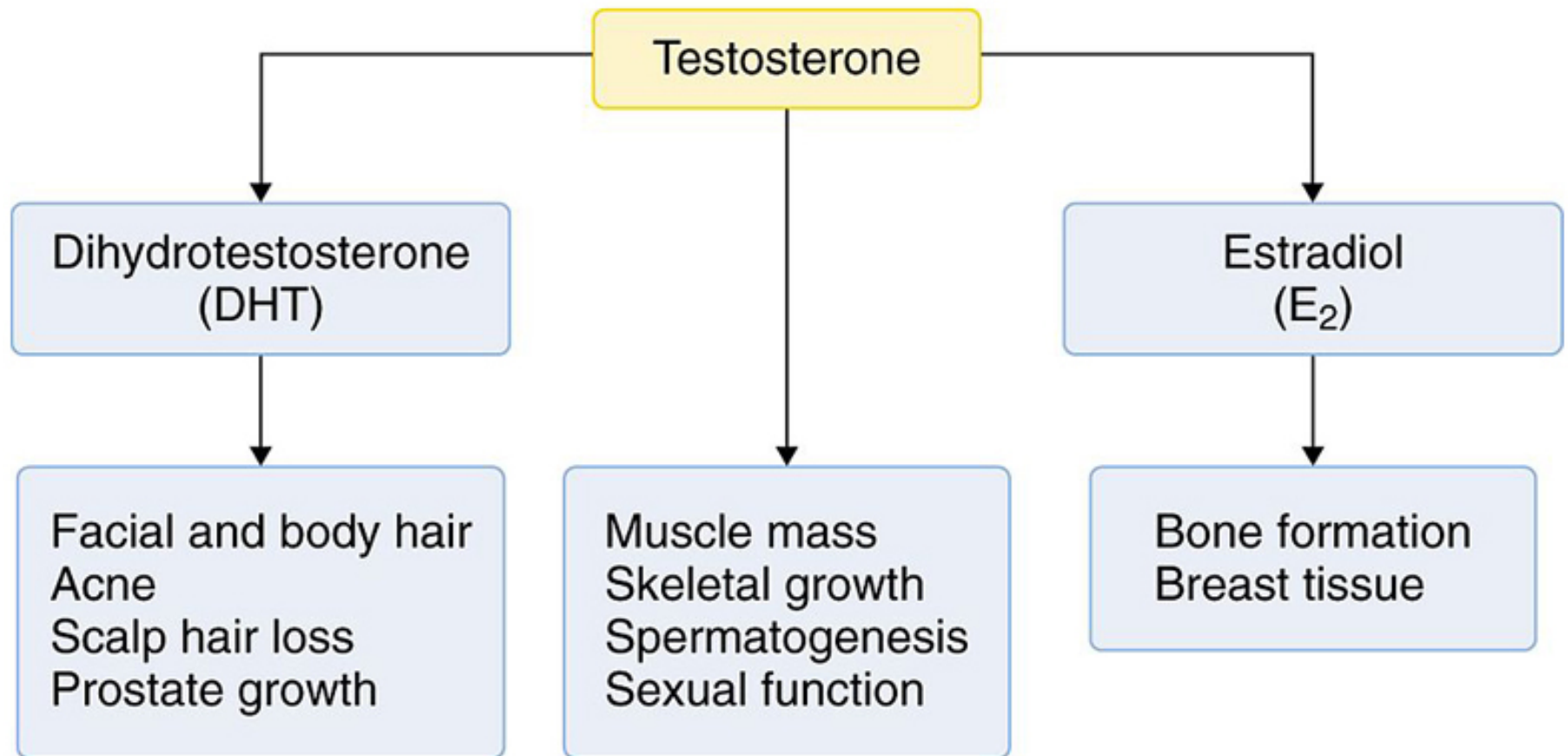


- *Eunuch* comes from the Greek word *eunoukhos*
- A **eunuch** is a man who (by the common definition of the term) may have been castrated, typically early enough in his life for this change to have major hormonal consequences.
- In some ancient texts, "eunuch" may refer to a man who is not castrated but who is impotent, celibate, or otherwise not inclined to marry and procreate.

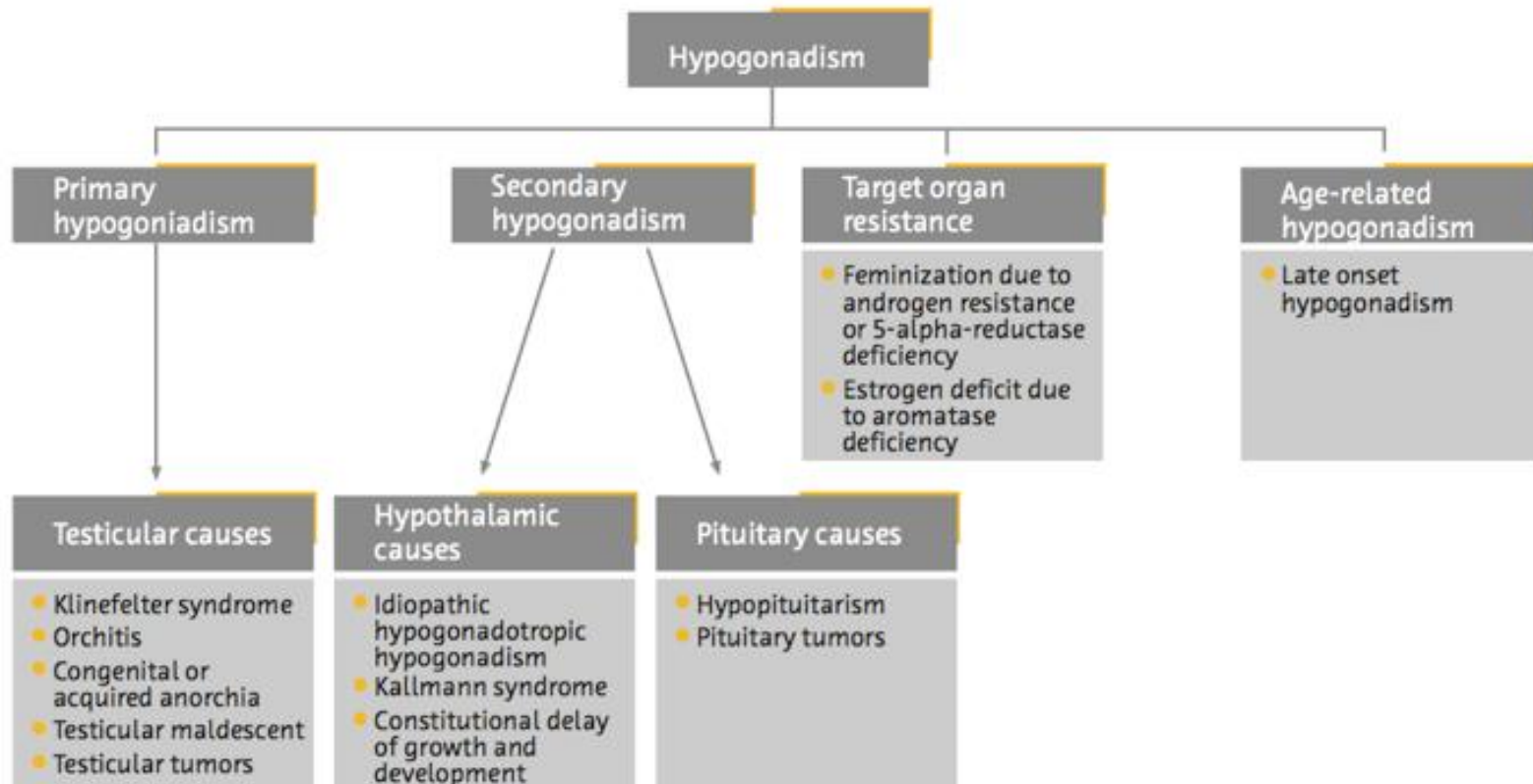
Castration eunuchs

- Castration was typically carried out on the soon-to-be eunuch without his consent in order that he might perform a specific social function; this was common in many societies.
- The earliest records for intentional castration to produce eunuchs are from the Sumerian city of Lagash in the 21st century BC.
- Over the millennia since, they have performed a wide variety of functions in many different cultures: courtiers or equivalent domestics, treble singers, religious specialists, soldiers, royal guards, government officials and guardians of women or harem servants.
- Eunuchs would probably be servants or slaves who, because of their function, had been castrated usually in order to make them reliable servants of a royal court where physical access to the ruler could wield great influence

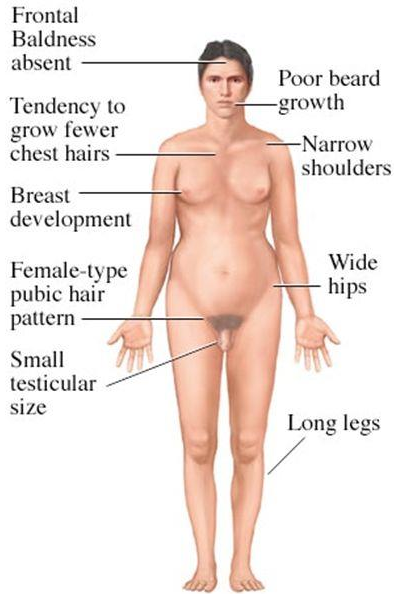
Effects of Testosterone and its Metabolites in Men



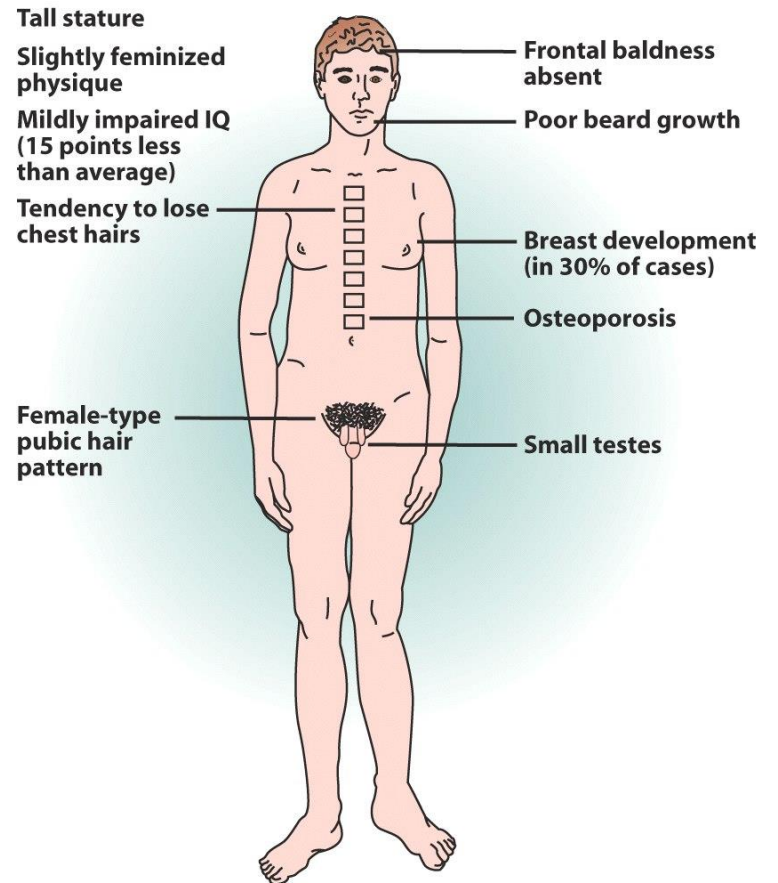
Classification of hypogonadism

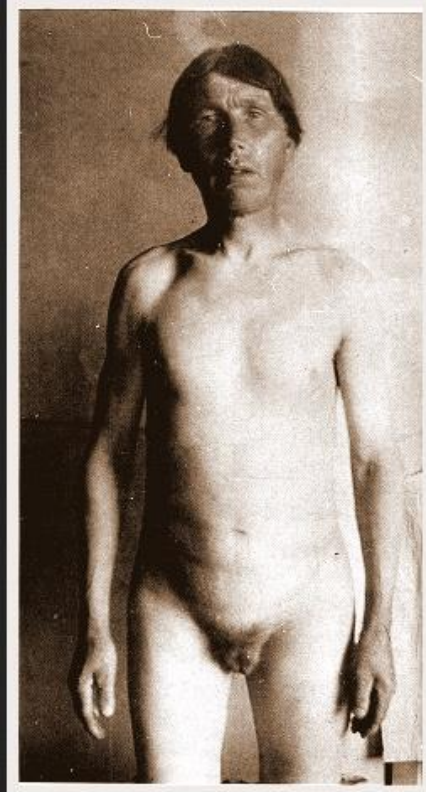


Klinefelter syndrome



- Lower IQ than sibs
- Tall stature
- Poor muscle tone
- Reduced secondary sexual characteristics
- Gynaecomastia (male breasts)
- Small testes/infertility





Non-castrated eunuchs

- According to Aristotle , male or female gender is defined by the function played in procreation and consists of two elements: the faculty to procreate and the anatomical parts needed to put that faculty in practice
- Any man who either lacked the faculty of procreation from birth, even with a full set of genitals , or was eventually deprived of the anatomical parts necessary for procreation met the definition of a eunuch.
- Hence, the term "eunuch" was applied not only to castrated men, but also to a wide range of men who were unable to procreate.

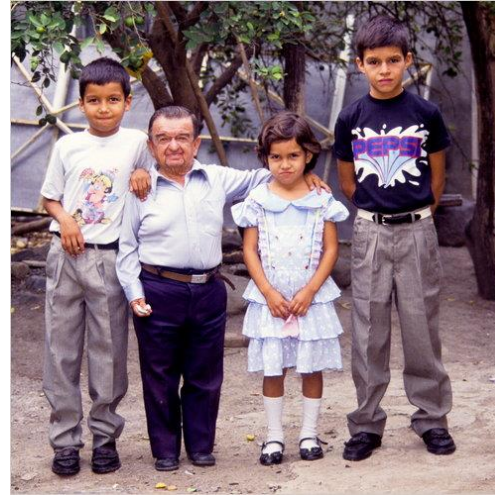
Body Height < normal

- Nanisme: lacking somatotrophin hormon in growing phase
- Infantilism: lacking somatotrophin hormon and reproduction hormon in growing phase
- Cretinisme: : lacking thyroxin hormon in growing phase
- Chondrodystrophia: disorder in chondrogenesis, stopping in long bone growth and basis cranii

Nanism (dwarfism)

- **Dwarfism** occurs when an individual person is short in stature resulting from a medical condition caused by abnormal (slow or delayed) growth.
- In humans, dwarfism is sometimes defined as an adult height of less than 4 feet 10 inches (58 in; 147 cm).
- *Disproportionate* dwarfism is characterized by one or more body parts being relatively large or small in comparison to those of an average-sized adult, with growth variations in specific areas being apparent.
- In cases of *proportionate* dwarfism, the body appears normally proportioned, but is unusually small.

nanisme



Chondrodystrophy

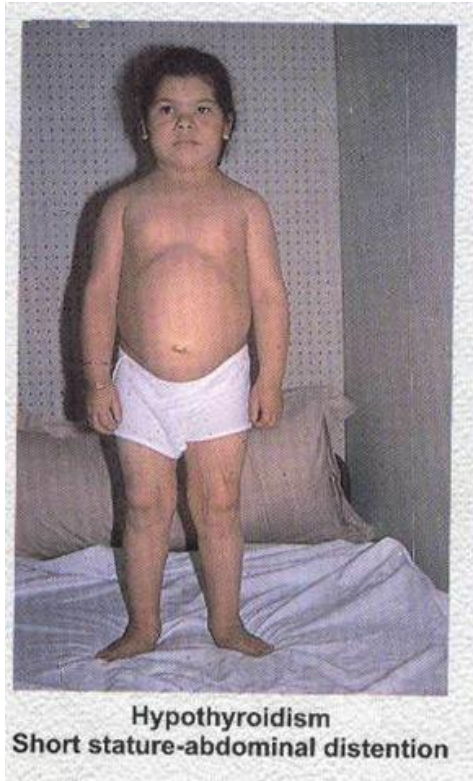
- (literally, "cartilage maldevelopment") refers to a skeletal disorder caused by one of myriad genetic mutations that can affect the development of cartilage
- As a very general term it is only used in the medical literature when a more precise description of the condition is unavailable.
- People with chondrodystrophy have a normal-sized trunk and abnormally short limbs and extremities (Dwarfism)
- Those affected with the disorder often call themselves dwarves, little people or short-statured persons.
- Over 100 specific skeletal dysplasias have been identified. Chondrodystrophy is found in all races and in both females and male and occurs in around one of every 25,000 children.
- Chondrodystrophy and Achondroplasia are the most common forms of genetic hyaline disorders

chondrodystrophy

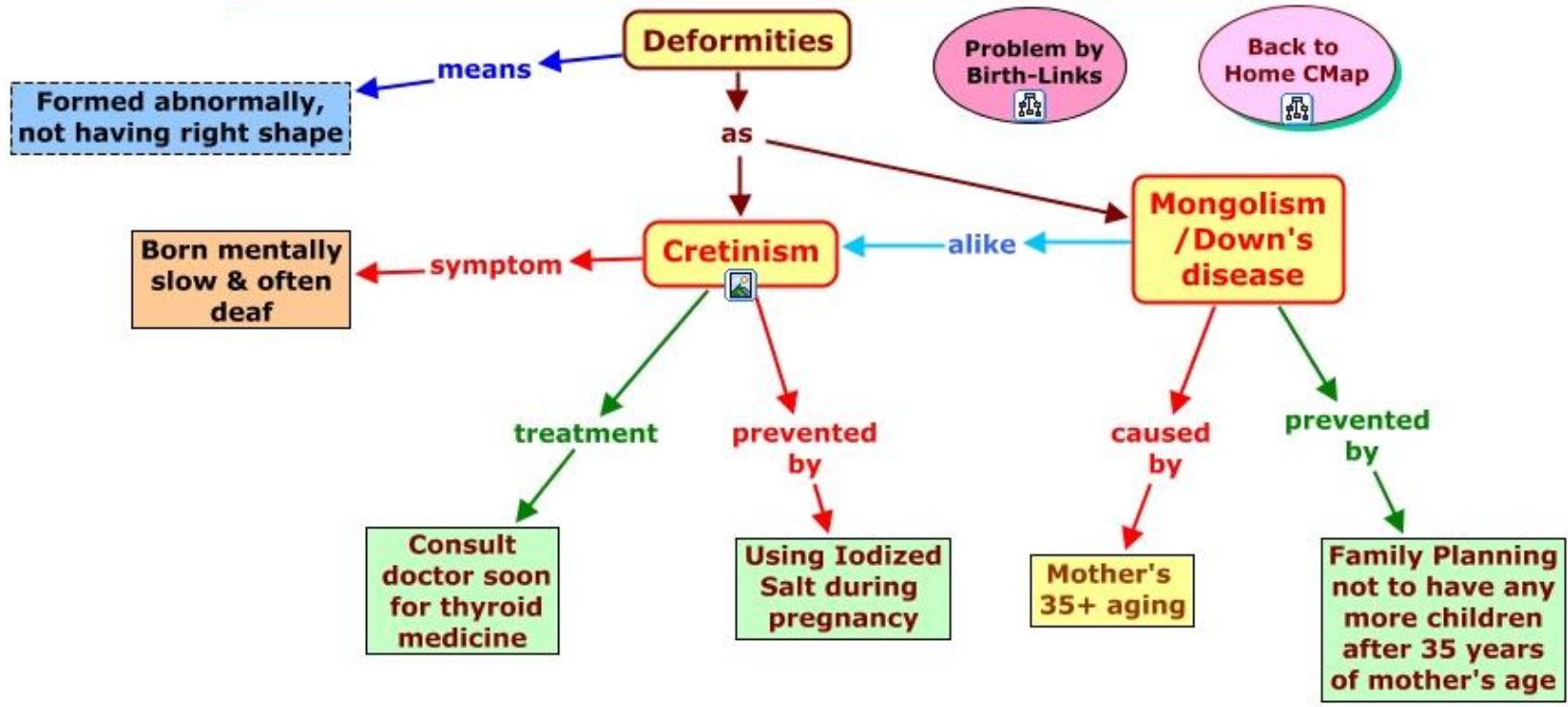
- Hyaline cartilage caps the long bones and the spinal vertebrae. Most childhood limb growth takes place at the ends of the long bones, not in the shaft.
- Normally, as a child grows, the most interior portion of the joint cartilage converts into bone, and new cartilage forms on the surface to maintain smooth joints.
- The old joint margins (edges) reabsorb, so that the overall shape of the joint is maintained as growth continues.
- Failure of this process throughout the body results in skeletal dysplasia.
- It also leads to very early onset of osteoarthritis, because the defective cartilage is extremely fragile and vulnerable to normal wear and tear.



cretinisme



Zoom- Problems by Birth: Deformities-Cretinism, Mongolism



Infantilism (adiposogenital dystrophy)

- **infantilism** may refer to:
- In psychology Paraphilic infantilism , a paraphilia involving the desire to wear diapers and/or fantasies of a return to infancy
- Psychosexual infantilism, a concept in psychosexual development introduced by Sigmund Freud
- In medicine Infantilism (physiological disorder) obsolete use of the term for some developmental disorders and disabilities
- Infantilism, also known as infantile speech, a speech disorder in which early speech stages persist beyond the age they are normally expected to fade
- Hypothalamic infantilism-obesity, or sexual infantilism, synonyms for adiposogenital dystrophy

Marfan syndrome

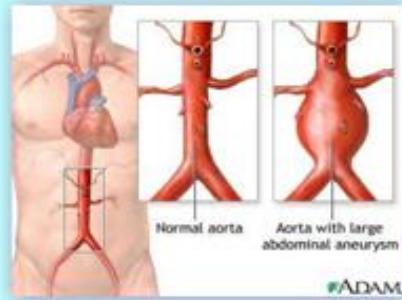
(Marfan's syndrome)

- is a genetic disorder of connective tissue.
- It has a variable clinical presentation, ranging from mild to severe systemic disease.
- The most serious manifestations involve defects of the heart valves and aorta, which may lead to early death if not properly managed.
- The syndrome also may affect the lungs, eyes, dural sac surrounding the spinal cord, the skeleton, and the hard palate.
- People with Marfan syndrome tend to be unusually tall, with long limbs and long, thin fingers and toes.
- The syndrome is caused by the misfolding of fibrillin-1, a glycoprotein which forms elastic fibers in connective tissue and contributes to cell signaling activity by binding to and sequestering transforming growth factor beta (TGF- β)

Martan Syndrome

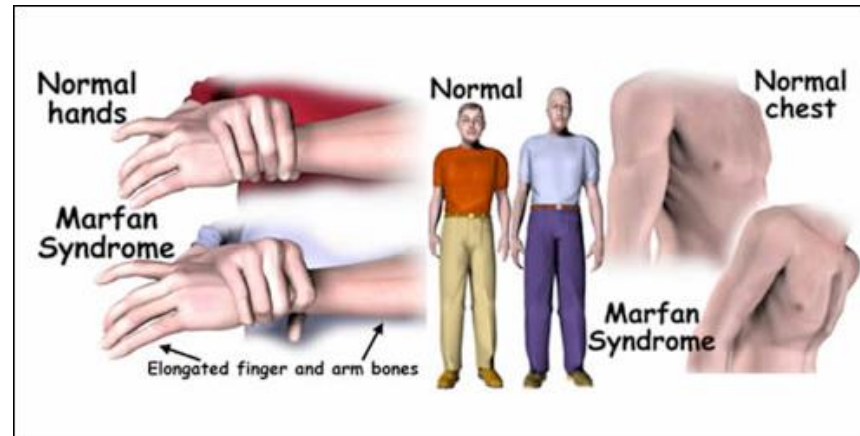
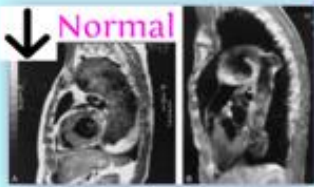


By:
Faith Breen
Audrey Herberger
Bella Cafaro



Marfan Syndrome Affects:

1. Skeleton
2. Eyes
3. Cardiovascular System
4. Lungs
5. Nervous System



Osteo- arthritis

Who Gets Osteoarthritis?

Osteoarthritis occurs most often in older people. Younger people sometimes get osteoarthritis, primarily from joint injuries.

What Causes Osteoarthritis?

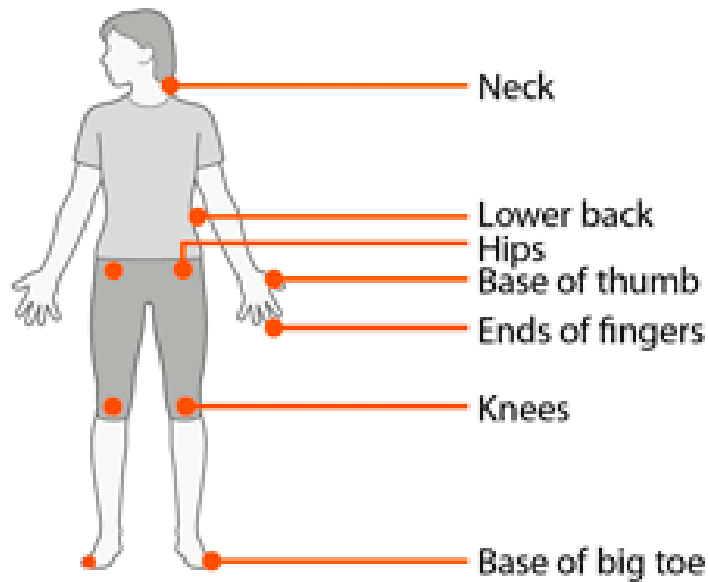
Osteoarthritis usually happens gradually over time. Some risk factors that might lead to it include:

- Being overweight.
- Getting older.
- Joint injury.
- Joints that are not properly formed.
- A genetic defect in joint cartilage.
- Stresses on the joints from certain jobs and playing sports.

How Is Osteoarthritis Diagnosed?

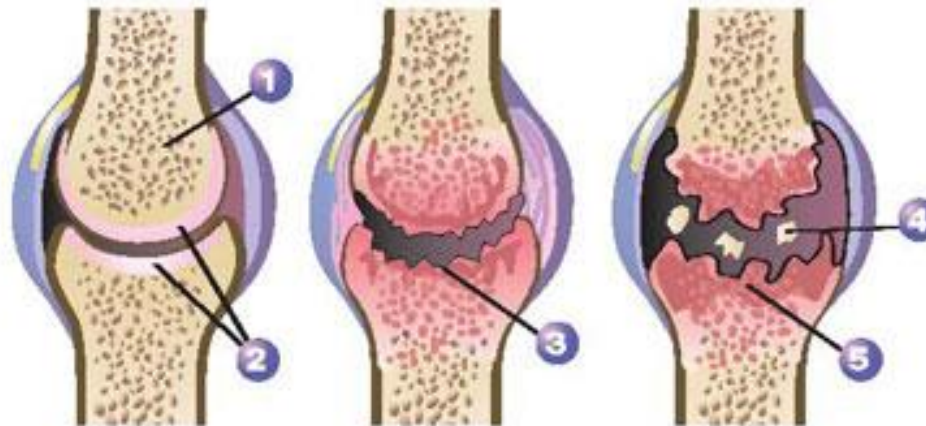
Osteoarthritis can occur in any joint. It occurs most often in the hands, knees, hips, and spine. Warning signs of osteoarthritis are:

- Stiffness in a joint after getting out of bed or sitting for a long time.
- Swelling or tenderness in one or more joints.
- A crunching feeling or the sound of bone rubbing on bone.



The joints most often affected by osteoarthritis

Evolution of Osteoarthritis



1. Bone
2. Cartilage
3. Thinning of cartilage

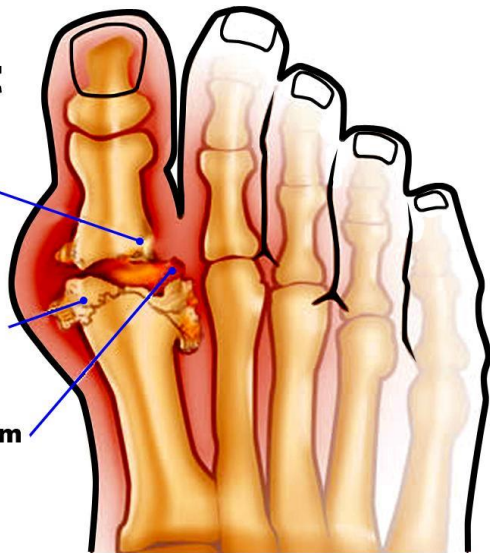
4. Cartilage remnants
5. Destruction of cartilage

Gout

Bone erosions

Urate crystals in a tophus

Synovium

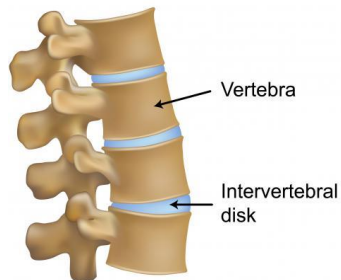


Normal

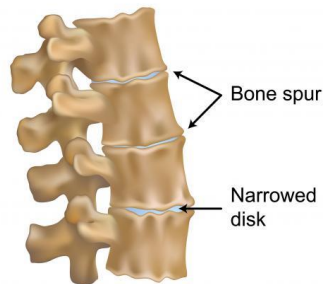
Arthritic



Osteoarthritis of Spine



Healthy spine

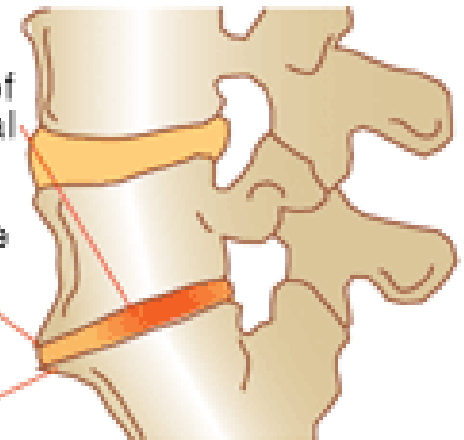


Osteoarthritic spine

Degeneration and narrowing of the intervertebral disk

Bony spur of the intervertebral joint

Formation of bony spur



Rheumatoid arthritis

- is a skeletal deformity that can cause fingers to cramp and make your fingers lose their shape.
- Your fingers will become twisted and bent.
- The way you can prevent this is by avoiding cracking your fingers and doing slow constant exercises.
- This can be treated with heat, cold, shots, or in the worst case surgery.
- The signs of Rheumatoid are swelling, pain, and stiffness.



Neoplasma (cancer)

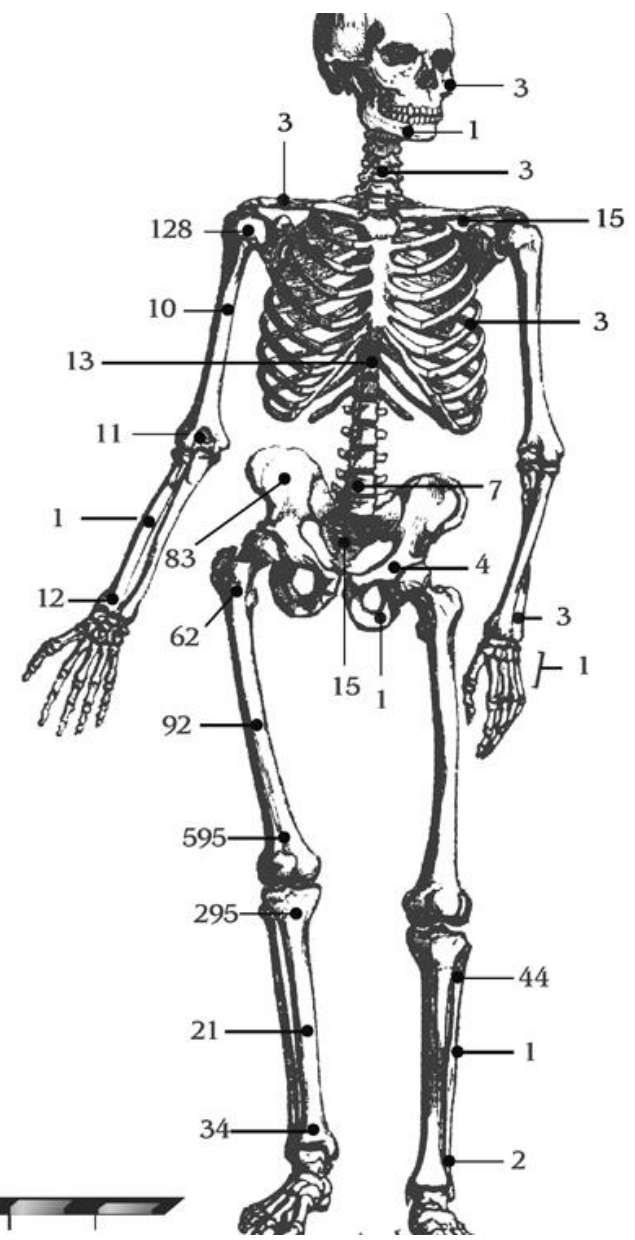
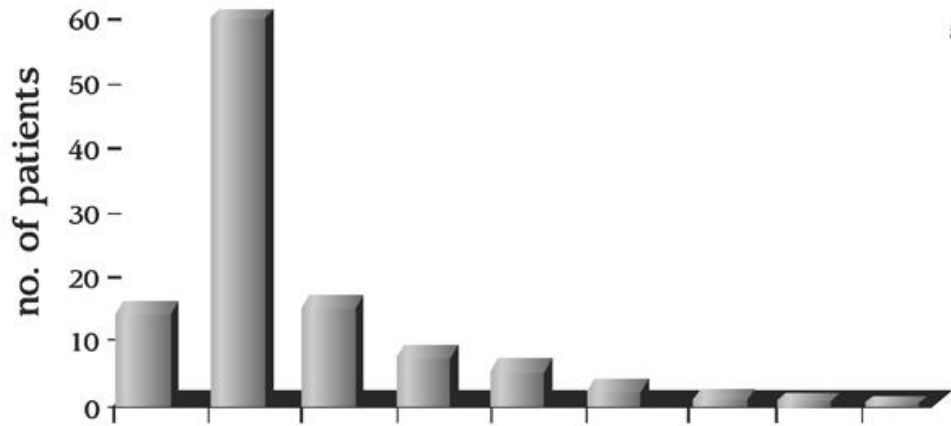
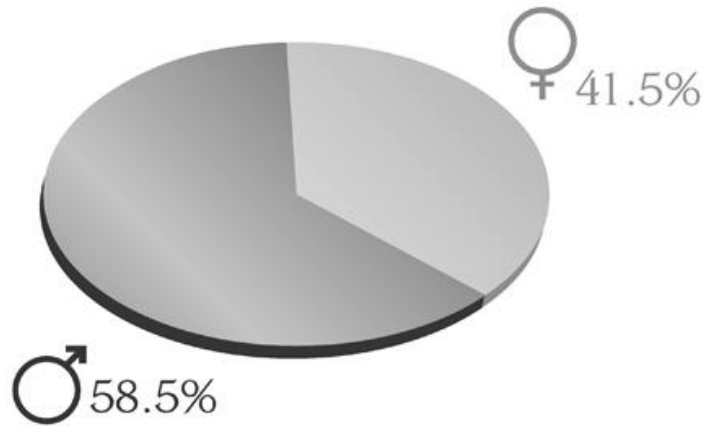


An osteosarcoma

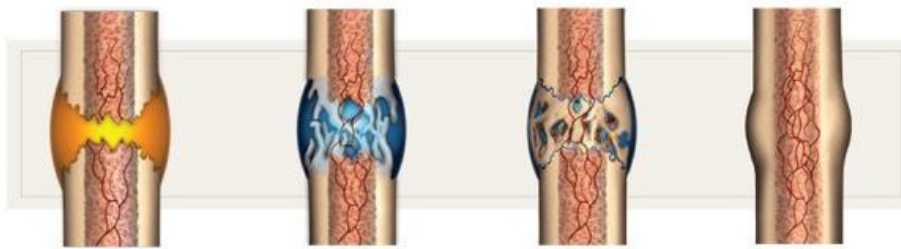
1 patient 2 The cut surface of the tibia after amputation
3 X-ray image 4 Histology of the tumor.

OSTEOSARCOMA

Data from Campanacci / Istituto Rizzoli 2000



Healing process of fracture



Inflammation

Soon after a fracture occurs, a hematoma forms at the injury site. Macrophages and inflammatory leukocytes move into the damaged area to scavenge debris and begin producing the pro-inflammatory agents that initiate healing.

Soft callus

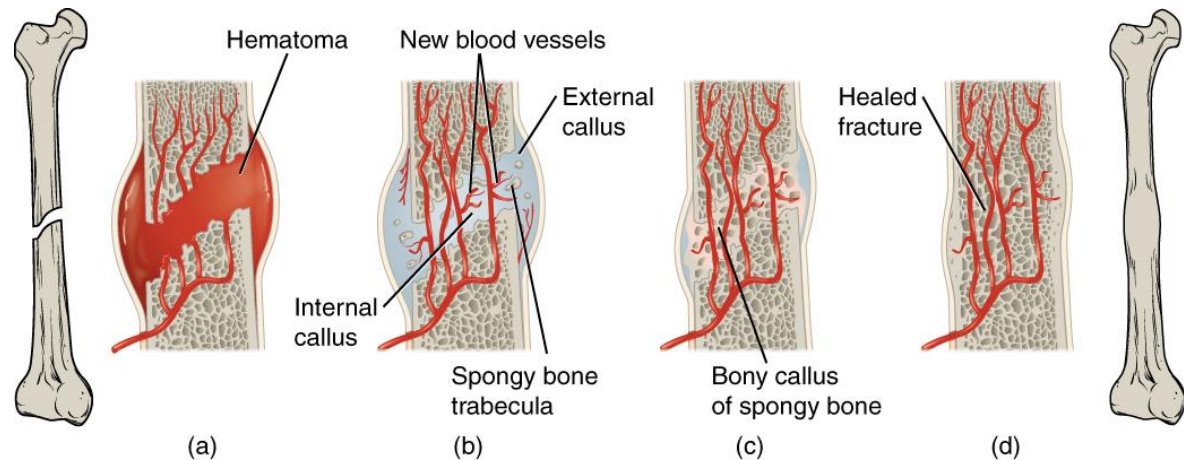
Inflammation triggers cell division and the growth of new blood vessels. Among the new cells, chondrocytes secrete collagen and proteoglycans, creating fibrocartilage that forms the soft callus.

Hard callus

Through endochondral ossification and direct bone formation, woven bone replaces the soft callus to create a hard callus around the broken fragments of bone.

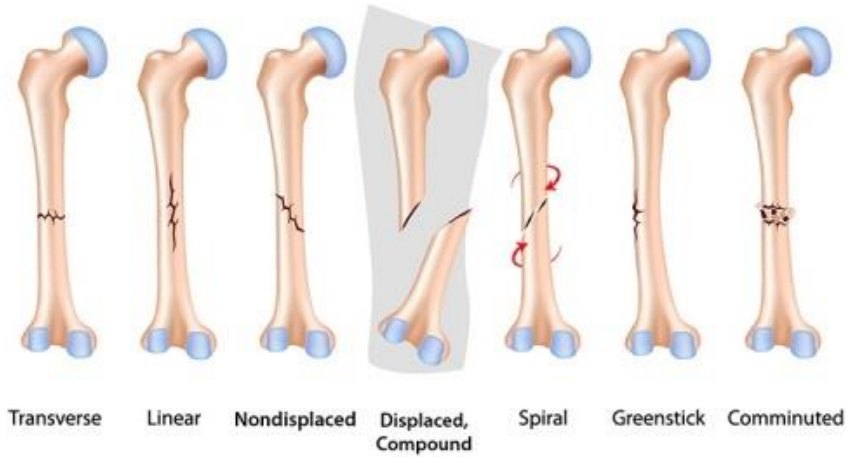
Remodeling

Over time, mechanically strong, highly organized cortical bone replaces the weaker, disorganized woven bone. Because it is continually remodeled, bone is the only tissue to heal without a scar.



Trauma: fracture and malposition healing

Types of Bone Fractures



Types of Fractures

