

Respiratory

Function: Move air in and out of lungs (pulmonary); exchange gases to internal surface and then exchange between blood and cells.

Alveoli Features:

- Thin epithelium layer and extra cellular matrix.
- Macrophages disinfect and kill harmful bacteria
- Pour out surfactant to cope with air/water pressure, reduce surface tension
- many very small which increase surface area of lungs which allow them to exchange more gases

-->Oxygen path – CO₂ & O₂ transport

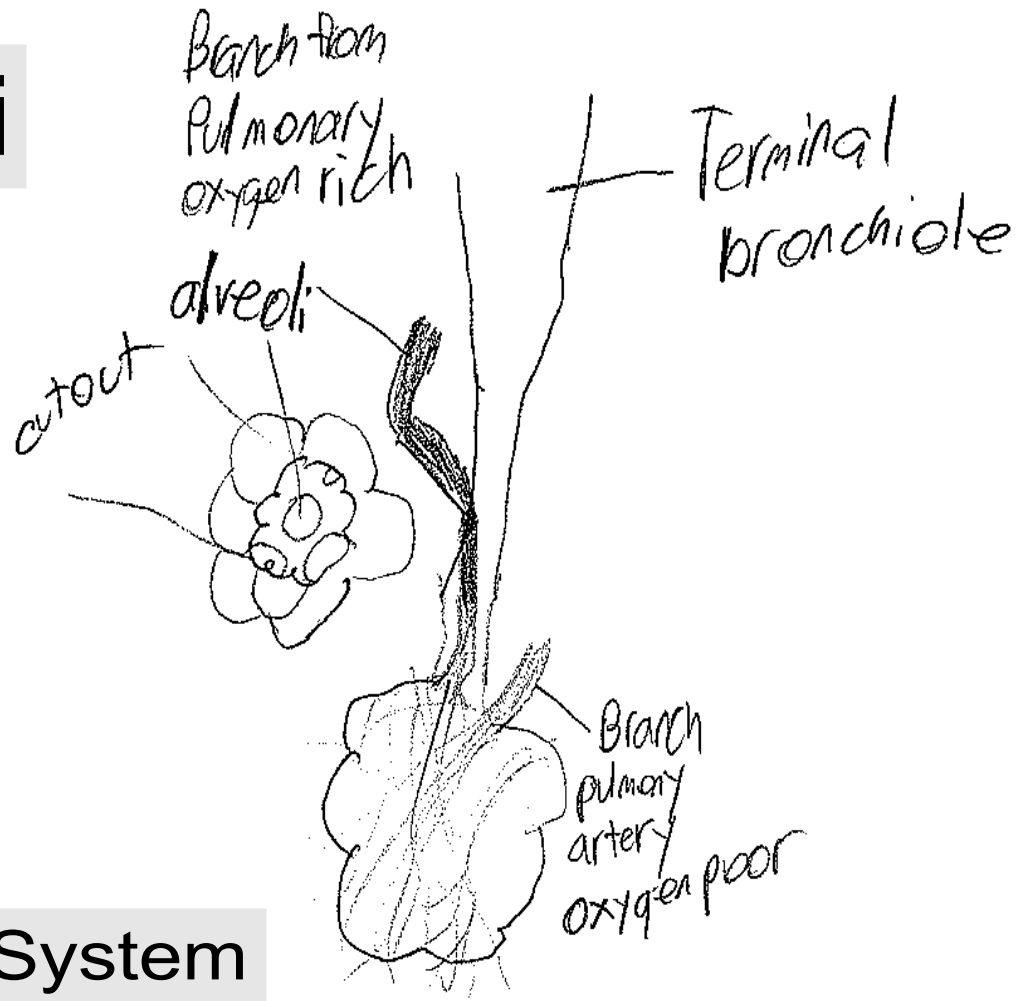
Oral cavity→Nasal Cavity→trachea→Bronchi→Bronchioles→Alveoli
After it has reached the alveoli, oxygen is taken by the hemoglobin in the Red Blood cells of the capillaries surrounding the clustered sacs.

Hemoglobin in red blood cells carry the oxygen though the veins, once it reaches the capillaries it is pushed out and picks up waste products like CO₂, this is now called interstitial fluid, which is deposited in the lymph system.

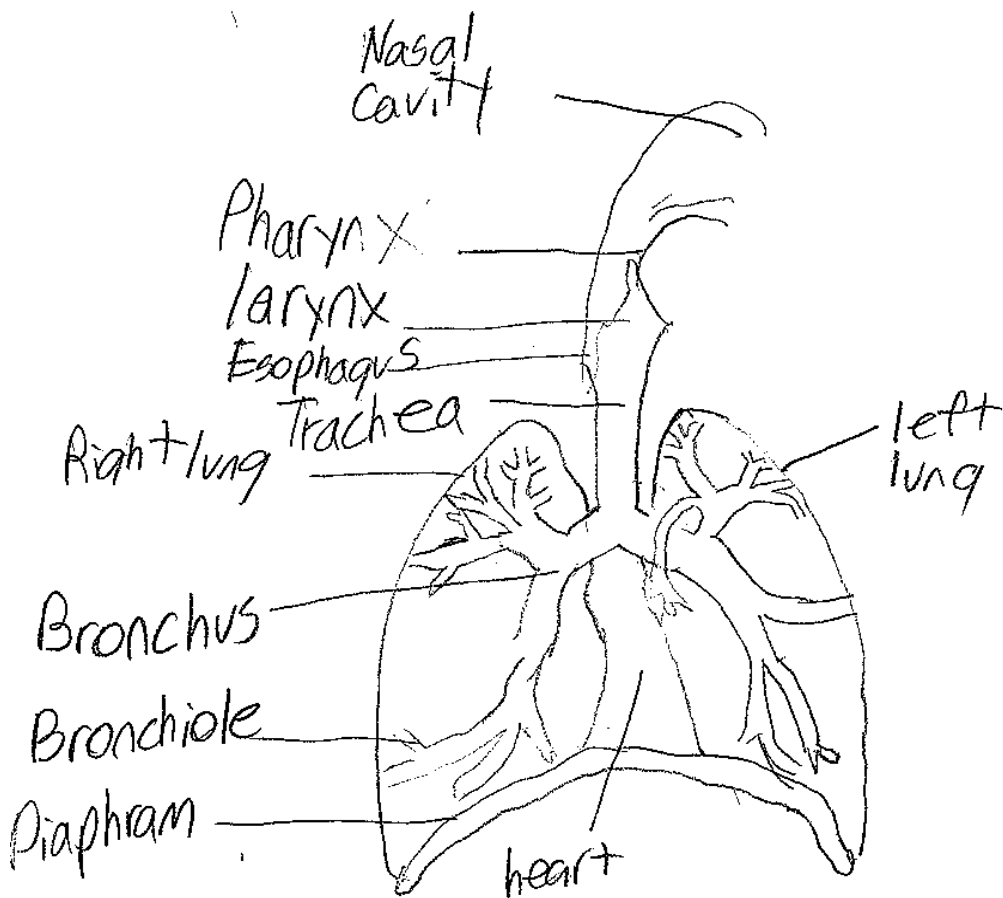
Inspiration- or the rib cage expands and the diaphragm lowers, atmospheric pressure is greater than pressure in lungs.

Expiration- The opposite, diaphragm rises and rib cages squeezes, increasing the pressure

Alveoli



Respiratory System



Excretory System

- Excretes waste and toxins. Uses bladder to hold urine; and kidney to filter toxins and helps regulate your water balance.

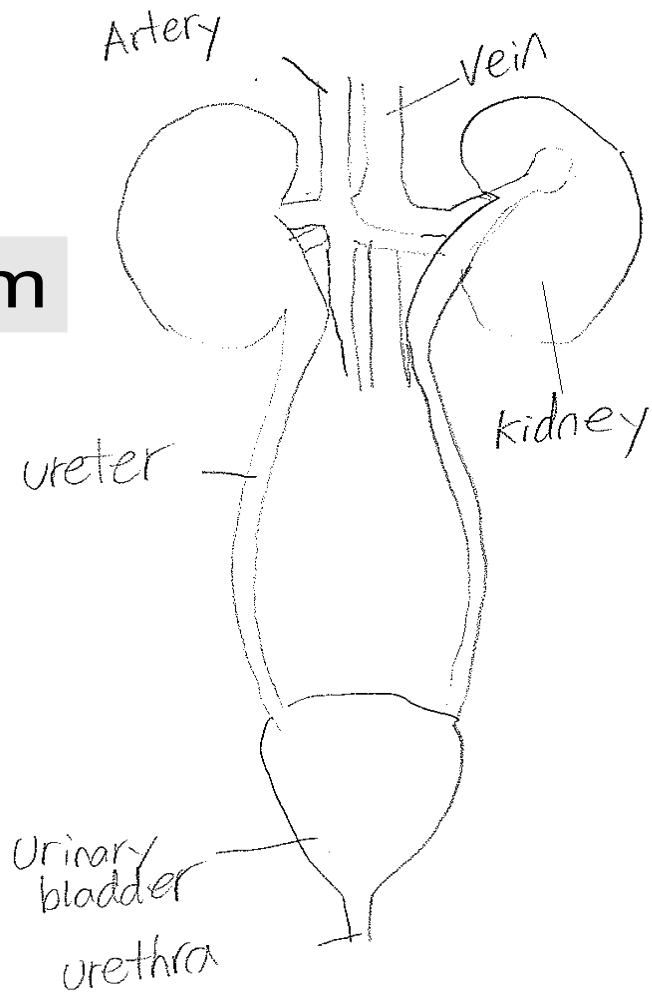
Types of Waste-->

- Ammonia- Fish and amphibians, 1N per molecule used by fish and amphibians since they have plenty of water.
- Urea- animals, less toxic 2N per molecule; less water available
- Uric Acid- reptile and birds, use to package 4N per molecule(Non toxic); practically no water available
- As N/molecule increase so does metabolic energy to make it

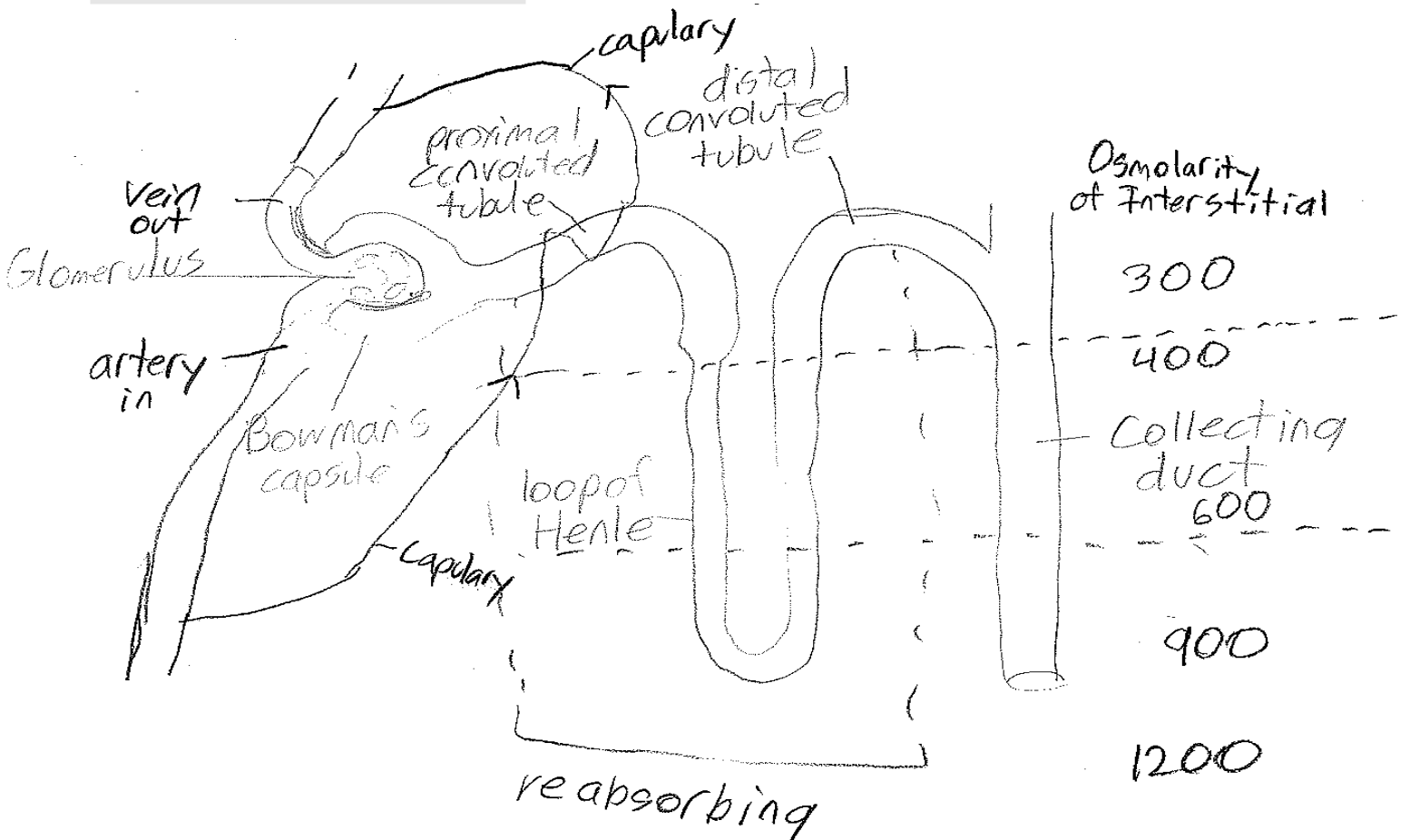
Processes of a nepharon-->

- Filtration: water and small molecules are filtered but blood cells and large molecules do not; hydrostatic pressure is driving force.
- Reabsorption: as filtrate passes down most of it is reabsorbed into blood.
- Secretion: a few substances are secreted from the blood to the nephron.
- Excretion: is excreting the waste out of the body

Excretory System



Nephron



Skeletal System

Function: Movement, Posture, support and heat regulation.

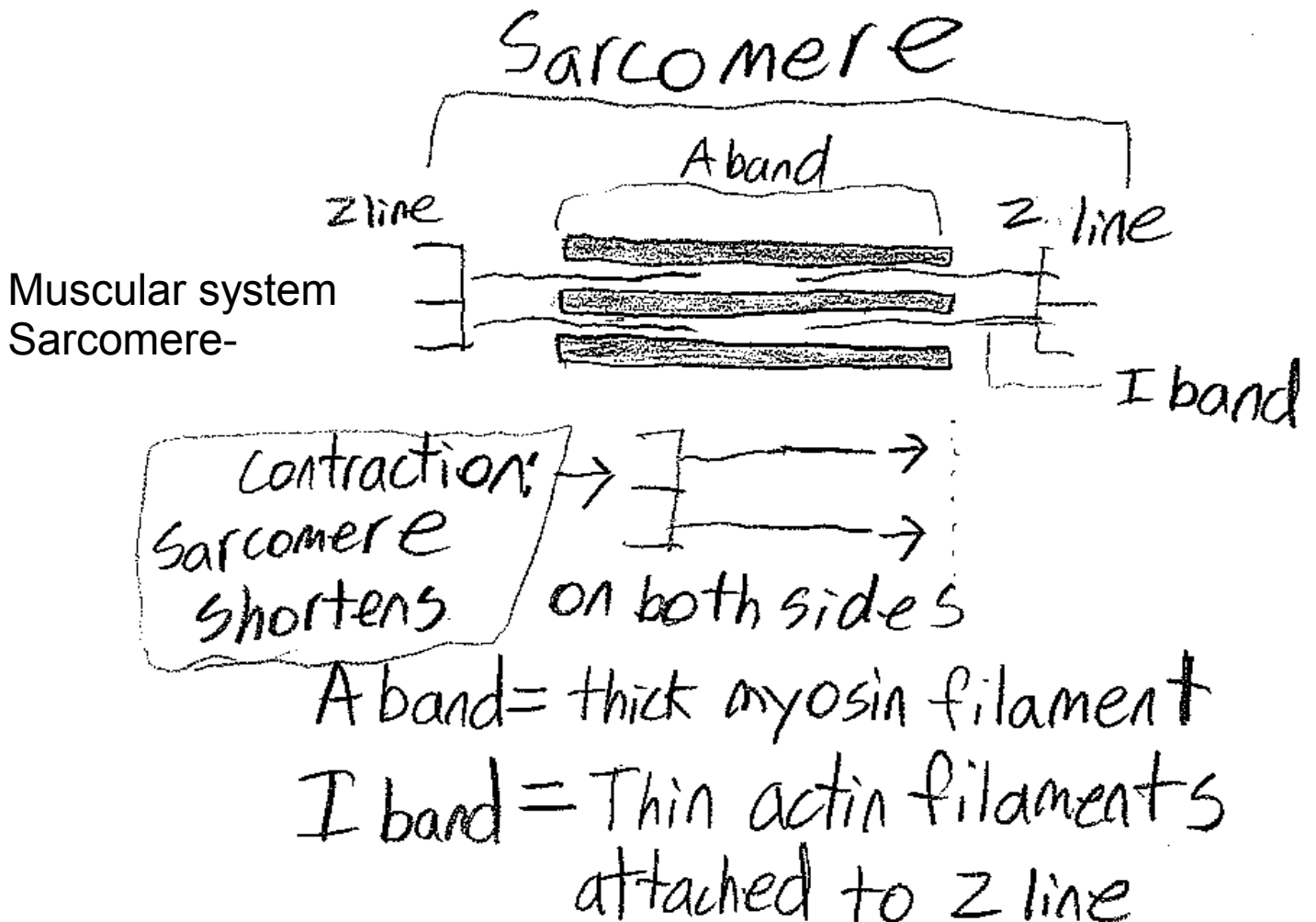
Bodily movement involved both the muscular and skeletal systems.

Muscles are connected to bones by tendons, which are cords of fibrous connective tissue. Bones are connected to each other by ligaments, and where bones meet one another is often a joint.

Hydrostatic skeleton- compartments filled with fluids, that can be manipulated to propel the invertebrate forward. Have a coelom, which is surrounded by muscles. (EG: annelids, nematodes)

Exoskeleton- hard encasement on an animal, often made up of chitin. Can be segmented. (EG: tortoise, insects)

Endo Skeleton- Composed of bones, cartilage and soft tissue, often the skeleton will be split into the upper and lower half divided by the pelvic bone. (chordates, proifera)



Muscular System:

Function- Attaches to and covers the bony skeleton and moves the skeleton. Use fascicles which are bound together by fascia, fascicles are muscle fibers organized by small strands called myofibrils.

Skeletal Muscle- Muscles attached to the skeletal structure, contract and slide by each other to produce movement of the bony structure.

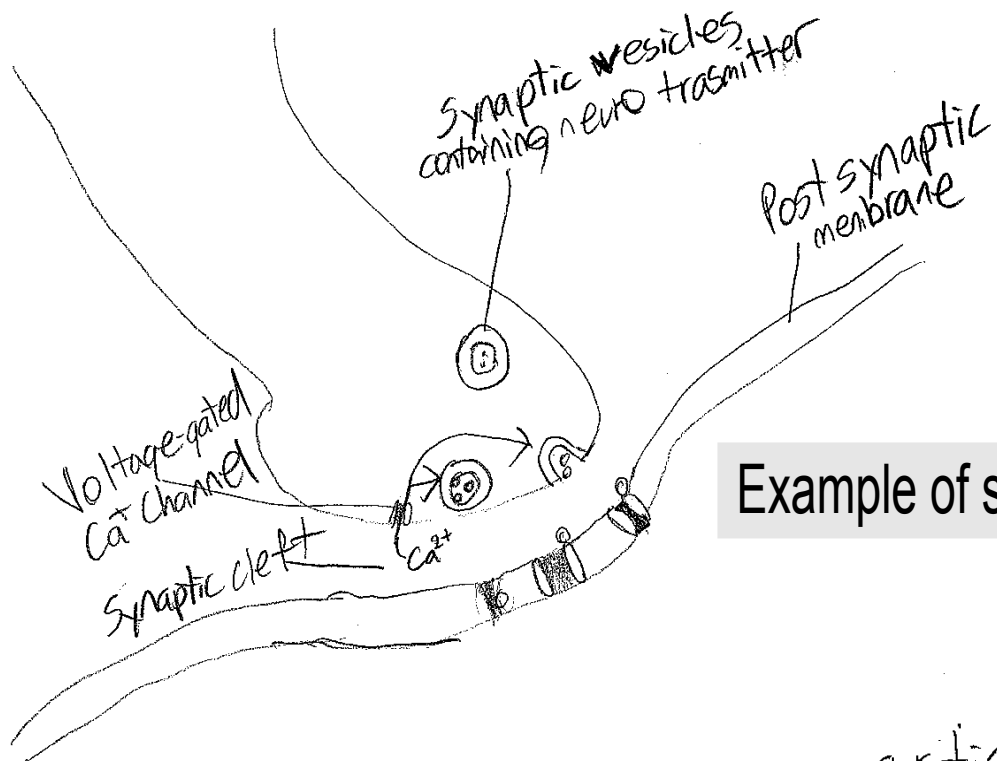
Cardiac Muscle- Found only in the heart, is an involuntary muscle that controls our heartbeat.

Smooth Muscle- Found in walls of body organs, an involuntary muscle with a pathway for electrical signals between neighboring fibers.

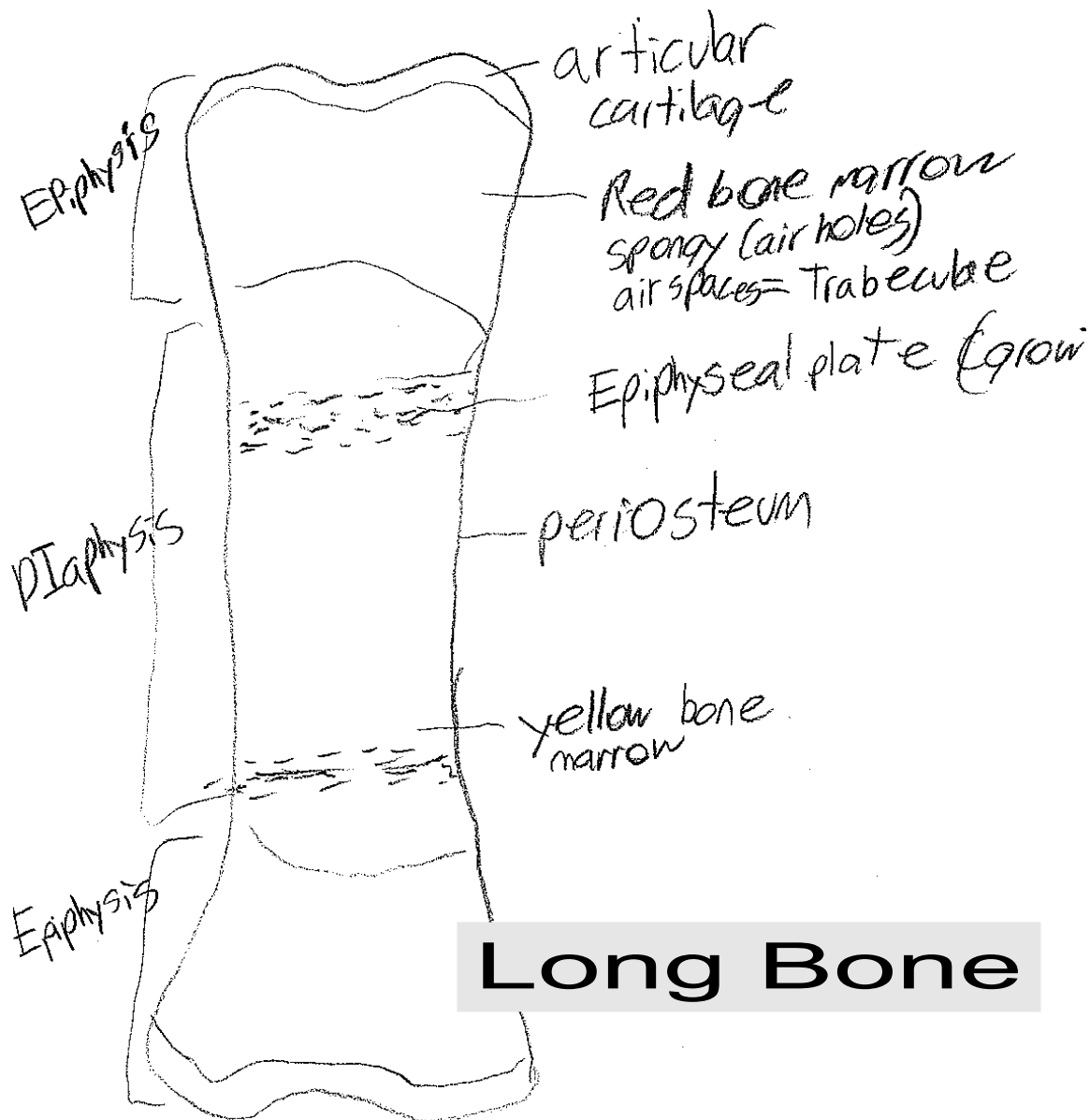
Acetylcholine- very common neurotransmitter, that transmits impulses between neuromuscular junctions.

Actin and Myosin: cellular motor, using ATP as energy. Helps in cell division, muscle contraction and other movements by non muscle cells.

Acetylcholine receives a signal which causes the thin actin filaments to slide by the thick myosin filaments and to increase their degree of overlap. Action potentials spread along T tubules (transverse tubules) to the sarcoplasmic reticulum, which causes calcium ions to be released which bind to troponin which opens the myosin sites on actin. Once these sites are open the myosin crossbridges alternately attach and detach to pull the actin toward the center of the sarcomere, with the help of ATP.



Example of signal transfer



Long Bone

Senses System

Mechanoreceptors- A specialized sensory end organ that responds to mechanical stimuli such as tension or pressure. (Fingertips)

Thermoreceptor- detect heat or cold and help maintain a constant body temperature. (Skin)

Chemoreceptor- detect chemical stimuli, also solute concentration (smell and taste receptors (Ventrolateral medullary surface/tongue)

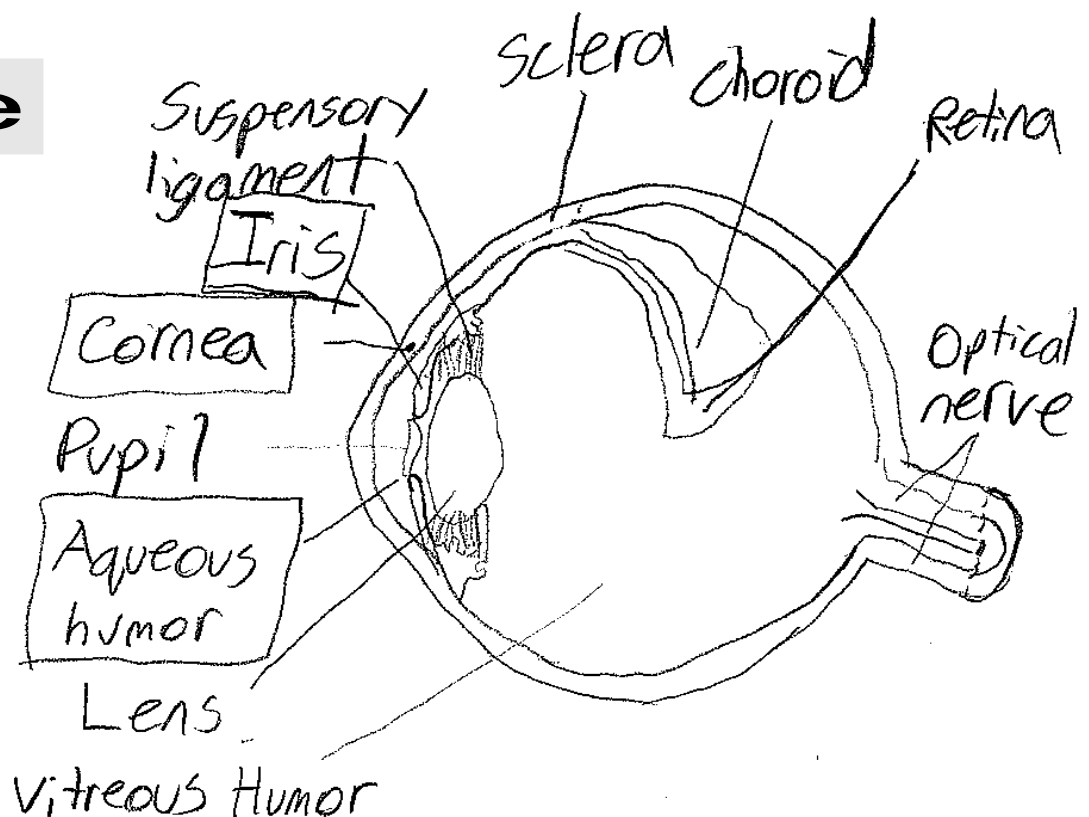
Photoreceptor- Receive light, sensors read colors of lights.

Pain receptor- respond to excess heat, pressure, or specific chemicals released from damaged or inflamed tissues. (stomatic on skin, visceral on heart/other internal organs)

Rohopsin: Light absorbing pigment that triggers signal transduction, pathway-->sight.

Cell Signaling: Micro-environment Communication and response, The ability of cells to perceive and correctly respond to their micro environment is the basis of development, tissue repair, and immunity as well as maintaining homeostasis.

Eye



Nervous System

Based on the sensory input and integration, the nervous system responds by sending signals to muscles, causing them to contract, or to glands, causing them to produce secretions. Muscles and glands are called effectors because they cause an effect in response to directions from the nervous system. This is the motor output or motor function.

Central-CNS- Command center, Takes input from sensory organs through the PNS and then coordinates the other parts of the body.

-Spinal cord, Brain Stem, and prosencephalon.

Peripheral-PNS- connect CNS with limbs and organs. Connections with various organs are established through cranial nerves and spinal nerves

Motor neurons- transmit signal to *effectors*; Carry information from CNS to organs muscles and glands divided into the:

Motor/Somatic NS- control skeletal muscle and external sensory organs, said to be voluntary (controlled) exclude reflexes.

Autonomic NS- control involuntary muscles, like smooth and cardiac muscles

-Parasympathetic- Rest and digestion, when activated causes heart to slow and slow digestion.

-Sympathetic- fight or flight, when activated causes heart to beat faster and adrenaline to be secreted.

Neurotransmitters are chemical messengers released from the synaptic terminal into the synapse. They diffuse across synapse and bind to receptors on the neuron or muscle fiber which causes a change in the cell, depolarization.

Cerebellum- coordinate motor functions; Hypothalamus regulates homeostasis; Thalamus-Sensory&Motor information to and from cerebrum; Cerebrum- Information processing; Cerebral cortex- voluntary+cognitive functions; Corpus Callosum-band of axons that enable communication between right and left cortices.

Endocrine system

Homeostasis- the body must maintain a set of certain values for many factors. It does this by using negative feedback to maintain a certain value, an example is cited below for calcium.

Negative feedback- decrease the deviation from an ideal normal value, keeps the value oscillating around a 'normal' value.

→ if calcium level is too high {Thyroid release calcitonin which causes calcium levels to drop}, if calcium level is low {Parathyroid release parathyroid hormone which causes calcium to rise}

Hormones

Hypothalamus- hormones released from posterior pituitary, that work to regulate it

Posterior pituitary gland- oxytocin: stimulate contraction of uterus

Antidiuretic hormone: promote kidney water retention

Anterior pituitary gland- Growth Hormone: stimulate growth and metabolic functions

< Thy&Parathy [Regulated by calcium in blood]>

Thyroid gland- calcitonin: Lower blood calcium level

Parathyroid gland- Parathyroid hormone: raise blood calcium level.

Pancreas> [Regulated by Glucose in blood]

Insulin: Lower blood glucose levels [if level is too high]

Glucagon: raise blood-glucose level. [if level is too low]

Adrenal Glands>

Adrenal Medulla- epinephrine: increase metabolic activity

glucocorticoids: raise blood glucose level

Adrenal cortex- Mineralocorticoids: reabsorb Na⁺, excrete K⁺

glucocorticoids: raise blood glucose level

Gonads-

Testes- Androgen: promote development of many characteristics

Ovaries- [Regulated by FSH and LH]

Progestins: promote uterine lining growth

Estrogens: promote secondary female characteristics growth.

Reproductive-

Function: To produce offspring, which causes transfer their DNA into next generation in the Population of humans.

Sexual: creation of offspring by fusion of haploid gametes to form zygote, female gamete=ovum, male=sperm

Asexual reproduction-all genes come from one parent, no fusion of egg and sperm

Fission- separation of parent

Budding- offspring from outgrowths of parent (cnidarians)

Parthenogenesis-females produce eggs that don't need to be fertilized (male Bee);

Fragmentation- individual breaks into piece, all of which can form mature adults (regeneration is necessary)(Sponges/ Cnidarians)

Spermatogenesis: production of mature sperm cells from spermatogonia, undergo meiosis to become haploid

Oogenesis: development of mature ova. Oogonia multiply and begin meiosis but stop at prophase 1 of meiosis 1 (1st oocyte), after puberty FSH periodically stimulates a follicle to grow into a egg (2nd oocyte). The unequal divisions of the cytoplasm allow for the egg to receive more food and cytoplasm space than if they had divided equally.

Unequal division because the female gamete (ovum) requires more cytoplasm and cell machinery. This creates

Menstrual cycle vs estrous cycle- Estrous cycles reabsorb endometrium if conception does not occur, whereas menstrual cycles shed the endometrium through menstruation.

Menstrual Cycle:

Menstrual flow phase- bleed out endometrium,

Proliferative phase- endometrium begins to regenerate

Secretory phase- endometrium thicken, if embryo not implemented then menstrual flow occurs

The ovarian cycle parallels the menstrual flow cycle- Mfp growing follicle, Pp: maturing follicle, Sp: corpus luteum and degeneration corpus luteum

--(1) Progesterone helps maintain uterine wall during pregnancy.

--(2) Peak in estradiol causes LH peak which triggers ovulation, progesterone and estradiol causes thickening of the endometrium in the secretory phase. The anterior pituitary which released FSH and LH necessary for the follicle to grow are controlled by the levels of estradiol, the positive feedback causes LH and FSH to peak following the peak of estradiol right before ovulation.

Development-

-**Cleavage**- period of rapid mitotic cell division, divides cytoplasm of zygote into smaller cells called blastopores. Which develops into a ball of cells called morula, and then a fluid filled cavity called the blastocoel forms at the center to complete the blastula.

-**Gastrulation**- rearranging cells in blastula to form 3 layered embryo consisting of ecto-, meso-, and endo- derm.

-**Organogenesis**: development of rudiments of organs from the 3 germ layers
germ layers-

Ectoderm- Nervous system, skin, nails, teeth, lens of eye

Mesoderm- skeletal, muscular, excretory, circulatory, and reproductive systems.

Endoderm- Liver pancreas, epithelial lining of digestive, respiratory and excretory tracts

Disorders

Skeletal:

Leukemia: Leukemia is a form of cancer that originates in the bone marrow and affects the lymphatic system.

Osteomalacia (Rickets): Osteomalacia is a disease that leads to a softening and weakening of your bone tissue. This disease, which in children is also called rickets, is typically caused by prolonged vitamin D deficiency.

Muscular:

Myopathy: It is one of the many disorders of muscular system; it is characterized by muscle weakness which results from improper functioning of muscle fibers. The different muscle disorders like stiffness, muscle cramps and spasms could also be associated with myopathy. Treatment: Physical therapy, drug therapy, acupuncture, surgery and bracing for support are amongst the treatment measures used for myopathy.

Orofacial Myology Disorders: The orofacial myological disorders are a set of disorders that affect the muscles surrounding the face, jaw, lips and mouth. There are many different types of orofacial myological disorders like: blocked nasal airways, dental malocclusions, speech problems, atypical swallowing and chewing patterns. The treatment measures used for orofacial myological disorders include restoration of correct/proper swallowing patterns, re-education of muscle movement and establishment of adequate labial-lingual postures.

Excretory Disorders:

Kidney Stone- is when a hard mass forms in the urinary tract

- Sharp cramping and major pain when it blocks urine
- Treatment: Plenty of water, may need surgery
- Men get kidney stones more than women

Bladder infection- is where the bladder gets infected, often by E. Coli 20% are woman

- Treatment: Amoxicillin, Keflex.
- Symptoms- overactive bladder, testicular pain