(1) Video notes "The process of Science"

- Assumptions can not be proven, but are important
- Phenomenas are all caused by natural things

- hypothesis - supposition about a specific system supported by initial observations
  ("A prediction")
  estimated guess should be test
- Scientific theory - highly validated explanation for phenomena - applies to all systems

EXAM 1

- The original mother probably laid her egg in a different species nest

Scientific theory - highly validated explanation for a phenomena

Observation
↓
Question
↓
Hypothesis
↓
Prediction

BIO Exam 1

8/30/22

Gene flow: any genetic change in a population
One population to another

Genetic drift: when a population migrates to another location
Sometimes not by choice
The difference between the 2

What happens to bacteria when you wash your hands?

Evolution is any genetic change
in a population

Video notes

evolutionary mechanism
evolution defined

(2)

Evolution - any genetic change in population

example: if brown eyes were 80%. of population, changed to 82% yes population occured

Group of | species in one area

any genetic change in a population - is evolution

evolution occurs in population NOT in individuals

genetic change - shift in frequency of gene

↳ No set minimum time for evolution to occur.

↳ The moment something dies → evolution occurs

Mechanism of Evolution

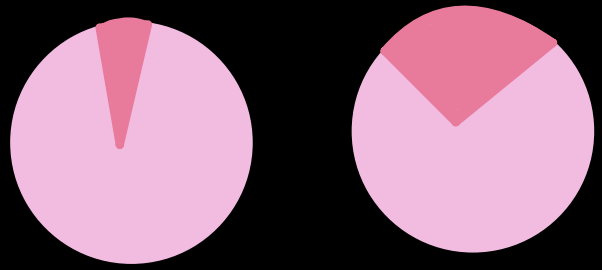
4 ways Evolution occurs

- Mutation
  - change in DNA sequence
  - Ultimate source of variation
  - mutation occurs randomly errors in DNA copying exposure to ultra violet light or specific chemicals
- Gene flow
  - migration
  - movement of individuals to/from population changes gene frequency in population
    - volunteery movement
- Natural Selection
  - Predictable
  - individuals with advantageous traits (those who are more fit) leave more offspring.
  - A trait varies
  - The trait heritable
  - certain trait produce more offspring.
- Genetic drift
  - Random changes in gene frequency
  - Small population affected more than large populations
    - tsunamis, asteriod impact, random natural disasters, omnicron, delta, covid
    - some may survive and reproduce, Hand washing

- Have more babies

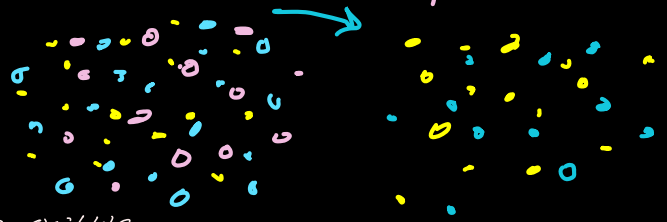
analogy

Genetic Drift founder effect:



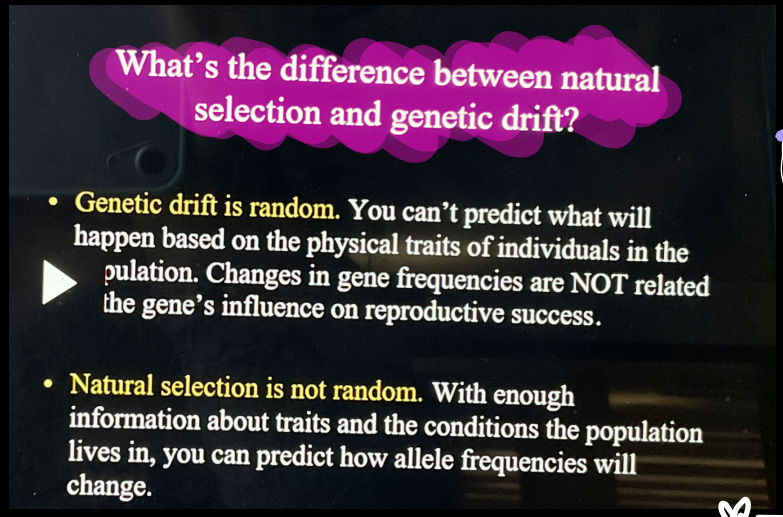
Bottleneck effect:

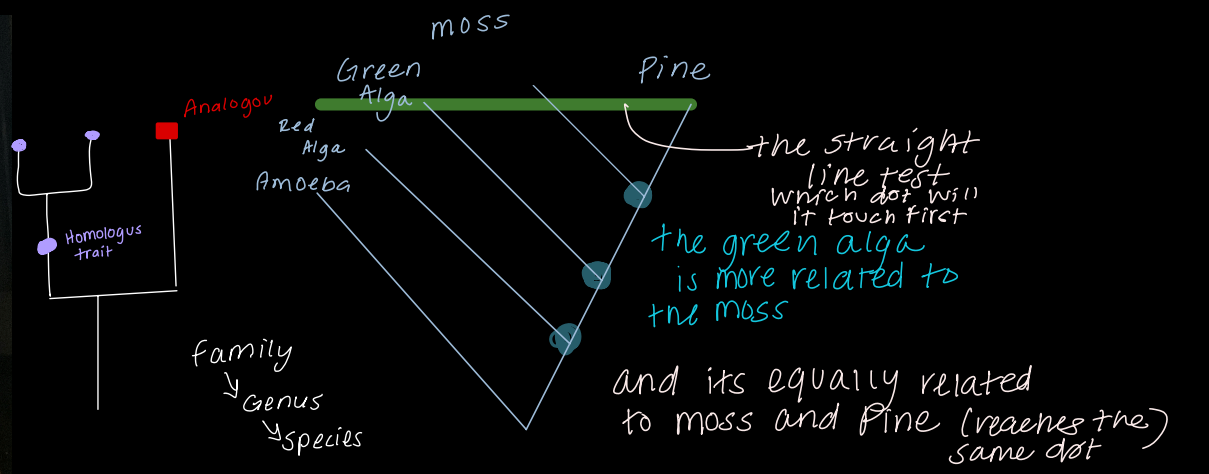
random event indiscriminately eliminates individuals leaving behind less diversity



pretend these are skittles in a bottle being transferred

Fitness - reproductive success





Video Notes Evidence for evolution (3)

the fossil record

preserved parts of an organism

Biogeography

- Groups of a similar species tend to be found in the same

Physical Characteristics

- Homologous traits

geographic areas
→ All native mammal species in Australia belong to a group of related species called marsupials

have shared evolutionary origin.

- Analogous traits
  - have similar function but evolved independently
  - insect wing vs. bird wing
- embryological development of organs and the body structure in animals follows similar patterns.

DNA sequence

the more distantly organsms relate, the more their DNA differs

DNA alphebet consist of
(A) adenine
(T) thymine
(G) guanine
(C)

Trees in Antarctica show similarty of antifreeze protien genes of Antarctic fish

Experiments

Artificial selection
↳ crops, dog, livestock
antibiotic and pesticide resistance

4

Video Notes Speciatation

What is species? if they can not reproduce naturally → different species

Biological Species Concept

no real definition → depends on context
- Can they reproduce w each other

A population is a group of organisms of the same species who live in the same area who can breed w each other

zygote = sperm fertilized egg

Taxonomy

the science of categorizing species into progressively smaller groups.

- A hierarchical system that categorizes species into proggressievly smaller groups

prokaryotes - lack nucleus
Eukaryotes - have nucleus

Scientictic name:

genus - species

species are interbreeding or potentially interbreeding natural populations which cannot produce fertile offspring with other groups:

Reproductive isolation
inability to reproduce

About having offspring

There is no "magic" percentage similarity of DNA that defines the boundary between one species to another.

Speciation

formation of new species from an ancestor population

other/different father

Allopatric speciation

- A population must be seperated from other populations of the same species

over time the seperated same species begins to stop being able to reproduce w one another

types of community interactions.

9/1/22

Ecology & Population Growth

Ecology

Study of how systems interact and how they affect one another in an enviorment

- individual
- population (single species)
- communities
- ecosystem

Community

all interacting population in an ecosystem (more than 1 species)

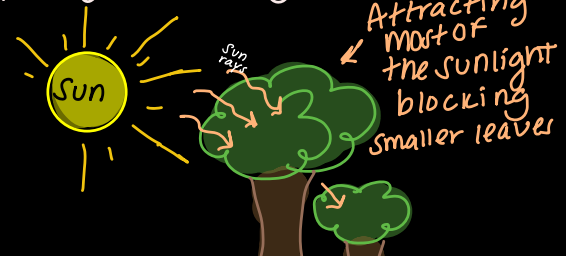
Ecosystem

All living things and non living elements in an enviorment

Growth Video ♡

All populations are able to grow exponentially if they've got unlimited resources (space food etc.) but limits on resources and interactions w other species constrain this growth.

example: Some trees will die competing for sunlight



Interactions in Communities

Energy is the currency of activity in living forms

- life requires an input of energy

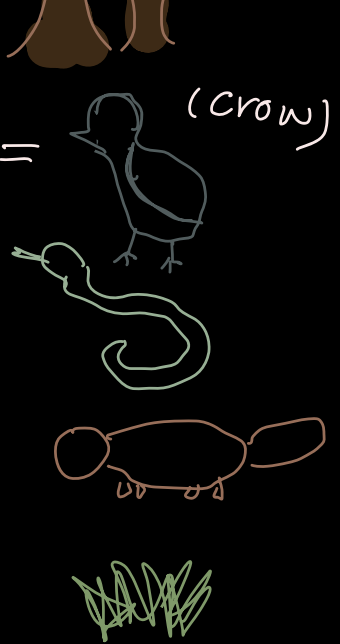
Autotrophs
organisms that perform photosyntesis to generate thier own energy.

Competition
Sharing of limited resource reduces fitness of both parties.

Predator/prey
killing and eating another organism

Parasitism
Harming host but not necessarily killing positive for

each community interaction =
- gain or loss of energy in both parties



Heterotrophs
feed on other organisms to obtain energy.
- At every step in a food web energy is lost as heat, waste (poop, urine) and metabolism.

10% Rule

Principle of competitive exclusion
(Gause's law)
Over long time strong competition for the very same resource will end in elimination

Mutualism
drives fitness up

parasite but negative for host

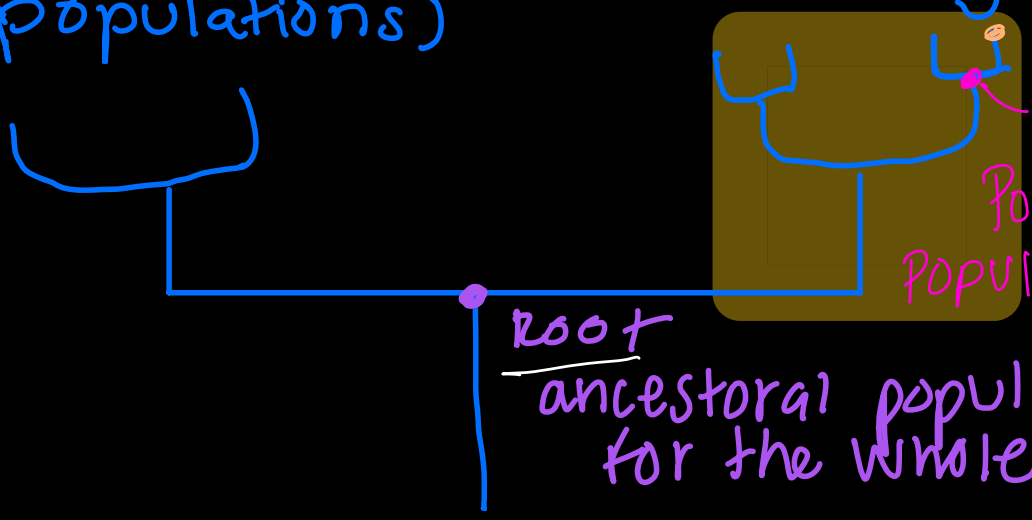
9/6/22

Carbon Cycles & Human Activity

What nutrients do all living things need?

Phalangoid trees

Stastical models built to explain speciation (splitting of populations)



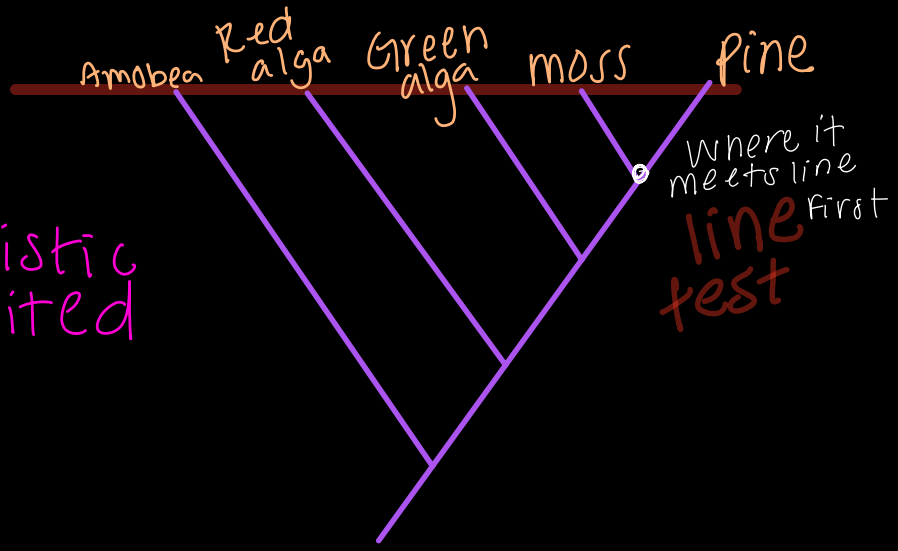
tips- represents different species

Node
Point where an ancestoral population speciates

Root
ancestoral population for the whole tree

= Family.

macro and microevolution results of the same process



Homologous trait- characteristic that 2 groups inherited from common ancestor

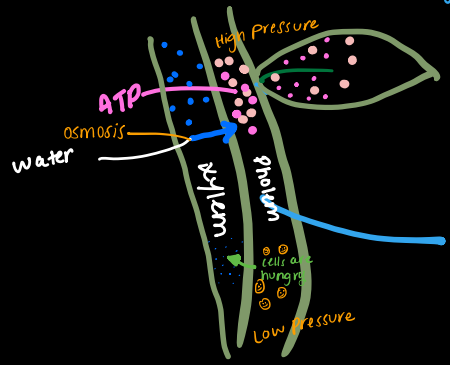
Analogous trait-

Different anscestory branching.

EXAM 2

video Notes

Grapes get treated w hormones "seedless"



Pholem.. "the stem"

Pholem transport includes
- Active trans.
- Diffusion
- High and low pressure
- Requires ATP
  [All of the Above!

Plant life Cyles

- All plants have waxy cuticle that covers the outer cells and limits water loss
  (works like bilayer membrane)

"ploid" = number of chromosome sets

Gametophyte (1n): a plant that makes sex cells

Sporophyte (2n): a plant that make spores

↳ Next generation makes gametophytes

Sporophyte (2n) ↘ Gametophyte (1n) ↘ (Reproducing pattern)

Phyte means plant

Sporophyte (2) ↘ Gametophyte (1n)

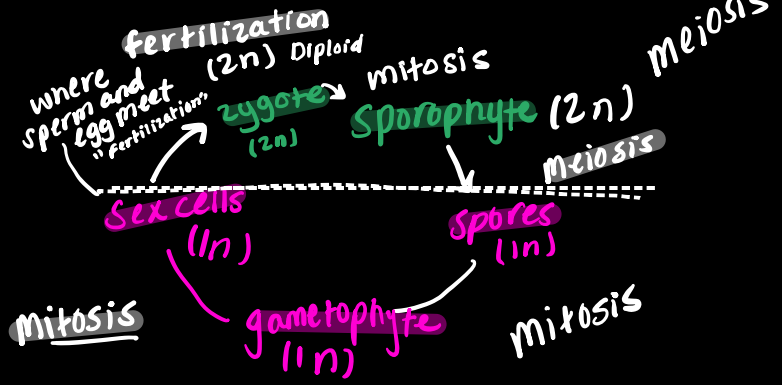
Mitosis = making exact copies

Meiosis = dividing number of chromosome sets in half (2n → 1n)

Sperm = Haploid (half)

Plants have 1n chromosome sex cells

Plants make sperm and egg by mitosis and are multicellular



Plant Diversity

None-vascular plants

- Sporophytes are small

Mosses (most common non vascular plants

pollen is multicellular male gametophyte
"Adult plant"

Vascular plants
~~gametophyte are small~~
~~gametophyte must be attached to sporophytes to survive~~

Gametes produced by gametophyte
Gametophyte (1n) → gametes (1n)
same = mitosis

- transport of water & nutrients
- Support
- Ability to grow higher
- Sporophyte & gametophyte can survive independently off each other

ferns = 12,000 species
true roots, stems, and leaves
Spores travel long distances via wind
- vascular
spores (1n)

- sporophyte must be attached to gametophyte to survive
- No vessels for transport
- No roots to uptake water / nutrients

reproduction relies on swimming sperm
swimming in the wetness of the ground
"wet toes in moss" / Most areas
- Usually short close contact w other plants"
- relies on diffusion to spread sperm

May see "liverworts" or "hornworms"
very short
grow upward

green portion of plant is the gametophyte (1n)
Short lived sporophyte sprouts form, dependant on gametophyte to survive

Life cycle of Moss
sex cells → gametoph (1n) → zygote / embryo → sporophyte (2n)
mitosis
spores (1n)
meiosis

Vascular seed plants
- independant from water doesnt need water to reproduce thru ground

Vascular seed plants can live far from water
- No swimming sperm
- pollen (male gametophyte"

SEEDS
- dormant/resting stage embryotic sporophyte
- protected by seed coat
- contains energy for growth called endosperm (3n tissue)

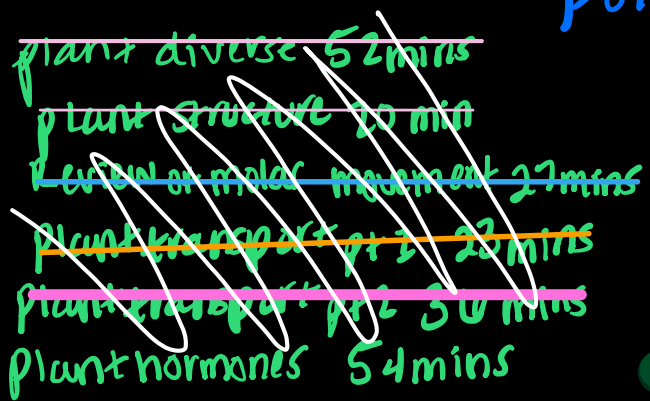
Sporophyte → gametophyte (1n) → sperm & egg → embryo

travels via wind, or animals & insects

- Seeds can lie dormant/sleep for long times.

special vessels help transport water long distances

Pollen Produces sperm



xylem transport water upward from root

pholem transport sugars in any direction

Gymnosperm

"naked seeds"

reproduce using cones

cones are reproductive organs

- female cones produce female gametophytes
- male cones produce male gametophytes (pollen)

- Rely on wind for transport

Angiosperm

- All flowers & fruits

female gametophytes (7 cells)

male gametophytes (2 cells)

- 2 sperms involved in reproduction (double fertilization)
  - 1 sperm (n) fertilizes egg → (zygote 2n)
  - 1 sperm fertilizes a special cell (n+n) to produce endosperm (3n)
- mutually beneficial

Plant Structures Video

Organ System

- Shoot system - stems, leaves
  Photosynthetic

- Roots
  - water and mineral uptake
  - Anchor plants to ground
  - Storage of photosynthesis Products as starch
  - Nodes are connections betweens leaves connect to stem

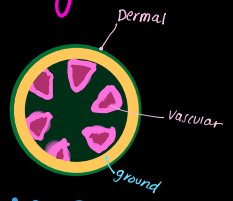
Roots are covered in hairs because they can take more into system from enviorment more surface area = more water

★ leaves are filled w open gas filled spaces because

Stomata - pores on bottom of leaves surrounded by guard cells

tissues fall into 3 categories

- Dermal tissue system
  protective skin
- Vascular tissue transports



Ground tissue system
- photosynthesis, storage, support

Vascular tissue ↑ goes up

xylem - tubular dead cells that are used to move water & minerals from roots, also structural support (Dead)

Phoem - living tubes) move sugars, flows every where

Apical meristem - divides and grows plant
- very "top", can make any kind of cells found at leave & stem node, for growth and length

Lateral meristem
outside edge of stem
goes down the center of plant

Allows plant to grow wider & thicker

Molecular movement ♡

Molecular Movement ☆

Passive Transport (diffusion)
movement down concentration gradient
due to random molecular movement
- Doesnt require input of energy

Protiens + sugars embedded in membrane bilayer

Aquaporin
facilitates water diffusion by providing pathway (only water)

Simple diffusion
doesnt require help

Osmosis
diffusion of water across selective permeable membrane
water alway moves towards lower concentration of water
" water moves across membrane to areas of lower water concentration "

faciliated diffusion
cant get thru phospholipid bilayer
- requires channel or pathway

isotonic solution = same size
Hypertonic = more water outside (shrink) → Plant wilts, dehydrated plant
Hypotonic = more water inside (swell) → plant cell
cell wall stiffens, does not pop

Active transport
requires ATP
moves against membrane
moves towards area of higher concentration

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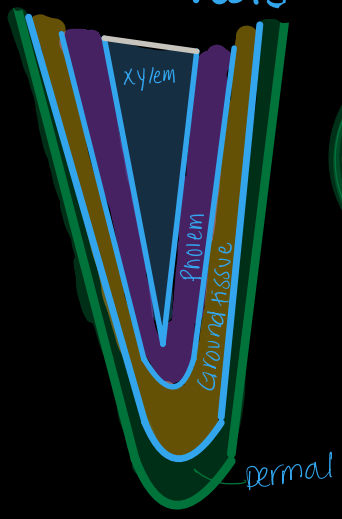
plant Transport 1

when Mineral concentration are greater inside cell, must

xylem cylinder bundle of xylem & phloem surrounded by endodermis in center of roots and stems



Plants move mineral from soil to xylem
K^+, Ca^{2+}, NO_3^- & PO_4^{3-}
charged - must use channel or pump

Water must pass through endodermis to get to xylem
↳ must pass through xylem seal
↳ uses ATP to pump into xylem

Water follows minerals

When mineral concentration are greater outside cell
= faciliated diffusion
↳ move into w facilitation

low → High
facilitated diffusion

Cytoplasm of root cells have lower concentration in soil water

Water gets into vascular cylinder by
- endodermal cells pump minerals into xylem
- Mineral concentrations in xylem exceed that of root cells
- water moves in by osmosis

xylem → phloem = Osmosis

plant Transport

"Water moving sugars through out body"

Transpiration
evaporation of H_2O from leaves

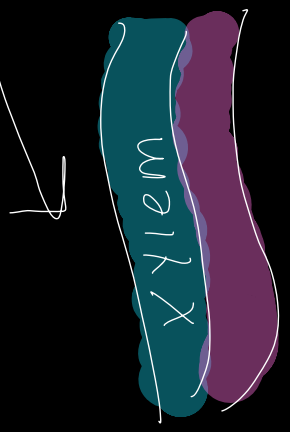
Cohesion
- linked together by chain, water molecules stick together by hydrogen bonds

Tension-
Pulling force generated by transpiration

the sun evaporates water, using tension

the sun "pulls" from cohesive chain of water

Occuring in xylem



water moves- osmosis

Transport in Phloem
requires costly pumping of sugars

Carbonydrates move from sources to sinks

Source- where sugars are
Sinks- where sugar are being consumed or stored

Phloem

- requires much ATP
- reqvires living tissue
- can move in any direction
- fluid is pushed through phloem and sucked up in xylem
- Active transport
- Sugar used for growth, cell storage

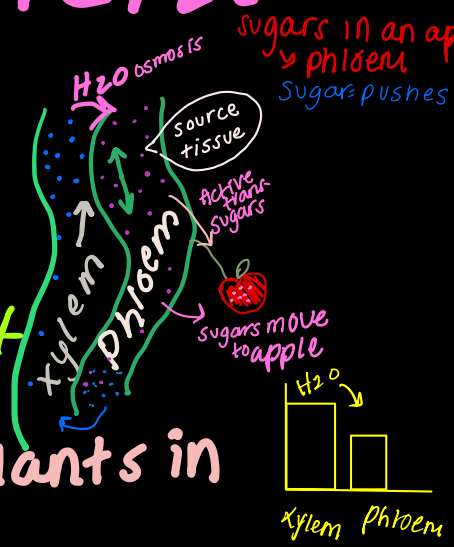
Plant Hormones & Response to Environment

Responses to environment

Phototropism= Plants move towards light

trop-movement

auxin= gibberellin herbacides that interrupt natural plant hormones.
- Axin orange - killed off plants in war dixin
- Roundup
-



sugars in an apple
↳ phloem
Sugar pushes

plant hormones
hormones binds to receptor protien, if theres no reapter, it wont respond to hormone.

types of plant roles of hormones
- Auxin + tropism
  - ↳ most important
  - movement using oxygen to control response of environment

Phototropism - Movement in response to light
Gravitropism - response to gravity knows up a down

Gibberellin - doesnt affect your cells!

What are hormones?

Chemicals secreted to influence target cells (by signaling)

Has different affects on cells where they are produced

Hormone	Effect	made where
Gibberelin elongates plant Bakanae rice disease rice grows tall and spindy	Steroid hormone 125 types causes rice to grow rapidly tall and die, falling over caused by fungus. "false hormone" increases size stimulates cell elongation stem between nodes causes stem to grow longer Produced by seeds to increase fruit size seedless → smaller fruit	Seeds
Auxin "tip says dont grow"	stimulates elongation of cells, controls direction of plant growth elongates cell, control direction of plant growth apical dominance Top keep near by shoot underneath	Apical meristem (tip of plant)
Ethylene stress growth (gas) Artificial	gasseous stress normone, speeds up plant life to ripen may cause near by to ripen responses to wounds, drought, temp change	Artificial also naturally occuring causes leaves to fall
Abscisitic acid (ABA) keeps plant small + sleep	Stress hormone keeps seeds from growing saves water Stomata closes in response to water stress water cant leave stops Growth sleeps during fall	Root cells

to the xylem water would be lost

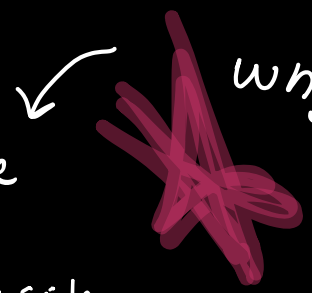
Auxin tells cell

Tropism - movement toward (positive) or away from stimulus (negative)
Unequal growth causes tilt over

growing away from gravity = negative
root grows toward gravity
Thigmotropism growth responds to touch

plant would not be able to use H_2O to convert carbon dox. into energy
Also would not be able to produce starch it's food

wall to loosen up
Allows water in by osmosis



Shaded cells cause increase in auxin
auxin → on shady side

Starch rocks = statoliths
fall toward lowest point, moves auxin toward statoliths

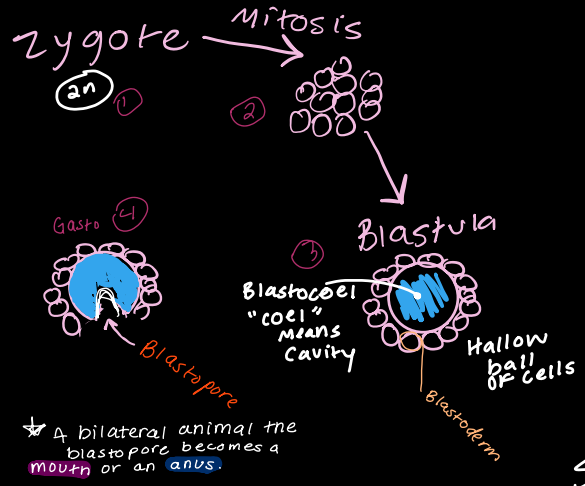
EXAM 3

Animal introduction

Tour of animal Phyla
- Sponges and radially symmetrical animals
- Protostomes

Terminology
Symmetry - Help indicate appearance
Blastula - early embryonic stages

Animal Characteristic
- Multicellular
- Heterotrophi
- Move at some stage in their life cycles



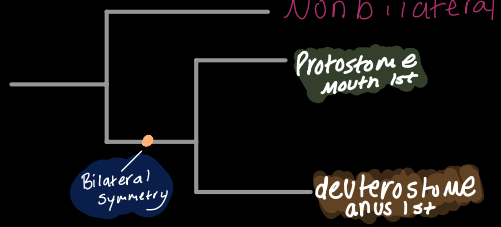
: Hallow ball of cells

Blastopore

- Special region on surface of embryo, that ends up as on or ends of the intestinal tract (mouth/anus)

Germ Layers

special group of cells in embryo that develp into different types of tissues & organs



- Can be very different but overwhelmingly share DNA of a common ancestor

Does it have tissues?

NO → then its sponges

Yes → what kind of symmetry

Bilateral

Radially → Cnidarians

Deuterostome
Choradates (monkey)
Enchinoderms (starfish)
Butt first

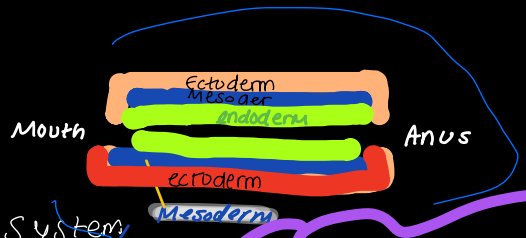
Protostome (most animals)
Does it have a cuticle
NO: Round worms, Arthropods
Yes: Flatworms, Tapeworm, Annelids, Segmented worms, Mollusca (snails)

Cnidarians: corals, jelly fish, Anemones

Cuticles shed

Germ Layers

1) ectoderm: Nervous system & epidermis or skin
2) Mesoderm Circulatory system, muscular & skeletal system, connective tissue, blood
3) Endoderm: lining of digestive/respiratory system / Gut lining



Sponges & Cnidarians & Protosomes

Sponges

Simplest body design

Porifera — "pores all over"

Cnidarians

Jelly Fish

- Asymetric
- Almost all marine
- Outbody layer is only a single thick
- Lack germ layers, tissues, organs, and mouth

Neither proto or deutra

- filter feeders

Collar cells

Specialized cells pull in water into sponge & capture food particles

Mollusca

- Protostomes / Most shells

3 Major classes

Gastropoda (snails)

- snails, slugs, sea slugs (lack shells)

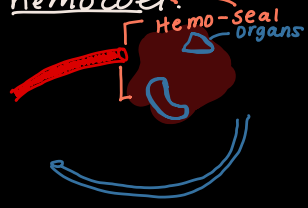
- Bivalvia (Shellfish) clam, oyster, mussels
  - Hinged shells
  - lack a head
  - Gills are used to filter feed & gas exchange

- Cephalopoda (squid, octopus)

Smart, active predator

- very mobile
- Short lived
- Well developed nervous system
- Closed circulatory systems

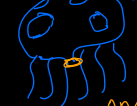
blood is not completely contained in blood vessels but directly bathes organs in hemocoel



Open - more active lifestyle

Jellyfish, anemones, corals

- Defined tissues, and ~~organs~~ (nervous, digestive, reproductive)
- Radial symmetry (Not a proto or deutro)
- Digestive system, 1 opening (Gastrovascular cavity) (incomplete)
- waste leaves same way it came in.
- Neither Proto or deut.



Tissues

2 germ layers

protostomes

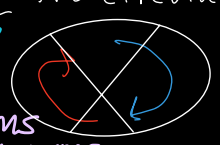
(most animals)

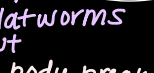
3 Major worm Phyla

- Platyhelminthes

"Flat" parasite

- flatworms,
- No circulatory tract
- Digestive (gastrovascular cavity) (No anus)
- Flat bc allows diffusion easier



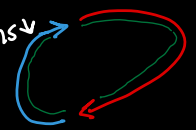


- Tape worms are flatworms without a gut
  - parts of the body break off and live inside & reproduce in host

- Annelida (mouth and anus) - Segmented worms

o rings around the body

- earthworms, leeches, polychaetes
- repeating body units (segments)
- Complete digestive system (both anus and MOUTH)
- No respiratory system
  - rely on diffusion of gas thru skin
- Closed circulatory system
  - Blood fully contained in vessels

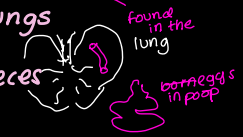


- Wet worms
- Wet leaches
- closed circulatory system

- Nematoda - "Thread like"

-No Segments
- Roundworms (exoskeleton)
- No circulatory
- No respiratory
- Shed exoskeleton

Ascaris lumbricodes
- eggs are injested
- Hatch and travel to lungs in blood vessels
- Reproduce in intestines
- Eggs released through feces



2 Body Forms Of Cnidaria

Polyp or Medusa

- Captures food w stinging cells (Cnidocytes)

Arthropoda

ectotherm (Hetero the cockroach) Youll meet him later:)

segmented foot open circulatory system

- Insects, crustaceans, spiders Milipedes & centipeds
- Any projection on insect body that is not wings are MODIFIED LEGS
- Segmented bodies into Head, throrax, and abdomen
- exoskeleton or chitin
- Must be molted to allow growth
- Limits water loss
- jointed & highly customizable
- Use different circulatory system to

closed

Study questions

More around oxygen

Stages of development

1) larva (feeding stage)
2) Pupa (resting stage; metamorphisis AKA transition)
3) Adult

indirect development - looks different as it ages.

How Animals control internal Conditions

- Negative feedback

System resist change to stabilize internal conditions

- Positive feedback

- Amplifies, encourages change to rapidly push away from homeostasis

Set point (desired valve. homeostasis)

- Sensors - measure current value or a variable
- control center - compare variable to set point & send direction to effectors responses
- Effectors
  - Body part used to respond (sweat glands

Heterotherms

Homeostasis

self — Stability, undergoing

- Homeostasis - Maintaining stable conditions inside body even while conditions outside are changing
- Physiology is how things function the processes, Managing external, internal enviorment

- Temperature
- Water intake
- Blood pressure
- Oxygen intake

Conforming
- changes inner state based on external change

Regulate
Remaining constant

Negative feedback

- Thermoregulation
  - heat
    - Cold is the absence of heat

Thermal energy moves

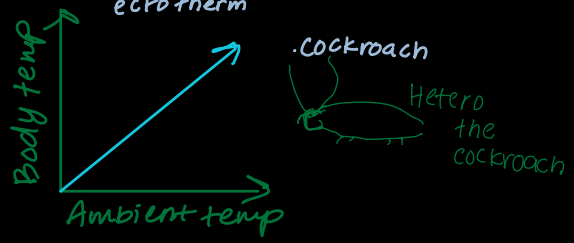
- Endotherms
  - Chemistry works at diff. speeds depending on temp.
  - Metabolism changes speed depending on temperature
  - Water Molecules freeze in cold

Body temp. matches outside

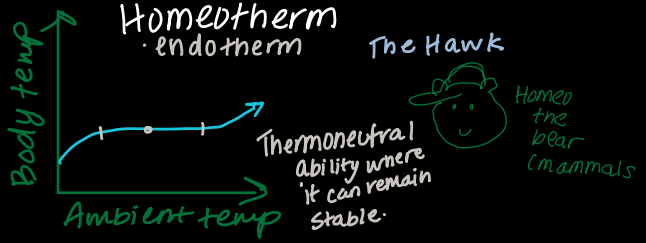
- can generate heat — mostly mammals & birds

- Ectotherms
  - unable to generate heat — most animals
- Homeotherms
  - Can maintain stable body temp when enviormental temp changes (independent of enviorment)

Heterotherm
ectotherm

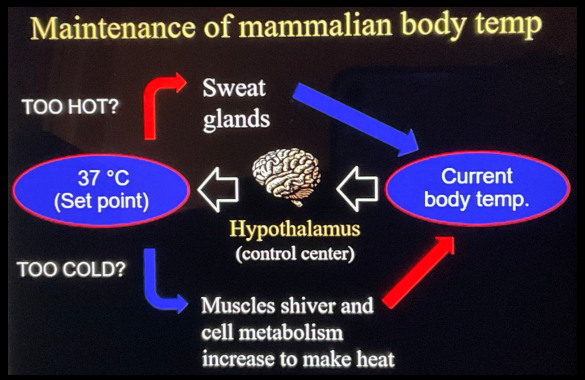


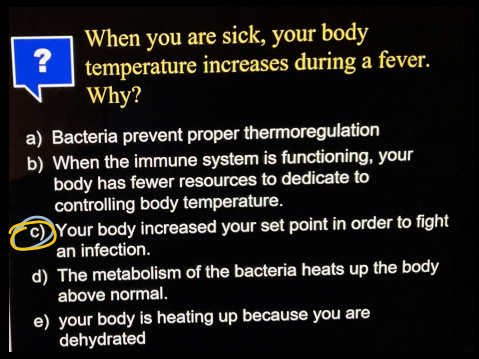
Homeotherm
endotherm



Control heat flow

- Physical
  - insulation = fat, hair, feathers, increase or reduces surface area
- Behavior
  - sunning, shading
  - activity during specific times a day





Positive feedback

- Clotting, urination, Childbirth
- Sexual responses

important in closed circulartory (high pressure)

left ventrical
- fish heart are better than amphibians
- friction
- diffusion frog

Deuterostomes

Echinodermata

starfish, sea cucumber, sea urchin

spiny skin — Hydrollic system = tube feet

- none live in fresh water

Chordata

"Noto cord"

- Urochordata (tunicates)
- vertebrata
- Cephalochordata

- supportive rod on our back
- dorsal hollow nerve cord (swells up & forms brain)
- pharyngeal slits (form gills in some animals)
- post anal tail
- no gills

DORSAL = Notocor
Hollow Nerve cord

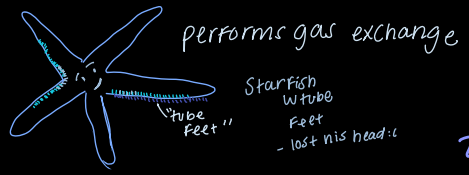
Notochord

- 1st structure to develop in chordate embryos

- Internal skeleton (calcium carbonate)

Notocord Picture
structure
- sits below a dorsal hollow nerve
- stiffens the body and provides a place for a muscle to attach

- Radially Symmetry
Larvae - Bilateral
Adults - Radial
- They lose their head
- Water vascular system (only echinoderms
- Hydraulic system composed of tubes & tube feet



laying out for easier gas exchange

- Humans had a notocord as an embryo

Most Modern Fish have jaws
Cartilaginous Fish - Sharks, rays, Skates
Ray finned fishes
- Bony skeleton
- Bony rays support fins
- Swim bladders


Swim bladder

Subphylum Vertebrata
- protective cartilage or bone protects the brain & skeletal elements protects dorsal & Hollow nerve! cord
- The vertebrae replaces notocord in adults

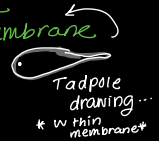
Lampreys
paralize other fishes w rasping mouth parts

Hag Fish
- jawless fishes have no fins or limbs
- feed on dying/decaying animals in ocean
- Skeleton is cartilage
- Adults retain notocord

Vertebrata
1) sweat glands
2) mammary glands
3) Hair
- Uterus
- endothermic

Vertebrata: Class Reptilia
lizards, snakes, birds
- scales
shelled egg, waterproof
Bird wings are modified legs

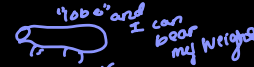
Amphibia
(both water & land animals)
like "androgenous"
Both water and land
* land - feet *
first tetrapods
- use lungs & skins to respire
- confined to moist enviorments
- skin i very thin gas permeable
- eggs surrounded by thin membrane
(double circuit) lungs, & skin



Amniotes AKA Sky army included green & birds
- Birds are Reptiles!
- lizards, snakes, turtles, crocodiles, dinosaurs
- Mammals
- Amniotic egg
- Fertilization inside female body
- Thicker skin
- Hair
- scales/feathers prevent water loss
- Excretory system conserve water

Reptilia Birds
- endothermic
- Feathers modified scales
- wings = hollow (modified legs
- large breast bone - supports wings
- Highly active

Lobe-finned
- Thick jointed bones in fins a step toward weight bearing legs.



living on land benefits
- more oxygen
- less energy to move thru air
- diffusion is faster in air
- challeges
- air is less supportive (need bones)
- Dehydration
- Need limbs / stiffen
- very dry (needs moisture to lower evaporation of water

shelled, waterproof amniotic

young must be protected on land (embryonic)

Respiratory Systems

Gas exchange -
- diffusion in/out body fluids

- Oxygen transport
- Types of respiratory system
- Vertebrae respiratory system

Aveolous
- tiny air sacs in lungs
300 mil.
- contact red blood cells

- Gas diffusion relies on gradients in gas concentration
  - Movement of gases into/out of body & cells rely on diffusion

Q) Why does oxygen move into your blood from air in your lungs
A.) O_2 concentration in air is greater than in concentration in blood

3 elements of GAS Diffusion
1.) Moisture
gasses dissolve in water
2) Thin surfaces
short distances allow quick diffusion
3.) Sufficient
surface area to ensure diffusion can oxygen needs

- Gas diffusion happens between air/water & blood at respiratory surface
- Between blood tissues & blood
  Capilitlaries - lots of surface area
  - lots of diffusion

Sponges
Porifera, Cnidaria (Jelly fish, coral, anemone), platyhelminthes (Flatworms), & Nematoda (round worms)
all rely on diffusion across body surface to move directly to/from body cells

No respiratory = Slow metabolism
Unable to sustain high level of activity.

Gills

Gills = AKA, "Get close to the surface"

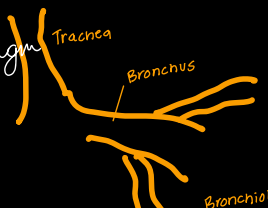
- extensions of body wall
- blood stays close to outside world
- lots of surface area allows blood to exchange gases w water
- Fishes & many invertebrates

Lungs

- internal "bags" of air attached to digestive tract
- location limits water vapor
- High surface area for

only mammals have diaphragm

Insulation
- Negative Pressure (suction)
contraction of



diaphragm
causes vacum when enlarged
- Ribs also assist

Exhalation (positive pressure)
"blowing"
- occurs when diaphragm relaxes
- rib muscle plays minor role

Alveoli surrounded by capillary beds

gas exchange
- Amphibians, reptiles mammals

Alveoli - connection between respiratory & circulatory systems

Blood is carry oxygen

Air moves into your alveoli by contraction of diaphragm muscle
- Creating negative pressure
- Insulating / suction

Tracheae (air pipes) (little air straws)
- air tubes bring gases near all cells in body
- O_2 doesn't travel through blood
- Terrestial arthropods
- gas enters tracheae openings called Spiracles.

More ATP, More feeding
- High metabolic rate

- Reduced O_2 concentration in alveoli = slower diffusion of O_2 into blood

air mixes in lungs

Hemoglobin - loads up oxygen and transport it to wherever its needed

Iron atoms are able either binds or release

Hemoglobin - releases O_2 when O_2 concentration is low

Hemoglobin - binds to O_2 when O_2 concentration is hig

Q) Why is carbon monoxide poisonous?

A) It binds to hemoglobin much stronger than oxygen

Humans have tidal breathing,
- slows down diffusion

We are breathing in "old air"

tidal

* questions here *

- Birds use unidirectional flow of air across lung. moves 1 way

"swiss cheese block"

comes in one side, comes out other.

air fills air sacs
- high O_2 air pushed old air out
- old air is stored in air sacs

Tide = fresh air

Exhalation

Oxygen comes in O_2 (suction) O_2 O_2 O_2

no longer 20% oxygen

Birds do not suction

back into trachea

Birds get fresh air when exhaling

this is why they can fly of stay in air

orange=old air

Circulatory

Non bird reptiles & amphibians

why do we need circulatory systems?

moves around

1) gas O_2 & CO_2 Diffusion is slower in long distances
- nutrients
- waste
- heat
- immune cells

Circulatory systems

* What's the purpose of circulatory systems?
* Are circulatory systems necessary?
* Vertebrate circulation systems are covered in lab and lecture we discussed differences in structure (2, 3, and 4 chamber systems), and in class discussion summarized what was in the video. Key things you need to understand before understanding this stuff are: (1) what is diffusion?, (2) why does blood slow down as it moves through a tube?, (3) how is oxygen related to the amount of activity an animal can do?
* Can you draw (flow chart or diagram) blood flow through the heart and body of each system?
* What direction does the blood flow in your diagram?
* What is different about the circulatory system structure in typical fish, typical reptile/amphibian, and mammal/birds?
* How is each type of system (2,3,4) better than the others? How is each type of system worse than the others? Why?

Blood slows down bc of FRICTION

Oxygen is needed to form ATP and ATP is what is needed to do activities. The less oxygen, the less ATP, the less activity in an animal.

blood comes in from the right

In amphibians they have 2 circuits. 1 being their lungs and the other being their skin tissue. In fishes they only possess 1 circut, 1 ventricle and 1 atrium

Amphibian
- 2 atriums
- 1 ventrical
- 2 atria

2 circuit system

Arteries
carry away from heart
(high oxygen blood)

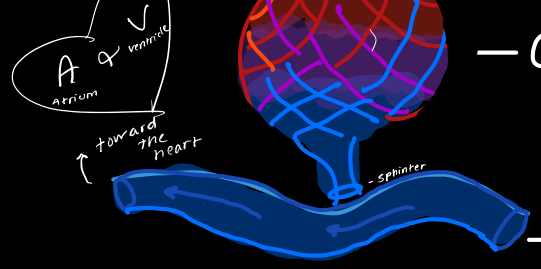
Veins
carry toward heart

Cnidarians dont need circulatory systems
- have cells that can bring oxygen closer (low metabolism creatures)

Arteries

Capillaries
thin narrow vessels where gas, waste, Nutrients exchange occurs

Red blood cells contains hemoglobin → a protien can carry 4 oxygen molecules.



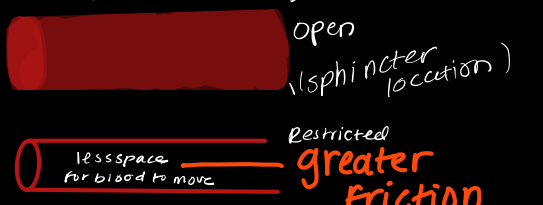
- Form dense capillary beds

Rubber band like muscles- "sphincters" change flow of capillary bed

Friction of smaller/restricted sphincter/muscle.

decides how much friction! (Muscle contracts between capillary or Artery/vein.) Similar to a rubber band.

(Closed) drawing sketch



Closed Circ. System

- blood fully contained within vessels, vertebrate annelids, cephalopod molluscs

Benefits

1) Rapid transport (oxygen, waste, etc.)
2) Better control of blood flow to specific areas of the body
3) Specialized blood cells and molecules can be retained inside vessels (explain why this is helpful to animals)

Vertebrate's 2 circulation circuts

1) Pulmonary - blood movement to/from lungs or gills
2) Systemic - blood flow to remainder of the body

Trend in evolution more seperation lung/gill & the "rest of the body" circuts

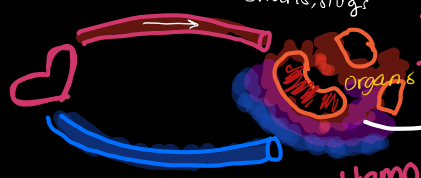
Shorten diffusion

Open Circ. System

circulatory

marinating; blood partially contained in vessels; blood mixes w ECF; arthropods (flies, roaches) & most molluscs (snails, slugs)

moves slower - blood



(Open)

Fish (most) 1 circuit, 1 ventricle and 1 atrium

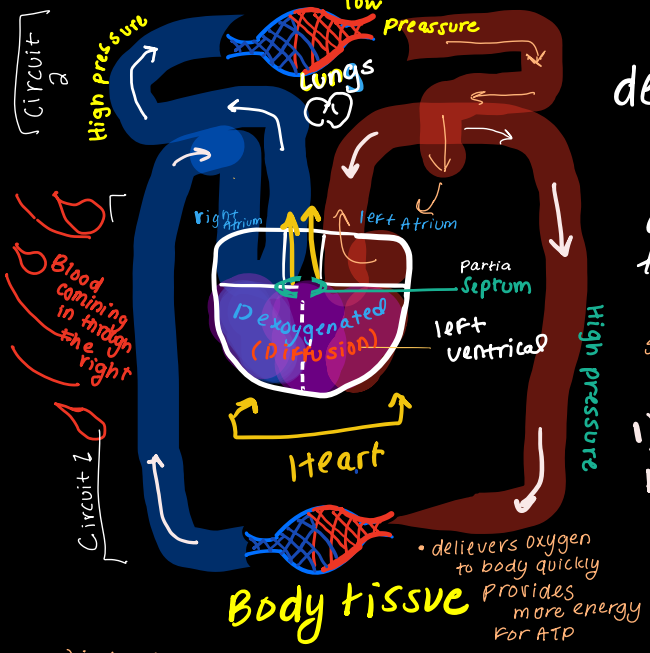
Amphibians & most reptiles

Not birds, Not crocodiles

2 circuits

1 ventricle

2 atria (atrium plural)



1) into ventricle
2) goes into lungs
3) into the body

1) Blood comes from right into the ventricle
2) sent to the lungs to get oxygen
• coming out the lungs it has low pressure
3) Back into left atrium
4) Back into ventricle (into purple)
5) *Diffusion occurring*
6) Out from left atrium now has high pressure
7.) to the body

deoxygenated blood in vertebrates always come to the right side of the Heart ← 3 Chamber heart

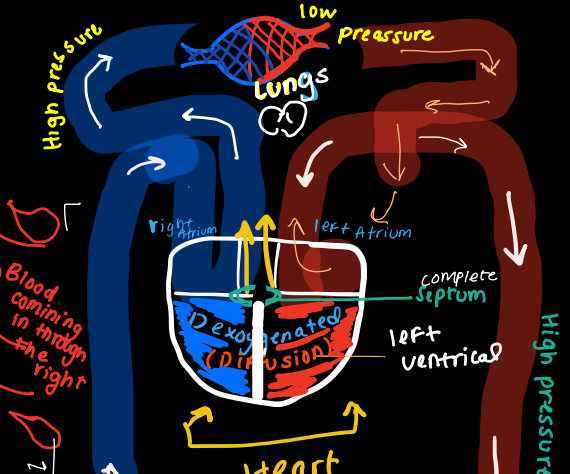
septum = seperates blood flow in ventricle

1) Blood comes from the right atriam,

Reptiles & Amphibians

- Dont have to use their lungs. they have 2 Curuits. =
- 1) lungs
- 2) Body tissues

Mammals

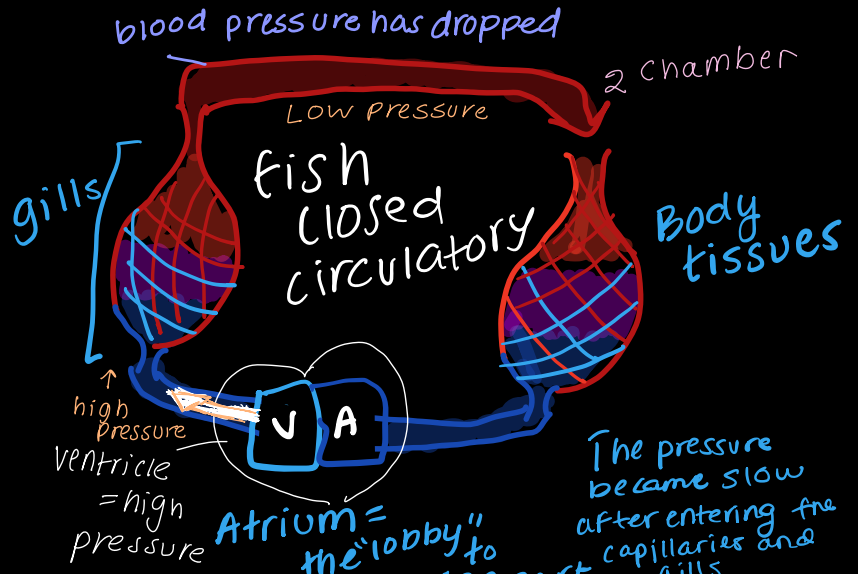


4 chamber heart

* Has complete septum *

incomplete septum allows your

blood pressure has dropped



Atrium = the "lobby" to the working part of the heart

The pressure became slow after entering the capillaries and gills

Ventricle

- much more Muscular, the
- working part of the heart. Generates blood

High pressure pushes flow to gills

the further the pipe, the greater the friction

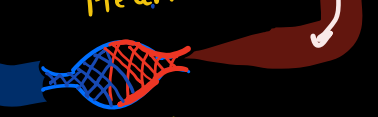
problem:

low systematic pressure slows delievery of O_2 to tissues

Oxygen is arriving slower to body tissues slower → less ATP → low metabolic rate → fishes move slower

- When your atria & ventricle relaxes = Diastole
  Filling up...

120/80



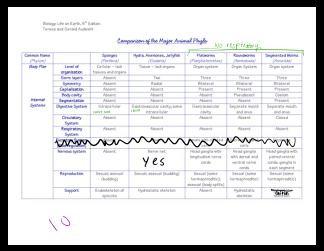
Body tissue

NO diffusion occurs

body recieve oxygen anyways

- When atria contracts forcing blood into ventricles
- Ventricle contracts pushing blood pushes blood into ~~artery~~ aorta & pulomonary arteries

systole pumps out



Sinoatrial (SA) node (located in Atrium)

Heart pacemaker

- generates electrical signals to the heart
- signals to heart when to contract after filling up w blood from atrium

Atrioventricular node

- Holds signals and delays
- Then sends it on into ventricle, pumps it out

signal stops here

waits = diastole

Coronary artery

- delievers oxygen & nutrients to cardiac muscle
- Cholesterol, plaque and calcium deposits can build up and block blood flow/blocks oxygen from getting to heart

EXAM 4

Flatworms, Earth worms, Slugs, Snail, Round worms, Bugs, Star fish, Monkey, Cats, Bird, Reptiles

	Porifera (sponge)	Cnidaria (Hydra, jellyfish, Anemone)	Platyhelminthes	Annelida (segmented)	Mollusca (slugs, snails,	Nematoda (roundworms thread like	Arthropoda (insects)	Echinodermata (starfish, sea urchin,	Chordata
			Protostomes					Deuterostome	
Symmetry	None Asymmetric	Radially (all around)	Bilateral	Bi	Bilateral	Bilateral	Bilateral	Bilateral (larva)	Bilateral
tissues	NA	yes							
Proto/Deutr	None	None	Proto	Proto	proto	Proto	proto	Deutro	Deutro
Cuticle?	X	X	yes	yes	Yes		No	No	No
Respiratory	NA	NA	None diffusion	None diffuse	yes, gills	NA	yes, Tracheal tubes	Hydralic tubefeet	
circulatory	NA	NA	NA	closed	closed	NA	open	open	closed
Digestive	collar cells	gastro vascular (opening)	Simple digest around the body	complete mouth & anus	complete mouth & anu	complete mouth & anus	complete mouth & anus	complete mouth & anus	complete (Tube like)
Germ layers	NA	2	3	3	3	3	3	3	3

ENDOCRINE SYSTEM

How do hormones interact with cells? Why do hormones interact with certain cells in our body but not with other cells?
Hormones interact by binding to receptors on target cells. Similar to keys

Draw the pituitary gland and the hypothalamus. Label clearly, specifically identifying the posterior and anterior portions of the pituitary.

Releasing hormones are always produced by the Hypothalamus. Tropic hormones are produced by the Anterior pituitary Gland.

Create a table for the posterior and a table for the anterior pituitary showing various hormones each produces. Indicate the releasing hormone that stimulates secretion of each tropic hormone produced by the anterior pituitary.

Chart ✓

Make a table illustrating the sources, targets, and effects of all hormones discussed today. Ask yourself questions about the table until you clearly grasp the roles of each.

Diagram relationships between the anterior pituitary, hypothalamus, and target organs using an appropriate hormone of your choice. Explain how negative feedback is used to control levels of this hormone. Hypothalmus releases hormone, in goal of keeping body at set point, either on or off target shuts off hypothalamus and pit. gland to maintain set point

Cortisol is a hormone that is used to control inflammation in patients because it suppresses the immune response. Given that cortisol is a stress hormone, would you expect student levels of cortisol to be highest in the middle or a the end of the semester? highest at the end of the semester, when it lowers immune system causing many to get sick

Would you expect high levels of cortisol in the GSU student body to occur when disease is more common or less
when disease is more common

If you were to increase parathyroid hormone concentrations in a cow by a series of injections over several months, would you expect the cow's bones to become stronger or more fragile? Justify your response, clearly explaining the connection between parathyroid hormone and bones.

- would expect the bones to become stronger because after the parathyroid gland releases parathyroid hormone then targets bones and kidneys it raises Ca+ in the blood, Calcium is a good source for bone stregth

Consider the impact of thyroxine on metabolism. Would you expect a person with lower thyroxine levels to have higher or lower body temperature? Justify your response.

- Thyroxine is responsible for metabolism and thermoregulation, if thyroxine is low, the person would be cooler in temperature

Imagine that your job requires you to work outside for long periods of time. During Winter, would you expect thyroxine levels to increase or decrease? Justify your response, paying close attention to thermoregulation.

- I would expect thyroxine levels to be increased in the winter because the external temp is much cooler so the body would need more thyroxine to help regulate internal set point

Cancers are often treated with radiation to kill rapidly dividing cells. This can be done by administering to patients a radioactive substance that selectively accumulates in tumors. Would it be possible to treat thyroid cancer with this method?

Explain. Hint: what element does the thyroid store that is needed to make active thyroxine?

Iodine

Given what we have learned regarding regulation of hormone levels, explain why men's testicles atrophy if they use testosterone for muscle enhancement.
Once testostrone levels reach set point GnRH + FSH/LH turn off / on when regulating testostrone in the body, but when testrone is consumed, the testicles atrophy bc they have now surpassed set point causing GnRH to turn OFF, thus a reduction in size bc GnRH is responsible for growth.

List and describe the functions of the glands associated with the reproductive tract of human males.

-

Which costs more energy for an animal to produce: an egg or a sperm? Give a rationale for your selection.

- It cost more energy to produce an egg bc it requires a longer cycle and more complex process than sperm, which has stem cells that continously divide.

Is it evolutionarily more valuable to produce many small offspring or few, larger offspring? Give an argument that supports your selection

quality over quantity - fewer larger offspring

Endocrine System

Endocrine hormones travel through the blood & can affect very distant cells

Animal hormones

Secreted into ECF to influence target cells

(Insulin is made by pancreas)

1) release hormone
2) transport to target cell
3) Hormone binds receptor protien
4) target cell responds

Hormones only affect cells that possess a matching receptor
"Similar to a key"

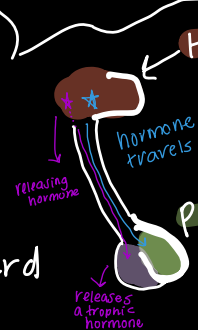
Steroids like testostrone, estrogen are fat soluble, are able to by pass fatty bilayer phospolipid membrane

The Human Endocrine System

- Glands secrete endocrine hormones
- some glands are composed of nervous tissue
- Lesser glands
  - kidneys
  - Heart
  - Intestines
  - Fat cells

The Pituitary Gland

- controls many aspects of our physiology
- "Middle man" brain vs. body
- Controlled by hypothalamus
- 2 glands
- Posterior - neural; secretes hormones produced by neurons whose cell bodies are in the hypothalamus
  - secretes neurohormones
  - composed of neurons extending downward from the hypothalamus
- Anterior - Endocrine; releases hormones



Posterior

Oxytocin
- Target smooth muscle in uterus and mammery glands
- Effectors:
  - Uterine contractions; milk let down reflex

- Pancreatic

Glucagen
Source: Pancreas
Target: liver & fat cells
Effect: increases level of blood sugar by stimulating uptake of sugar by organs

Insulin
- regulates blood sugar

Source: Pancreas
Target: liver and skeletal muscle
Effect: Reduces blood sugar by stimulating uptake of sugar by these organs

Growth — Anterior

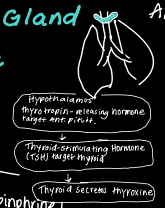
1) Hypothalamus Secretes Growth hormone releasing (GHRH)
2) Anterior pituitary releases Growth Hormone (GH)
3) Liver releases IGF-1 stimulate bone and muscle growth

Parathyroid gland

Parathyroid Hormone
Source: Parathyroid gland
Targets: Bone & kidneys
Effect: Maintain/releases Ca^{+} in blood

Calcitonin
Source: Thyroid
Target: Bone
Effect: lowers blood Ca^{2+}
in some vertebrates (Not Humans)

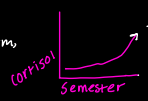
Thyroxine — Thyroid Gland



- increases Metabolic rate
- requires iodine to be active
- too little iodine is common reason for goiter; growth of thyroid gland

Adrenal Gland

adrenaline = epinephrine (and norepinphrine)
Epipens= opens lungs & throat to allow more oxygen for allergic reaction
- Target: various
- Effectors: Fight or Flight
- uses positive feedback to increase heart rate metabolism, oxygen delivery to tissue



cortisol
- steroid hormone
- Targets:
- Effectors: increased blood glucose, and reduced inflammation
"hey body dont worry about that"

Sex Hormones

Androgens - Male hormones
Source: Testes
Target: various

Estrogen & Progestrone - Female hormones
Major estrogen in humans is estradiol
Source: ovaries
Targets: various

Anterior = endocrine releases hormones when stimulated by releasing hormones produced by the hypothalamus

Target gland hormones inhibit secretion of releasing and trophic hormones "returns to set point"

Secretes trophic hormones that controls endocrine glands "Middle manager"

Hypothalamus → Anterior Pit. → Gland

Secretes releasing hormone

Trophic = movement

Anterior Pit. = Manager → releases trophic hormone

Target gland secretes a hormone in response

Diuresis - urine

Anti-diuresis - makes kidneys make less urine (less access to H_2O, dehydration)

Antidiuretic Hormone (ADH)

- Target: kidney
- Effectors: reduced urine production

Human Male System

Sex Hormone Regulation in humans

Hypothalamus secretes gonadotropin-releasing Hormone (GnRH)

↓

Anterior pituitary Secretes FSH & LH

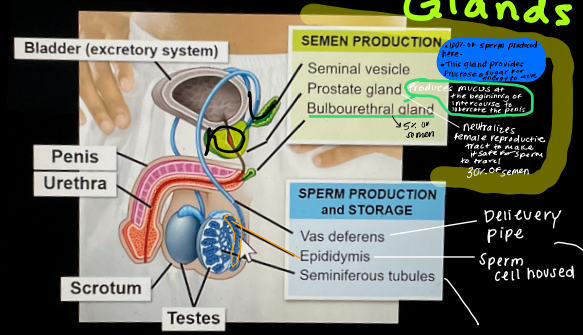
↓

Gonads release sex hormones

Sex hormones turn off hypothalamus if over the set point

Gonads
- ovaries
- Testes

Male designed to produce and deliver semen, a complex mixture of sperm (<5%) and fluids



"LH" = Luteinizing Hormone
- goes to testes
- Raises testostrone levels

Testostrone:
- From the testes
- Stimulates sperm production & development of secondary sexual characteristics

"FSH" = Follicle stimulating Hormone
- goes to testes
- stimulates sperm production

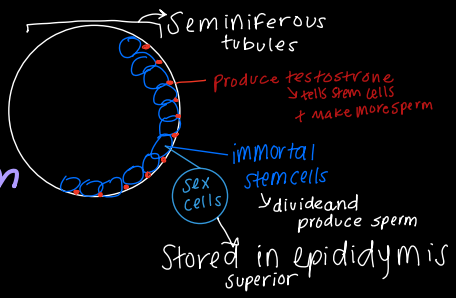
2 Categories of Reproduction

- Asexual Reproduction
  - only require one parent
  - Produces offspring exactly the same
  - Fast and cheap
- Sexual Reproduction
  - Requires 2 parents for genetic material
  - Generates variation
  - cost alot of energy compared to asexual reproduction
  - Requires egg & sperm

How Sperm is produced

process called "Spermatogenesis"

Semen is the liquid used to house sperm



MALE SYSTEM
questions •

Review the definitions of positive and negative feedback. Try to explain them to someone else. Then have that same person explain it back to you.

•

Make a table illustrating the sources, targets, and effects of hormones in reproduction. Ask yourself questions about the table until you clearly grasp the roles of each.

•

Use a flow chart to illustrate regulation of human sex hormones. Your diagram should include negative feedback. Explain this chart to someone outside the class. Then have that person explain it back to you.

•

Given what we have learned regarding regulation of hormone levels, explain why men's testicles atrophy if they use testosterone for muscle enhancement.

•

List and describe the functions of the glands associated with the reproductive tract of human males.

•

Which costs more energy for an animal to produce: an egg or a sperm? Give a rationale for your selection.

•

Is it evolutionarily more valuable to produce many small offspring or few, larger offspring? Give an argument that supports your selection

FEMALE SYSTEM

Create a diagram of some sort (drawing, flow chart, etc.
) that illustrates the ovarian cycle assume a "typical" cycle of 28 days) from egg to breakdown of the corpus luteum. Next to each stage in your diagram or drawing, identify the hormones produced and their respective levels (High, Low, Absent).

•

Graph levels of the following hormones in the human ovarian cycle: GnRH, progesterone, estrogen, LH, and FSH. Your x-axis should be time (days), and your y-axis should be "amount of hormone."

FSH high at 14 lowest at 21 days
LH high at 14 days

•

In your own words, explain how the ovarian cycle controls what occurs in the uterus. Your answer should clearly include information on levels of hormones and effects (such as when they are present and when they are not present).

hypothalamus produce GnRH? Why or why not?
Yes because its needed to trigger release of FSH and LH in anterior pit.

During the weeks when she is taking the pills containing progesterone, would her anterior pituitary produce FSH? Why or why not?
NO, Progestrone supresses FSH & LH

How does this birth control regime keep her from getting pregnant? (Ignore the effects on cervical mucus here. Focus on hormonal regulation and interactions with the ovary.)
The Progestrone supresses FSH + LH. If these hormones arent produced A follicle will NOT develop and she will not ovulate

Progestrone suppresses FSH + LH If FSH is not produced, A follicle will not develop and she will not ovulate

Why is iron included in the placebo pill
can increase the proliferation of endometrium

Human Female System

2 cycles

— Designed to recieve and nourish —
a growing embryo

- All eggs are produced before birth but meiosis pauses until puberty

Ovarian Cycle

- follicle - oocyte surrounding nurse cells

1 follicle develops per month and release a mature egg

1) Menstural Cycle

peperation of uterus for embryo
the uterine wall (endometrium) periodically thickens & sloughs off menstration (thinning)

2) Ovarian Cycle

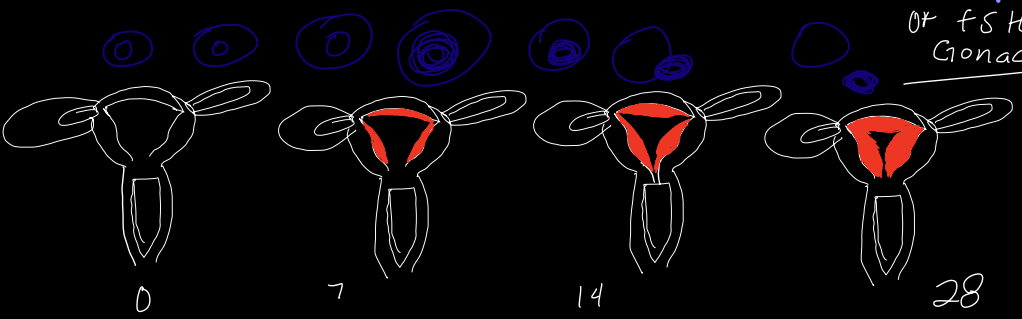
- After puberty, meiosis in a oocyte starts again with ovulation
- When fertilization occurs (in fallopian tube), the egg finally completes the last steps of meiosis

(ovulation)

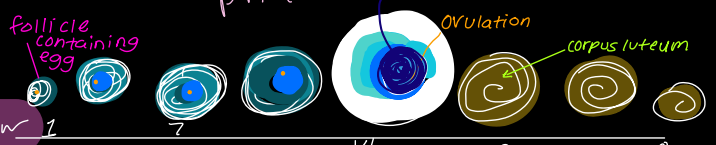
Anterior Pituitary Hormones involved
- FSH → stimulates follicle development
- LH → Triggers ovulation

GnRH stimulates release of FSH and LH
Gonadotropin

Development and release of egg; controls uterine cycle
- Regulated by activity of hypothalamus and anterior pituitary
- The human cycle (~28 days) has 2 phases



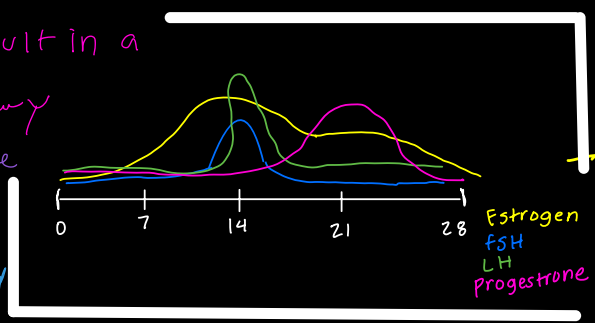
corpus = dead body
luteinum = yellow



1. Day 1-14: development and release of an egg
2. Day 14-28 endocrine (glandular) Phase
   - remaining cells left behind the "corpus luteum" secrete estrogen and progestrone which single to uterus

1) At day 1, FSH stimulates new follicle development
2) The follicle produces estrogen. Estrogen initially suppresses FSH and LH
3) increasing estragen levels result in a surge of LH release from pituitary
4) LH causes rupture of the follicle
5) Progestrone from the corpus luteum maintains uterine lining and suppresses FSH release
6) When corpus luteum degrades, progestrone levels drop, menstration begins and fsh levels rise.

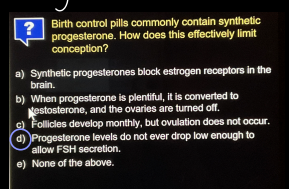
Estragen is triggered by growing follicle



Progestrone low = FSH is high

Embryo signals to uterus to maintain high levels of progestrone
- Uterine wall must be maintained in order to support the new embryo
- diffusion carries gasses/nutrients, wastes to and from developing child

Hormone Chart


Birth control pills commonly contain synthetic progesterone. How does this effectively limit conception?

a) Synthetic progesterones block estrogen receptors in the brain.
b) When progesterone is plentiful, it is converted to testosterone, and the ovaries are turned off.
c) Follicles develop monthly, but ovulation does not occur.
d) Progesterone levels do not ever drop low enough to allow FSH secretion.
e) None of the above.

Hormone	Source	Role
FSH Follicle stimulating Hormone 14	Anterior Pituitary	Stimulates follicle development • Higest right before egg is released from ovary at day 14
LH 14	Anterior Pituitary	Triggers ovulation (right before) Around day 14
Progestrone 21	Secreted by corpus luteum	Prepares endometrium for potential pregnancy after ovulation Highest at about 21 days
Estrogen 12-14	-Follicle produces	Thickens lining of endometrium helping prep. pregancy later half of cycle

Progestrone suppresses FSH & LH

If FSH is not produced, A follicle will not develop and she will not ovulate

- estragen causes raise in LH
- FSH and progest. are oppisite in #

- Human chorionic Gonadotropin (hCG) from an embryo sustains the corpus luteum
  - Later the embryo produces estragens and progesterone to maintain the placenta.

Detects Ovulation = LH

Detects pregnancy = HCG

Nervous System

What is the nervous system?

- An "electrical" interface between enviorment and body
- Network of cells capable of detecting stimuli interpreting this information, and initiating responses.

Q & A

A Neurons can produce

- Neurons - basic unit of a nervous system
  - excitable
  - can send/recieve electrical signals
- Glial cells
  - Life support for neurons
  - Do not send electrical

signals that impact other cells.

- Signals
- Actively divide
- Abnormal division cause cancer

3 different neurons:

Sensory neurons
detect enviormental stimuli and translate these into electrical signals

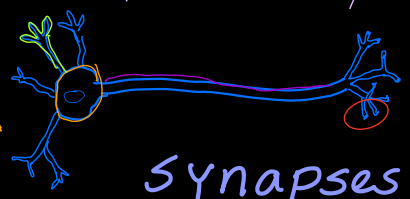
Interneurons
Integrate, store and process information

Motor Neurons
control muscles glands

Neuron Structure

Dendrites
recieve information

Axon
conducts electrical signals away from cell body



Cell body
Processes info from dendrites

Synapses
Signals are communicated to other neurons at synapses

2 Major Components

- Central Nervous System
  - brain
  - spinal cord

Brain
- thoughts
- emotions
- complex processing and responses
- memory

- 3 Major Regions in Brain
  - Forebrain

Forebrain

♡ Hypothalamus
- homeostasis / hormones

♡ **Cerebrum**

Higher thought and processing

- Seperated into 2 hemispheres (right / left)

Each hemisphere consist of 4 lobes

- cerebrum
  thought, consciosness, memory
- Hypothalamus
  transmit sensory and motor info to/from fore brain

Midbrain

Midbrain
transmit sensory and motor information to/from forebrain

Hindbrain

Hindbrain regulates automatic functions like breathing/heart rate.

- responsible for subconscious processes
- Medulla & pons (brainstem)
  Control breathing rate and pattern
  - Heart Rate
  - Blood pressure

Frontal lobe

- Higher thought
- Voluntary muscle movement
- Personality

parietal lobe

- Sensory interpretation

Occipital lobe

- Visual prosessing

Cerebellum

- Coordinates routine movements
Plays role in "muscle memory"
- walking
- standing
  playing instrument

Temporal lobe

- Auditory Processing
- Pattern recognition
- Naming
- Sounds in language

Peripheral NS

- Carries info to/from CNS to body
- composed of 2 systems
  - Autonomic
  - Somatic

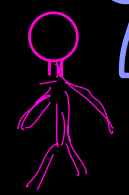
Somatic

- Conscious control
  +
- Sends signals to skeletal muscles for movement

Autonomic

- involuntary control of glands
  smooth muscle
- Sympathetic NS
- Parasympathetic NS

- Interstate of nervous system
- limited processes
- Reflexes



Study questions

NERVOUS SYSTEM QUESTIONS

- What are the general roles of sensory, motor, and interneurons?
  - Detect enviorment stimuli + translate to elect signals.
  - Integrate store & process information
  - Control muscles glands
- Draw and label a neuron. Identify roles of each part of the neuron.
- Review the slide on functions of the different cerebral lobes. Describe the symptoms you think a patient would have if they had a stroke in each of these areas.

Cards

- In your own words, tell a friend or family member what the following parts of your nervous system do: Cards
  - – Somatic division of your peripheral nervous system
    - Conscious control / Sends signals to skeletal muscles for movement
  - – Autonomic division of your peripheral nervous system
    - involuntary control of glands smooth muscle
    - Sympathetic NS
    - Parasympathetic NS

Sensation

Neurons are slightly negative in charge when resting

Sensory receptors

Neurons – Able to detect/measure things in the outside world that translate stimuli into electrical signals

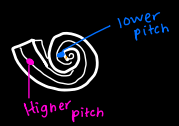
Different types of stimuli require different sensors

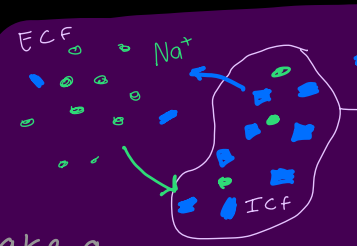
Mechanoreception

vibration, pressure

EARS

"Sounds" are pressure waves





more sodium outside than inside

what would make a voltage to increase (become positive in a neuron?

Sodium diffuses into the cell.

Sodium move into the cell

Potassium is greater in the cell, it moves out!

always running the K+/Na+ pump

Our Brain First ask...

- How strong or weak?
  - only a few neurons will respond if theres not enough action potential.
- Frequency

If enough sodium enters the cell, it will send an action Potential.

- Our ears convert pressure waves to neural signals

Outer Ear

Tympanic membrane

when waves hit it, it bends

Middle Ear

[the malleus, incus, stapes]
the ossicles
puts pressure on bones

Inner Ear

Sound moves different links of the cochlea

- Bouncing trapoline = tympanic membrane/ear drum
- Middle ear connected to throat
- Ossicles bones in ear place pressure

depending where cells are stimulated in cochlea/snail shell.

[loudness comes from
How many action potentials]

Sound travels through the cochlea and bends hair cells

Pushing on the hair cells, sends action potential on auditory nerve.

Different pitches travel diff. distances to stimulate diff neurons.

EAR

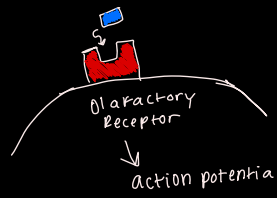
= Sensation & Perception

how frequent or action potential sent from each neuron.

Chemoreception

Chemical compounds
(odor / taste)

- Olfaction / Smell
  - molecules diffuse into mucus
  - bind to receptor protiens or olfactory receptors
  - when smell molecules bind, ion channels open and trigger action potential thats sent to brain
  - until it reaches threshold



Taste (chemoreception)
molecules bind to receptors organized as taste buds
stimulating action potentials

More range of smell receptors

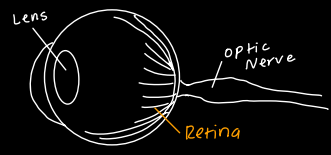
Photoreception

- light

Sight

- Inside photoreceptor cell membranes a light-sensitive pigment called Rhodosphin changes shape when stimulated by light

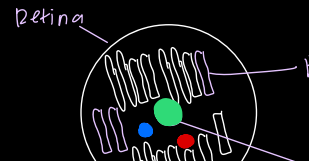
- Human photoreceptors are located in the retina, a layer in the back of the eye



- Cloudy lens = cataract
- As you age, the lens gets weaker

- **Rods**
  - responsible for black & white vision
  - concentrated in peripheral retina
  - very light sensitive
    - gray scale
    - doesn't do well in low light
- **Cones** (3 types) — Red, Blue, Green
  - sense different colors of light
  - found in central retina
  - poor sensitivity

Most cones are in the center of retina



Sensation questions

• Explain the difference between a sensory receptor and a hormone receptor. Sensory → able to detect/measure things in the outside world then translate to electrical signals

• If an auditory (hearing) receptor is stimulated, the voltage in the cell goes up. Did sodium or potassium move across the membrane? What is your reason for choosing that ion? Which direction did it diffuse (into or out of cell)? Explain the direction of the diffusion. Sodium moves in, voltage increases
K+ leaves, voltage decrease

• For each of the following situations, explain how your nervous system discerns stimulus strength in terms of action potentials and the number of neurons that are stimulated: Not enough action potential / weak stimulus — Many action poten. / Strong stim.

– An insect walking lightly over your skin vs. hitting your thumb with a hammer.
weak stim, — Strong stim

– Stepping on a tack vs. cutting your finger off with a circular saw
Weaker than this lol

– An example scenario of your own
• Define chemoreception, mechanoreception, and photoreception and give an example from the human sensory system.
Smell & taste — Receptors that bind w chemicals molecules — Vibration / pressure (Ears) — light receptors (eyes/sight)
• Watch the video link provided with the section on hearing to improve your understanding of human hearing.

– How do humans discriminate between different pitches of sound? low vibe - lower pitch; quick vibe - higher pitch

– Explain, in your own words, why human hearing is considered mechanoreception

Cones (...) see color at the center

Rods do better job at detecting light

Neuron Function

Neurons are little batteries
at rest the neuron's membrane is:
• positive outside
• Negative inside

Resting pote.

Channels
are pathways for diffusion across a membrane

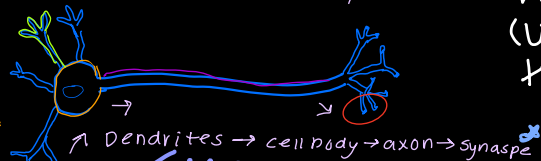
Pump - A protien that moves a substance across a membrane

Recall:

Dendrites
recieve information

Axon
conducts electrical signal away from cell body

Cell body
Processes info from



Active transport = uses ATP

• Diffusion occurs at A Sodium-potassium pump (uses ATP) and channels to create difference

• The difference in charges

where there is already a high concentration
- Against the gradient (Needs ATP)

dendrites

Neurons move positive ions to alter their charge

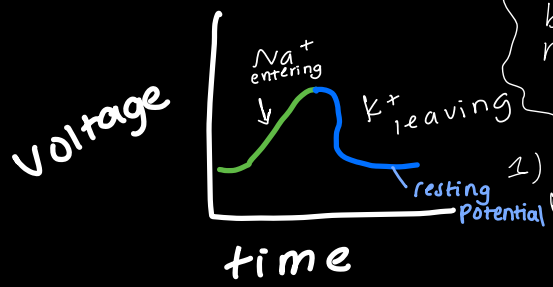
- Negatively charged ions trapped inside cells rarely move bc there's no negative pump
- **How can a neuron turn more negative?**
  If positive ions move outside the cell, the cell becomes more negative

Action potential are

Signals that travel down a neuron is sufficiently stimulated

Must reach positive threshold to send action potential

An action potential is a brief reversal of charge of the membrane that travels down an axon away from cell body

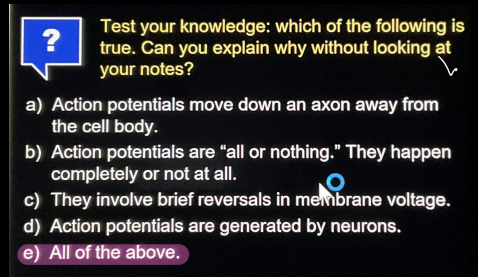


Action potential bc the brief reversal in charge moves down the axon

1) Sodium channels open first, raising membrane potential (diffuses inward)
2) Potassium channels open after, leaves the cell
3) Na^+ and K^+ concentrations inside + outside cell. By active transport to return to R.P.

How an Action potential Moves?

1) Threshold is reached in axon
2) Na channels open then more enters (domino affect)
3) Areas further down axon reach threshold



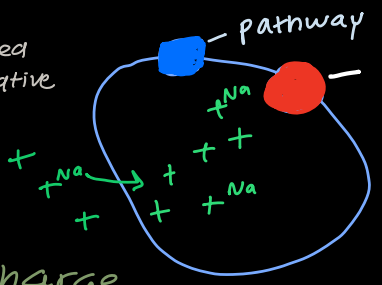
Synapses

Signals are communicated to other neurons at synapses

From inside to outside when a neuron is resting is called the resting potential

(-60 millivolts or -60 mV)

If a neuron is excited and becomes less negative it does by moving
A) Positive ions



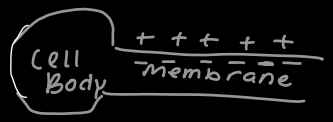
Pump brings in sodium

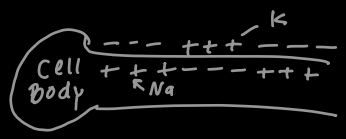
t = sodium

- When sodium moves in → voltage increase
- When potassium leaves → voltage decreases

- Action potential is the brief wave where it goes minus, plus, minus

Bye K^+
Hello Na^+
Bye K^+





Synapes

Presynaptic neuron → axon → Synapse → dendrites → Postsynaptic neuron

Delievers information

(recieving information) receptor

How are messages passed across?

and Na+ open

causes a pattern wave of voltage changes that moves toward synaspe

♡ chemical transmission between neurons

♡ Neurotransmitters are released into cleft by presynaptic neuron.

NEURON FUNCTION

• Diffusion is really important in neuron function. In a resting neuron,

– what ion is present at greater concentrations inside the cell? potassium K+

– which ion is present outside the cell at higher concentrations? Sodium Na^+

– which way would sodium move if sodium channels were opened?

moves inside the cell

– which way would potassium move if potassium channels open?

moves outside the cell

• In your own words, what is an action potential? How does an action potential move down an axon?

when the neuron reaches threshold –

• What do postsynaptic and presynaptic mean?

where its recieved/delievered

• Explain how one neuron uses neurotransmitters to communicate across a synapse with another neuron.

sodium ions reach threshold

• If a neurotransmitter opened up potassium channels on a post-synaptic membrane, would the membrane potential of the post-synaptic neuron become more positive or more negative - why?

more negative as a result of positive K+ leaving the cell, but then more positive when sodium enters the cell

– Does this move the membrane potential closer or further from threshold?

movement of anions sodium and potassium brings cell closer to threshold

Hormone	Source	Target	How does tissue respond
ADH	Posterior pituitary	kidney	increase amount of water retention reduces urine production (conserves water)
Oxytosin	Posterior pituitary	smooth muscle in uterus + mammary glands	uterine contraction Milk let down reflex
Insulin	pancreas	liver, skeletal muscles	Reduces blood sugar by uptaking sugar
Glucagen	pancreas	liver, fat cells	Increases blood sugar by releasing into blood
Parathyroid	Parthyroid	Bone, kidney	~~Elevates~~ plasma calcium level takes up calcium
Thyroxine	Thyroid	various	Metabolic rate Thermoregulation
LH (male) (Female)	Anterior Pit.	Testes	Raises testostrone levels
		Corpos luteum	triggers ovulation
FSH Male Female	Anterior Pit.	Testes	Stimulates sperm production
		Ovaries	Stimulates follicle development
TSH	Anterior pit.	thyroid	release thyroxine

epinephrine → adrenal gland → regulation, heart rate blood pressure