Pill Bugs' Preference Between Damp and Dry Environments

Abstract:
In this lab, an experiment was designed to test the preference of pill bugs between damp and dry environments. This was tested by placing 15 pill bugs in an enclosed box with a distinct dry and wet side and observing their position after 6 minutes. Substantial margins that pill bugs prefer damp environments than dry environments was indicated. When the pill bugs were in their favoured environment, they would find each other in groups of 4 and huddled together. Their preferences varied with the effect of the different humidities of environments. Our independent variable is the type of environments (damp/dry). Pill bugs' preference between damp/dry is our dependent variable.

Hypothesis:
If we expose pill bugs to both damp and dry conditions, they will prefer to be in the damp condition.

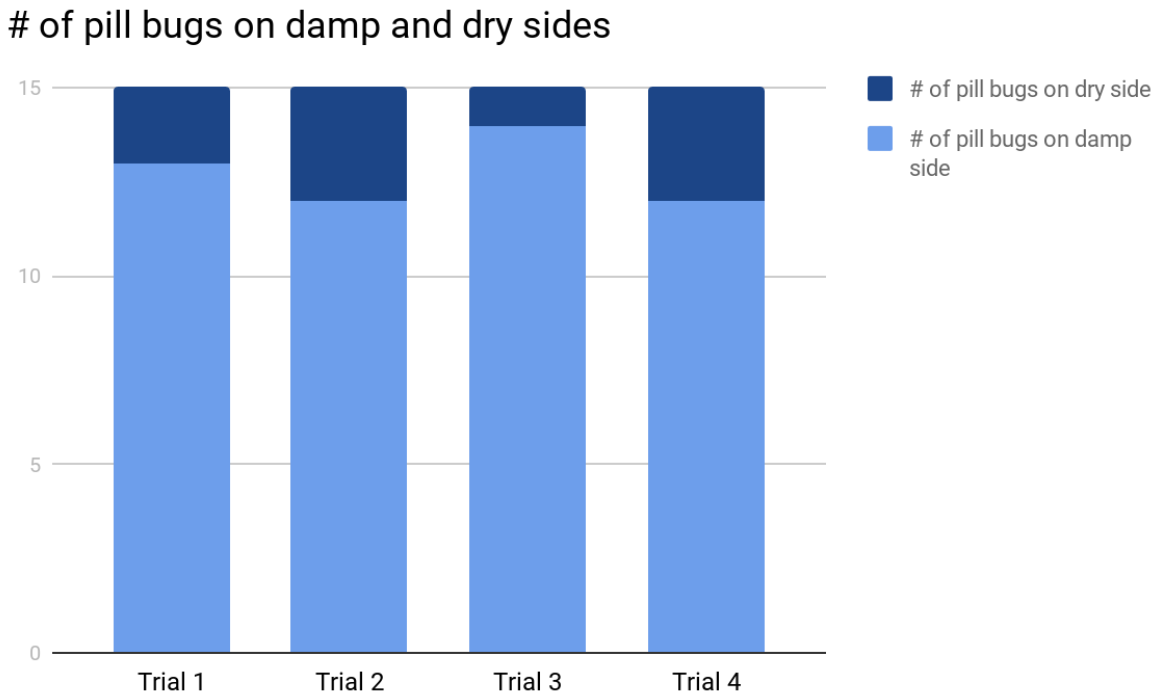
Procedure:
1. Acquire 15 pill bugs per trial.
2. Find a container with a lid, cover one half with dry paper towel and the other with moist paper towel on the bottom portion of the container.
3. On the lid, put moist paper towel on one half of the lid, tape the other half the lid with dry paper towel.
4. Place the 15 pill bugs into the middle of the container, cover with the lid and leave for 6 minutes.
5. Remove the lid and count the amount of pill bugs on moist side and on the dry side on both the bottom portion and the lid.
6. Place pill bugs back into original container for 10 minutes to allow them to have some break so that they won't get tired or stressed out. Only use the same batch twice to ensure consistent and accurate results (1 group / 2 trials).
7. Use another group to conduct more trials.

Observations:
- When the pill bugs were introduced to the container they moved around indecisively, they wandered to both sides but not staying on one side.
- The majority of the pill bugs tended to favor the damp side either remaining on that side or staying close to the border between dry and damp paper towel.

- After they had selected the moist side the pill bugs huddled into groups and became very still. The pill bugs did this in two of the trials and they huddled in at least groups of 4, and remained very close.
- We found that when we closed the lid on the pill bugs, they remained very still and would select a spot and remain there for the duration of the experiment, when the lid was removed the bugs moved a lot more and didn't remain in the same spot. The pill bugs would only huddle when the lid was closed and when the lid was removed the bugs wouldn't huddle in a group but rather they'd stay alone and continue to move.
- In other trials the same results can be seen with the pill bugs remaining calm in the dark damp places but moving fast and trying to find shelter when the lid was removed and light entered the container.

Data:

Trial #	# of pill bugs on moist side	# of pill bugs on dry side
1	13	2
2	12	3
3	14	1
4	12	3



According to the data, almost all the pillbugs preferred damp sides of the experimental environment over the dry side.

Discussion:

We used a container with a lid instead of a one uncovered is because when first putting the pill bugs in a container without a lid, the light was bright and the pill bugs kept going under the paper towels before the actual experiment started. Therefore, we guess pill bugs are nocturnal that they prefer a dark environment instead of a bright environment.

We think that the closed lid simulates the type of environment that would find when they are within the dead or rotting trees maybe without the same amount of moisture but the dark environment would be similar to their natural home. When the lid is removed this simulates the same feeling as being ripped from their home and exposed to light. So this is similar to the way they reacted when we were capturing them as they remained still and calm while in the tree making it harder to spot them but easier to catch them, when the chunk of the tree they were in was removed they began to move fast trying to get away from us and the sunlight.

The direction we opened the box may have affected the results, because this brings in the variable of light. If pill bugs favour darker environments, they could have moved away from light when the box was opened, regardless of the humidity. That is a variable that needs to be further

tested, and it will require a different method than the one used in this experiment to test the effect of humidity on pill bugs.

When they are first introduced to the container we think the reason that they didn't pick a side immediately was due to light being a factor, they were unable to pick as the light made both side seem undesirable. When the lid was removed however the damp side bugs remained relatively still while the dry paper towel side began to move almost as soon as light was introduced. We deduce this is due to their terrestrial nature, when they are on the damp side they have "burrowed" making them less affected by the light vs the dry side where they had not found a spot to "burrow" making them more affected by outside variables.

When the environments for the wet area was created, we cannot be confident that the wet side is the correct humidity favoured by the pill bugs. This means that although pill bugs may favour wet areas compared to dry areas, it is possible they favoured the dry side during the experiment instead of the wet side because it was not the right humidity (either too wet or not wet enough) for the pill bugs. This problem is very difficult to correct because it requires the knowledge of the ideal humidity that pill bugs favour, and even if we did know it requires more advanced equipment in order to recreate that environment for the purpose of the experiment.

This also connects to the type of surface they are on. The box the pill bugs were tested in was plastic, and it was covered by paper towels that were either wet or dry. This is very different to the natural environment they dwell in, such as trees, and this makes our data potentially unreliable. However, since the test is strictly for the effects of humidity, it is less likely their preference would change when the type of surface changes.

As mentioned, there were several limitations in this experiment. There was a slight degree of human error, as we may have missed times to record data. The box that the pill bugs were tested in was opaque, which was helpful to create a uniformly dark environment to take light out as a factor, but it also made it impossible to see what the pill bugs were doing exactly while they were inside the box, which could have been useful information. Lastly, the wet paper towels used to create the "wet" side of the environment made the dry paper towels on the other side slightly soaked as well, which made the sides uneven. That may create an unfair bias towards the wet side.

We have learned various things from this experiment, one example being the characteristics of this specific species, as we observed them over a period of time for experimentation. For instance, their way of living is related with water; breathe through gills so that they must live in moist places. This experiment helped us understand why some animals avoid light, as it can be a sign of exposure to danger. We also now know how to draw out pill bugs using several factors

such as humidity and light intensity, which can be a practical application of our knowledge in situations where pill bugs dwell in an undesirable area.

During experimentation, we realized that many factors other than humidity decides which environment is desirable for pill bugs. Therefore, this experiment can be taken further to experiment on different factors that may be confused with humidity, such as temperature or light intensity. It could also be a possible experiment to distinguish the importance of each factor over the other, and which factors pill bugs mainly decide their habitat on. It would also be useful to conduct the same experiment on other material, such as soil and wood, as that may introduce important factors for pill bugs that we may have overlooked entirely.

Conclusion:
We found that our hypothesis was correct and the pill bugs did indeed prefer the damp side over the dry.

Bibliography:
National Science Teachers Association - NSTA. (n.d.). Books & Resources. Retrieved from http://www.nsta.org/publications/news/story.aspx?id=48112

Team, B. (2017, August 11). Why Do Pill Bugs Prefer Moist Environments? Retrieved from http://animals.mom.me/pill-bugs-prefer-moist-environments-9126.html

Why are pillbugs found in wet/moist environments? | Socratic. (n.d.). Retrieved from https://socratic.org/questions/why-are-pillbugs-found-in-wet-moist-environments

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Non-Vascular Plants Vocabulary Practice

1. Photosynthesis happens in the ___ of cells.	chloroplasts
2. Cellular respiration happens in the ___ of cells.	mitochondria
3. ___ is the process of getting usable energy from glucose.	Cellular respiration
4. ___ is described by this equation: **sunlight + CO_2 + H_2O ➔ $C_6H_{12}O_6$ + O_2**	photosynthesis
5. **$C_6H_{12}O_6$** is the chemical formula for ___.	Glucose, a sugar
6. ___ is the green pigment that helps absorb light energy.	chlorophyll
7. Plants are ___, meaning they are made of many cells.	multicellular
8. ___ is a term that refers to organisms that can make their food from inorganic sources.	autotrophs
9. Cells that have nuclei are ___.	Eukaryotic/eukaryotes
10. ___ refers to organisms that make food by using light energy and carbon dioxide.	Photoautotrophs
11. The ___ is a structure surrounding the cell membrane that provide support and protection.	Cell wall
12. Plant cell walls are made of ___.	cellulose
13. Green algae are part of the group called ___.	chlorophytes
14. Algae are all ___; they live in the water.	aquatic
15. Mosses are part of the group called ___.	bryophytes
16. Plants have complicated life cycles called ___.	Alternation of generations
17. ___ is the term for sex cells.	gametes
18. The generation that makes sex cells is the ___.	gametophyte
19. The generation that makes cells for asexual reproduction is the ___.	sporophyte

20. A ___ forms when 2 gametes fuse.	zygote
21. The terms for the process of fusing gametes are ___ and ___.	Syngamy, fertilization (we use them interchangeably for this course)
22. The gametophyte and sporophyte of *Ulva* are ___; they look the same.	isomorphic
23. When sex cells look the same, we say that they are ___.	isogamous
24. Haploid or diploid? a. Sporophyte b. Gametophyte c. Egg d. Sperm e. Zygote f. Spore	a. diploid b. haploid c. haploid d. haploid e. diploid f. haploid
25. The ___ of mosses cannot live alone.	sporophyte
26. The dominant stage of mosses is the ___.	gametophyte
27. ___ produces cells with half the number of chromosomes as the parent cell.	meiosis
28. ___ results in two genetically identical nuclei.	mitosis
29. ___ is the movement of particles from high concentration to low concentration.	diffusion
30. ___ is the movement of water across a membrane to equalize solute concentrations.	osmosis

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Evolution Vocabulary Practice

Write the answers in the right-hand column. You can test yourself by covering up the answers.

1. _____ is the change in heritable characteristics of populations through time.	evolution
2. _____ is credited with the theory of evolution and wrote the book *On the Origin of Species.*	Charles Darwin
3. Dogs are descended from wolves through the process of ____ selection.	artificial
4. In ____ selection, humans decide which individuals reproduce.	artificial
5. In ____ selection, environmental pressures, such as predation and disease, decides which individuals reproduce.	natural
6. Members of the same ____ can mate and produce fertile offspring.	species
7. _____ selection is a major driving factor of evolution in the wild.	natural
8. _____ refers to an organism's ability to survive and reproduce.	fitness
9. _____ are physical characteristics, physiological features, or behaviours that allow an organism to survive in its particular environment.	adaptations
10. Evolution is often the result of _____ for food, shelter, or mates.	competition
11. Specialization into different ____ allows different species to exist in the same environment.	niches
12. Although not strictly accurate, Darwin's theory of evolution is often referred to as ___.	survival of the fittest
13. The tailbone in humans is known as a ____ structure.	vestigial
14. ____ structures are evidence that support convergent evolution.	analogous
15. A bird's wing and a bee's wing are ____ structures.	analogous
16. ____ structures are those that seem to serve no function, but they can support the theory of common descent.	vestigial
17. ____ structures are those that have similar functions but have evolved independently from different ancestors.	analogous
18. ____ structures are evidence that support divergent evolution. They have similar structures but may serve different functions.	homologous

19. In ____ selection, one extreme phenotype is favoured.	directional
20. In ____ selection, the intermediate phenotype is disadvantageous.	disruptive
21. In ____ selection, the intermediate phenotype is favoured.	stabilizing
22. Changes to DNA are called ____.	mutations
23. The process that creates haploid cells is ___.	meiosis
24. The change in a population's gene pool due do a random event is called ____.	genetic drift
25. Sources of genetic variation are ___ and ___.	mutations and sexual reproduction
26. ____ keeps populations similar. There is no reproductive isolation.	gene flow
27. ____ refers to one ancestor species giving rise to several species, usually rapidly, in response to differences in the environment.	adaptive radiation
28. The ____model states that species remain mostly unchanged until an event occurs and species undergo rapid change to fill empty niches.	punctuated equilibria

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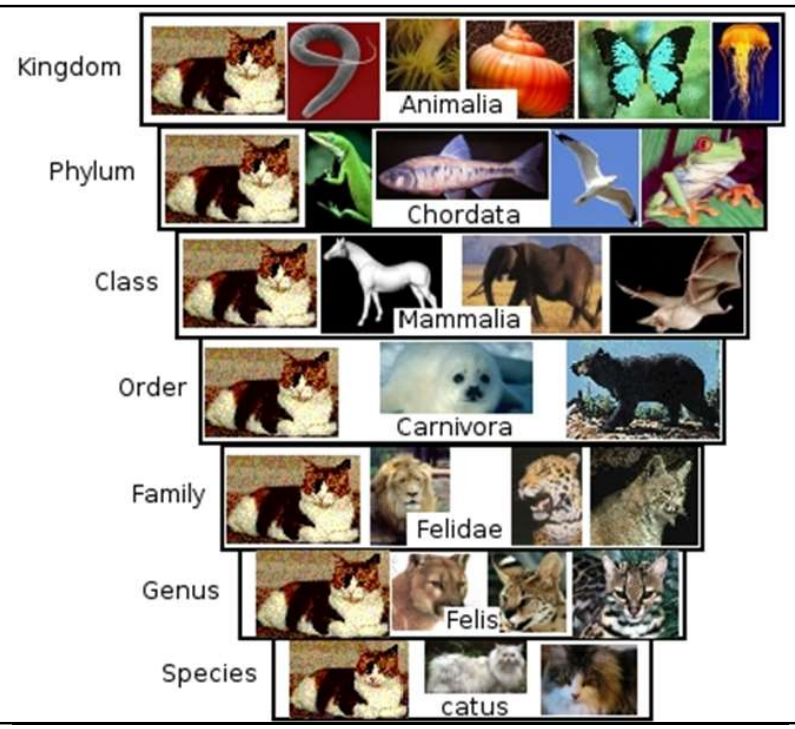
Taxonomy

Classification of organisms

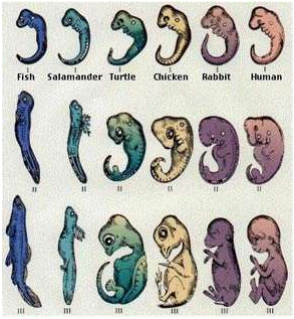
- Thoughts on reading the textbook?
- What difficulties did you encounter?
- Reading to learn is important; but how can it be done differently?

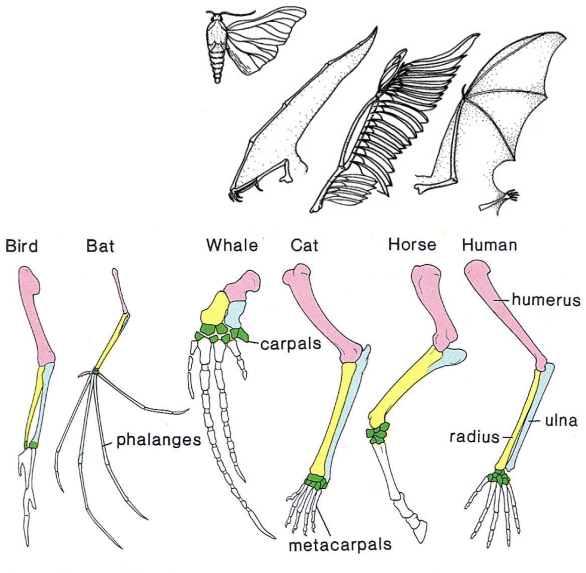


- From your textbook

Criteria for classification

- generally, more shared taxa = closer relationship
- historically based on:
  - physical attributes
  - homologous structures
  - embryology

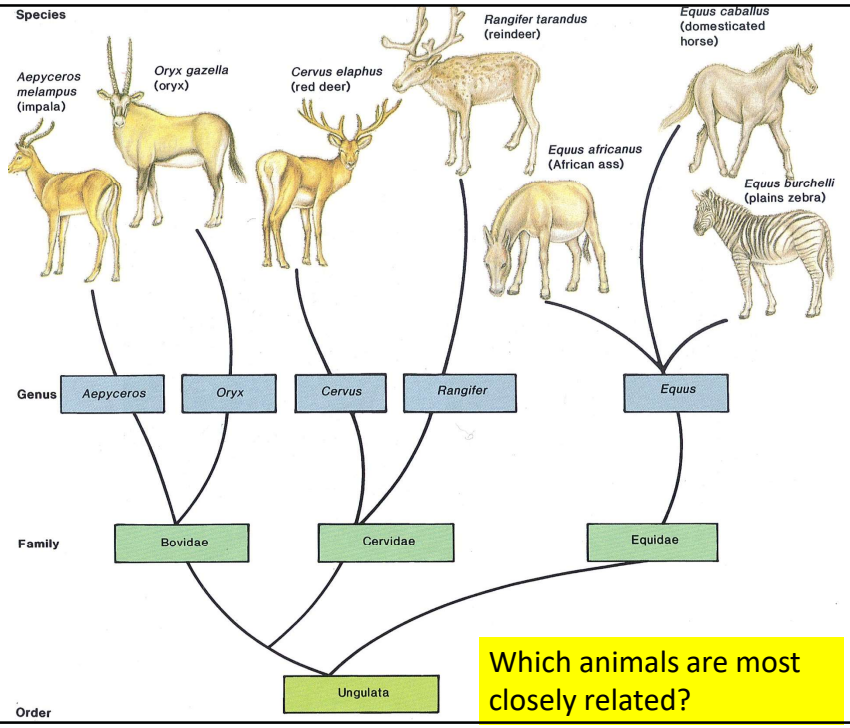




Homologous Structure
Figure 27.3

Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Cnidaria	Chordata	Chordata
Class	Mammalia	Hydrozoa	Mammalia	Mammalia
Order	Carnivora	Anthomedusae	Primates	Carnivora
Family	Felidae	Hydridae	Hominidae	Felidae
Genus	Felis	Hydra	Homo	Lynx
Species	catus	vulgaris	sapiens	rufus

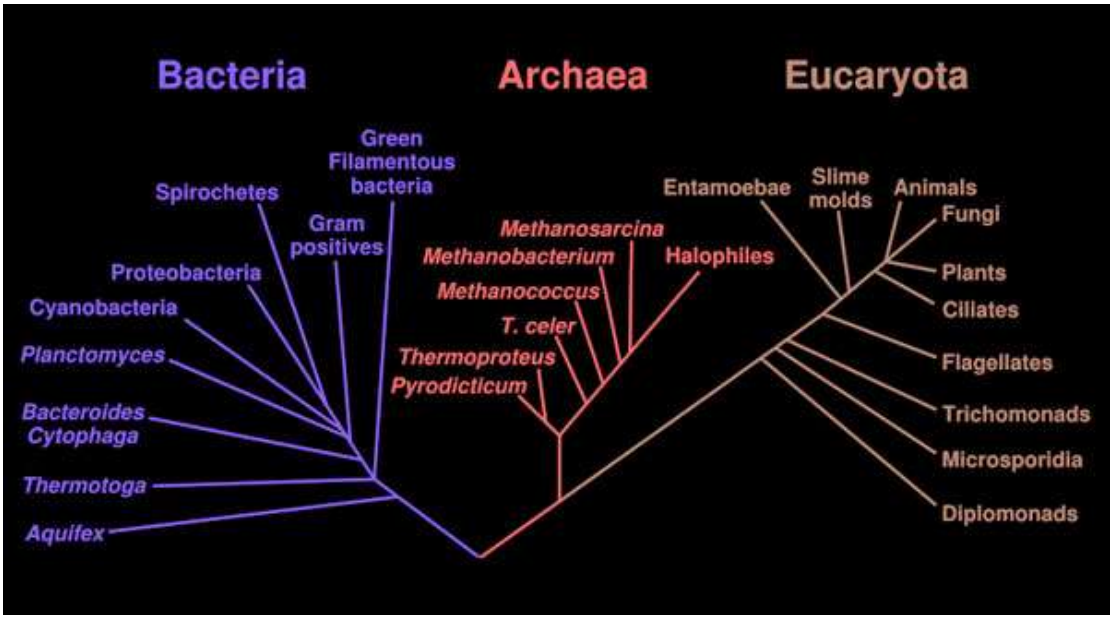
- Which two are most closely related?
- Which one is most distantly related?



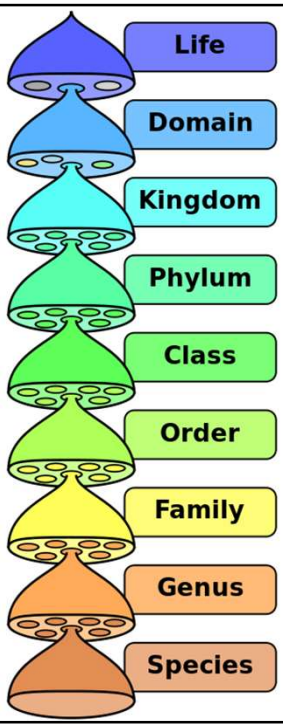
Which animals are most closely related?

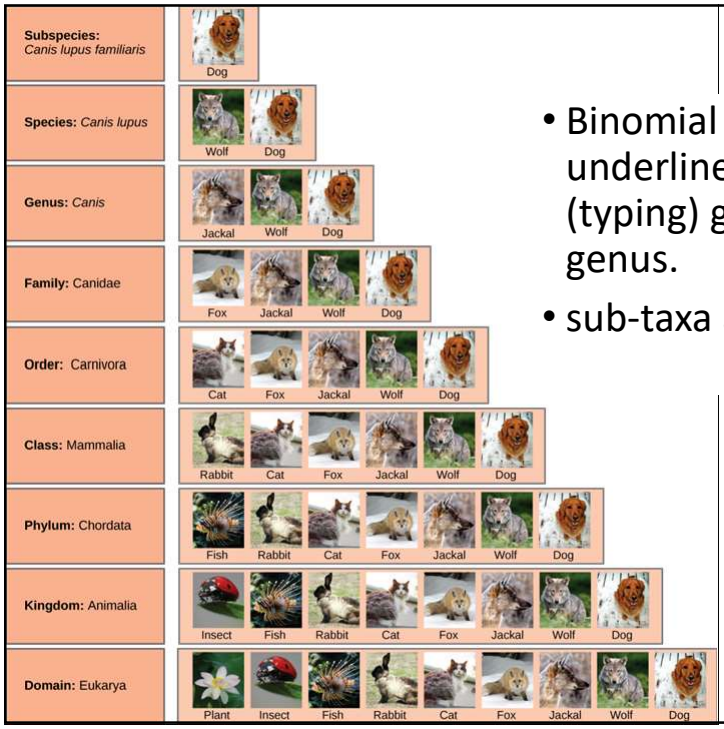
- current thoughts on phylogeny (evolutionary relationships)
  - biochemical relationships
    - DNA, enzymes, proteins, metabolic pathways, etc.
    - led to 3 domains:
      - Archaea, Bacteria, Eukarya
        - Archaea & Bacteria were previously both classified in kingdom Monera

Phylogenetic Tree: Biochemistry



- Remember these
- Know which are more general, and which is the most specific





- Binomial nomenclature: always underline (when writing) or italicize (typing) genus & species. Capitalize genus.
- sub-taxa are common

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Taxonomy Overview

Students will be able to apply the Kingdom system of classification to study the diversity of organisms

Textbook: Chapter 15

Key Terms:

If you don't already have a study strategy, make flashcards

- binomial nomenclature
- Carolus Linnaeus
- taxonomy
- taxon (taxa)
- domain
- class
- family
- genus (genera)
- order
- kingdom
- sub-phylum
- phylum (phyla)
- species
- dichotomous key
- biochemical relationship
- embryological relationship
- evolutionary relationship
- homologous structure
- analogous structure
- unicellular
- multicellular
- eukaryotic cell
- prokaryotic cell
- autotrophic
- heterotrophic
- Eubacteria
- Archaebacteria
- Protista
- Fungi
- Plantae
- Animalia
- Monera
- Archaea
- Eukarya
- Bacteria

Skills and Attitudes

- use classification keys
- observe organisms to recognize common characteristics
- demonstrate correct use of a compound microscope
- demonstrate ethical, responsible, co-operative behaviour
- show respect for living things

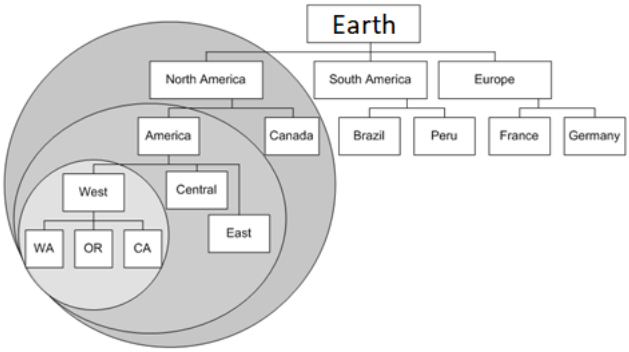
Knowledge

- explain how the following principles are used in taxonomy to classify organisms:
  - evolutionary relationships
  - biochemical relationships
  - homologous structures
  - embryological relationships
- compare characteristics of a prokaryotic cell with those of a eukaryotic cell
- describe the unifying characteristics of organisms in each of the following kingdoms:
  - Archaebacteria
  - Eubacteria
  - Protista
  - Fungi
  - Plantae
  - Animalia
- classify selected organisms using the following taxa: kingdom, phylum (and sub-phylum), class, order, family, genus, species
- apply binomial nomenclature to name selected organisms

Questions

Add these to the questions you've already created.

1. Which taxon has a clear biological identity? Explain.
2. Why is it important to standardize binomial nomenclature?
3. What is the proper way to write a scientific name?
4. In a report, a scientist writes that two species of duckweed, *Lemna minor* and *L. gibba*, were grown in the same tank. What is the genus of *L. gibba*? How do you know?
5. How can a study of biochemistry help taxonomists?
6. Consider the diagram below. If we equate the level of **continent** with **class**, complete the table with appropriate analogies.



domain		
class	continent	
species		San Diego

7. What is the significance of the nesting in the diagram above?
8. Draw a nested diagram for the biological taxa, from **species** to **domain**. Make the diagram large enough to include examples. It helps to start at the species level.
9. Summarize features of the 3 domains: Archaea, Bacteria, and Eukarya.
10. Summarize the features of the kingdoms in domain Eukarya: Protista, Fungi, Animalia, Plantae. You may find it helpful to give each kingdom its own card.
11. A unicellular organism could be placed in the Eubacteria, Archaebacteria, or Protista kingdom. What factors would be the most significant for determining into which kingdom this organism should be placed?
12. Kingdom Monera is part of an older classification system. It contained all prokaryotes. How were monerans reclassified in the three-domain system?
13. Generally, peas and beans appear somewhat similar. The pea is *Pisum sativum* and the bean is *Phaseolus vulgaris*. What do these scientific names indicate about the true relationship between peas and beans?
14. Consider the following taxonomic information about 3 organisms:

	1	2	3
Kingdom	Staria	Staria	Staria
Species	*nalus*	*aper*	*ascis*
Class	Mallus	Mallus	Mallus
Phylum	Colbi	Colbi	Colbi
Family	Calfi	Hopus	Calfi
Genus	*Gozis*	*Alpis*	*Gozis*
Order	Daptus	Changus	Daptus

a. Name the two organisms that would be the most closely related. Explain.

b. Which organism would have the fewest similarities to the others? How do you know?

15. Create a dichotomous key for the following organisms: dolphin, orca, blue whale, wolf, panther, sunflower, maple tree, *E. coli.*

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Evolution Test Guide

Test date: Nov 20, 2018

- 11 marks: short answers (1-3 words each)
- 7 questions ranging from 1 mark to 10 in value
- Total: 18 questions, 48 marks
- Includes 3 questions based on Reproduction Quiz

Things to know for reproduction:

- difference between:
    - sexual/asexual reproduction
    - mitosis/meiosis (NOT the stages in each)
    - gamete/egg/sperm/zygote
    - haploid/diploid
- how to figure out the number of chromosomes

Things to know for evolution:

- Vocabulary
    - use the unit overview and the vocabular practice sheet; make flashcards if that helps you
- Evidence for evolution
- Lamarck's vs Darwin's theories
- Process of natural selection & evolution
    - reasons why populations change
    - see the various questions on unit overview, as well as quizzes
    - types of selection
        - artificial/natural
        - disruptive, stabilizing, directional
- Process of speciation
    - definition of a species
    - reasons for why species don't interbreed

You should also know how to format a binomial name:

- Two parts are genus and species
- Capitalize the first letter of the genus name only
- Underline both parts of the name

Name _____

Date _____ Block _____

Interpreting Graphics: Taxonomy

Answer true or false to the following statements. Use the graphic to determine the answers.

1. _____ Dogs belong to the order Felidae.
2. _____ A fox belongs to the phylum Arthropoda.
3. _____ Snakes belong to the phylum Reptilia.
4. _____ Lions belong to the class Mammalia.
5. _____ The class Mammalia includes dogs, cats and rats.
6. _____ All arthropods belong to the class Insecta.
7. _____ All rodents belong to the phylum Chordata.
8. _____ All amphibians belong to the class Reptilia.
9. _____ All primates are mammals.
10. _____ A lion belongs to the genus *Felis*.
11. _____ All mammals are primates.
12. _____ Insects and lobsters are arthropods.

13. List the binomial names of all the animals that belong in the Felidae family. Use correct formatting.

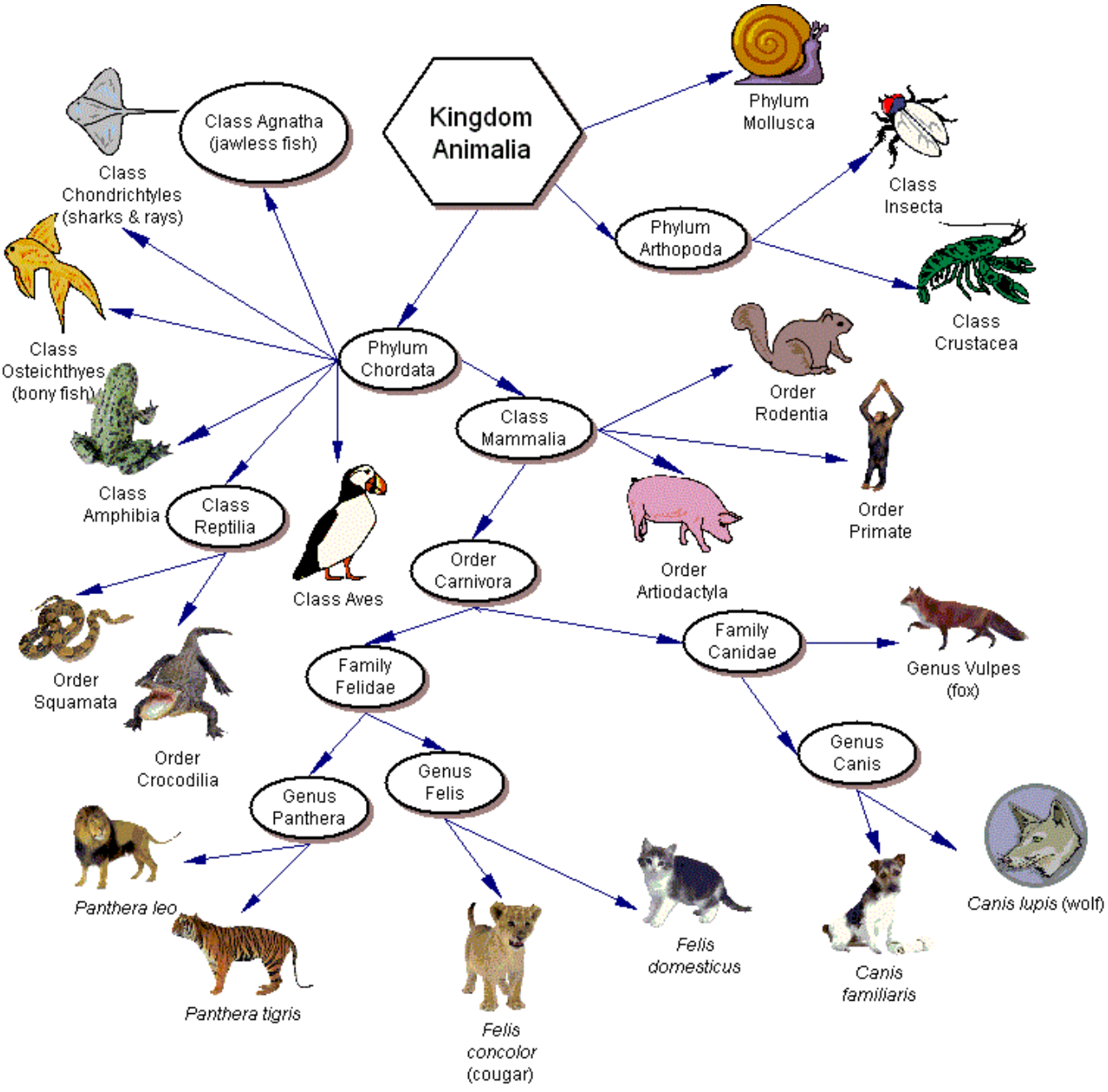
In each set, circle the pair that is more closely related.

14. snakes & crocodiles | snakes & frogs
15. rats & cats | cats & dogs
16. insects & lobsters | insects & birds
17. lions & tigers | lions & cougars
18. foxes & rats | foxes & dogs
19. cats & dogs | cats & lions

20. The image does not show orders of insects. Suggest three categories of insects that would likely be grouped into orders. Hint: think about what kind of insects there are. Add your three categories to the image.

Add the following information to the image:

21. Molluscs are divided into three classes: Class Cephalopoda (squids), Class Gastropoda (snails), Class Bivalve (clams and oysters)
22. Cephalopods have a few orders, one of which is Octopoda (octopus) and another is Teuthida (squids)
23. The scientific name for the common octopus is *Octopus vulgaris*.
24. The scientific name for the common European squid is *Loligo vulgaris*.


Kingdom Animalia
Phylum Mollusca
Class Agnatha (jawless fish)
Class Chondrichtyles (sharks & rays)
Phylum Arthopoda
Class Insecta
Class Crustacea
Class Osteichthyes (bony fish)
Phylum Chordata
Order Rodentia
Class Mammalia
Class Amphibia
Class Reptilia
Class Aves
Order Primate
Order Artiodactyla
Order Carnivora
Family Canidae
Genus Vulpes (fox)
Order Squamata
Family Felidae
Order Crocodilia
Genus Canis
Genus Panthera
Genus Felis
Panthera leo
Canis lupis (wolf)
Panthera tigris
Felis domesticus
Canis familiaris
Felis concolor (cougar)

Group 5 - Lysosomes to Cytoskeleton

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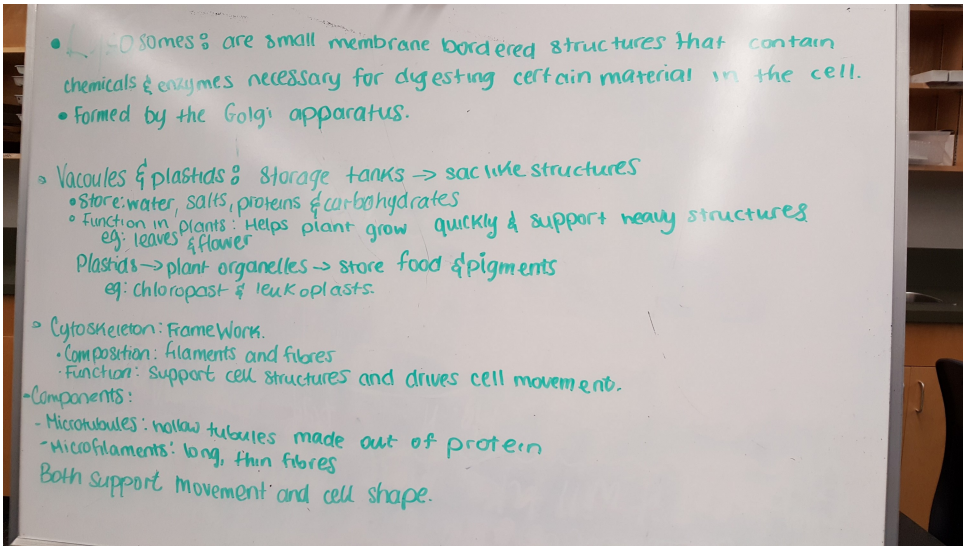

Group 6 - Cell Specialization

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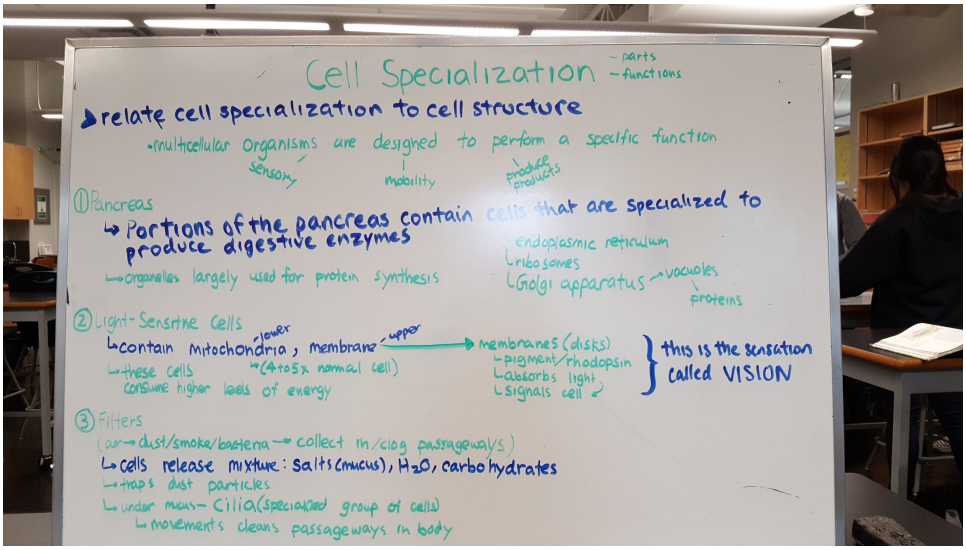

Group 7 - Levels of organization (p106 - 107)

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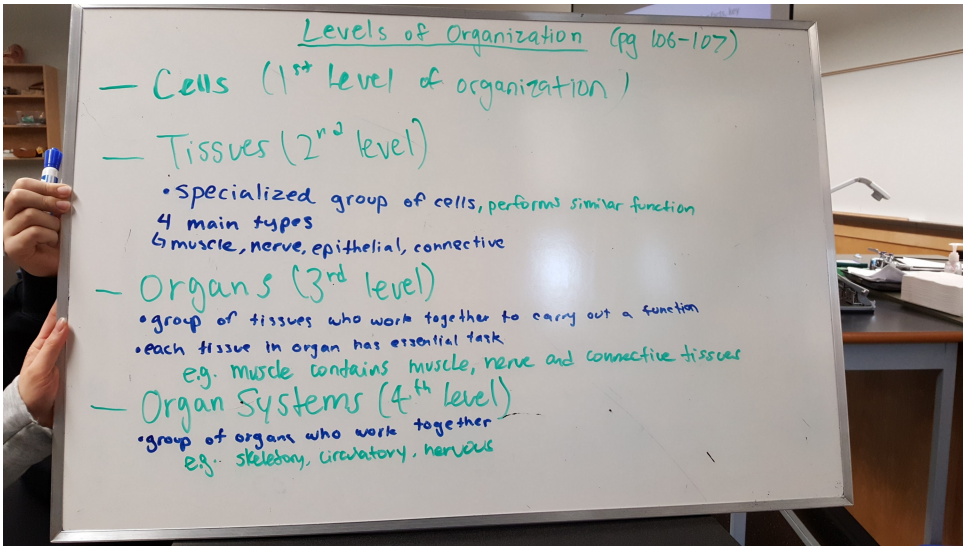
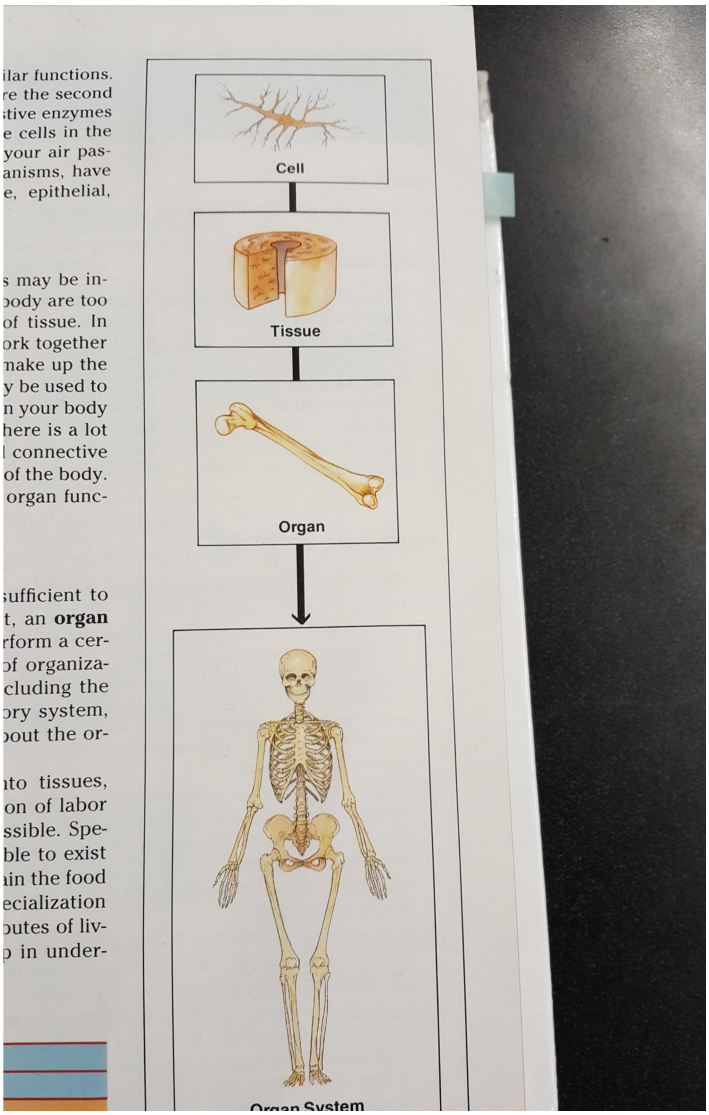
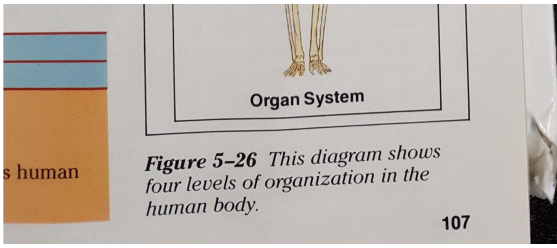






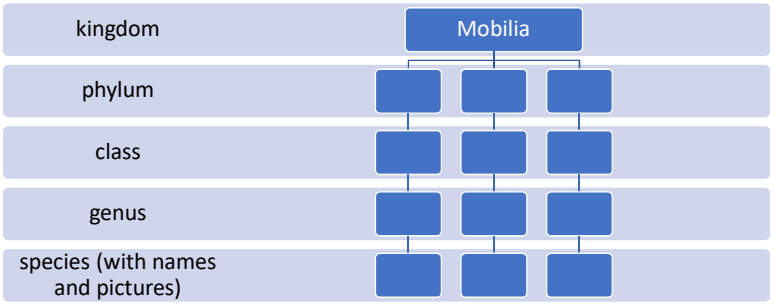
s human

Figure 5–26 *This diagram shows four levels of organization in the human body.*

Activity: Alien Taxonomy

- Your job is to classify the aliens found on the planet Bizarro-World. The planet has both plants and animals; you will only work with the animals. There are two main groups of animals: terrestrial humanoids, and aquatic fish-like organisms.
- Because there are so few species, your taxonomic scheme **will only use kingdom, phylum, class, genus and species**.
- Cut out the pictures of the aliens and create a visual showing the organisms' taxonomic structure.
- Create **names for each of the taxa**.
- Give all of the aliens a **binomial** scientific name. (Wikipedia's Latin suffixes list can inspire you). **Underline both parts, and capitalize only genus**.

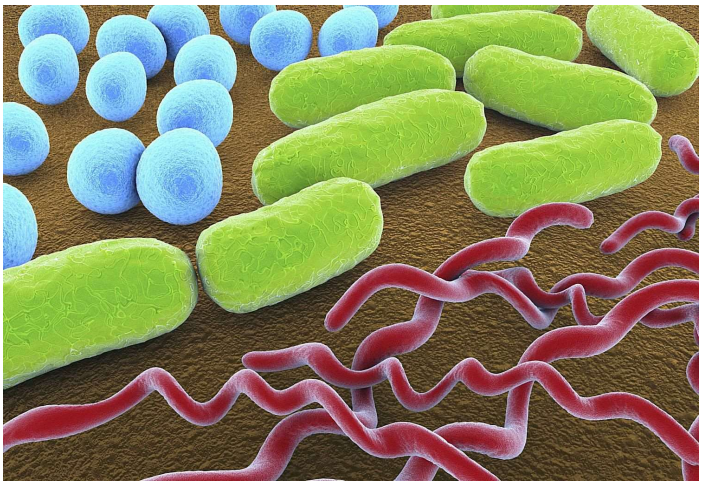
Sample (The number of boxes are inaccurate)



The 6 Kingdoms

Eubacteria

- "true bacteria" – now classified as Domain Bacteria
- prokaryotes
- cell wall: peptidoglycan



Grand Prismatic Spring, Yellowstone

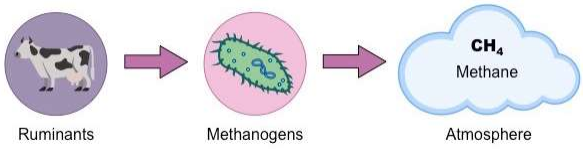
Owens Lake, California

- red is halobacteria

Archaebacteria

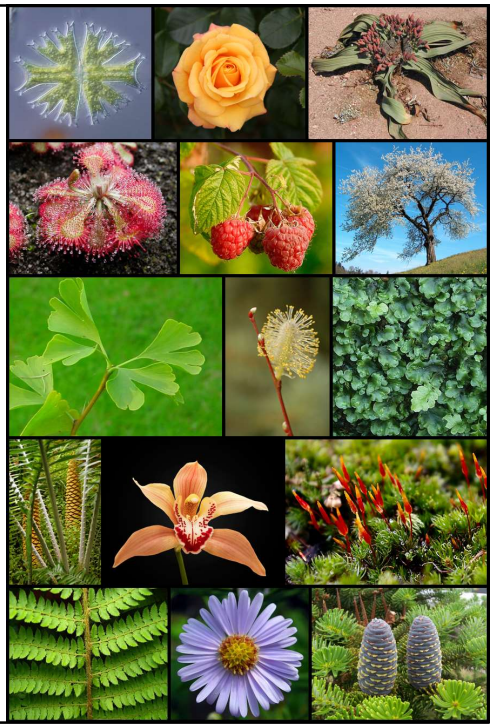
Domain Archaea

- name: ancient Earth conditions
- prokaryotes
  - thermophiles
  - halophiles
  - methanogens



Plantae

- autotrophic by photosynthesis
- multicellular
- cell wall: primarily cellulose



Fungi

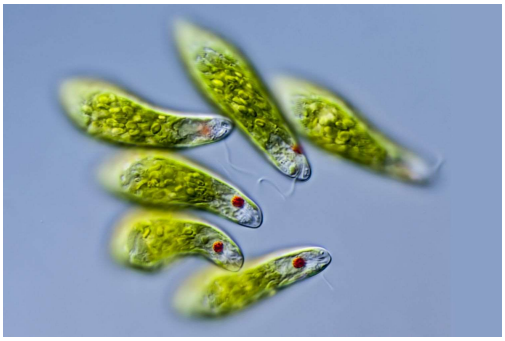
- Cell walls made of chitin – some walls are incomplete → multinucleate
- Obtain nutrients by absorption

Animalia

- heterotrophic
- multicellular

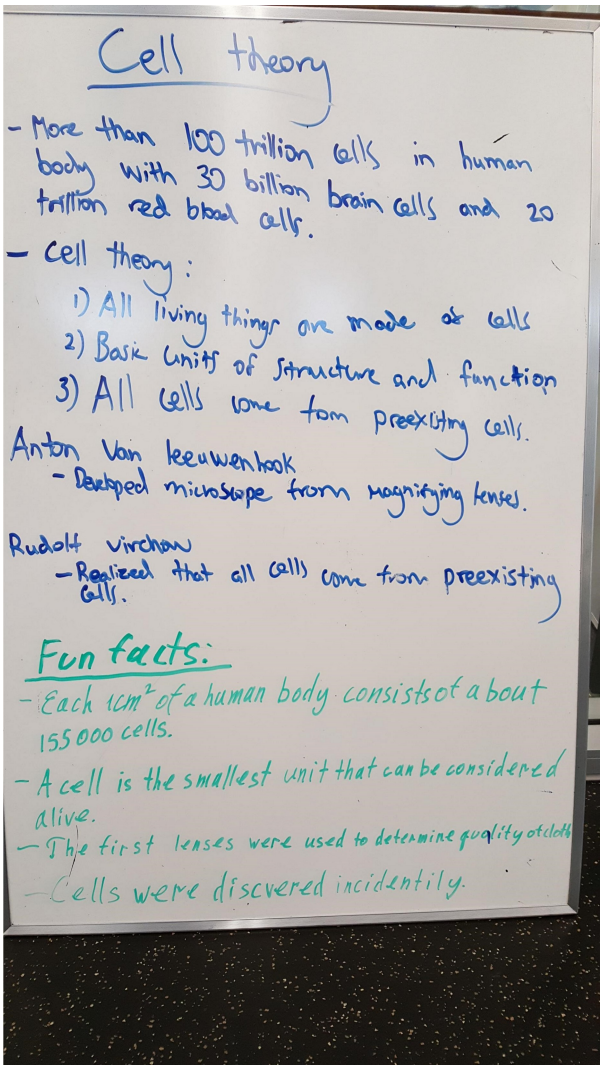
Protista

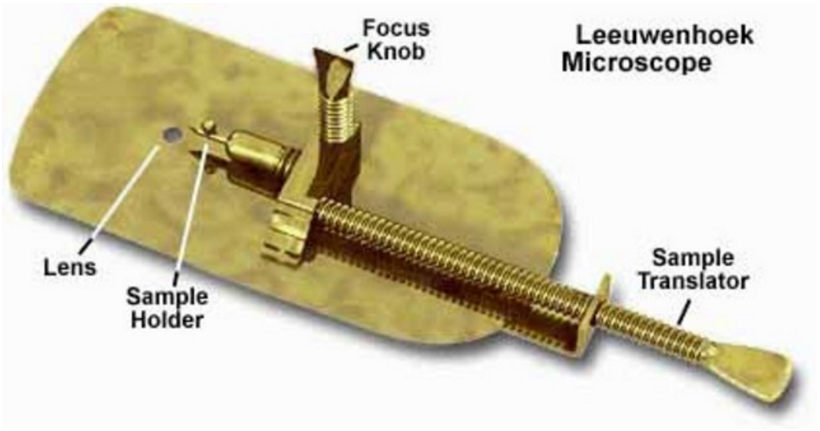
- the “junk drawer” (all other eukaryotes)
- mostly unicellular

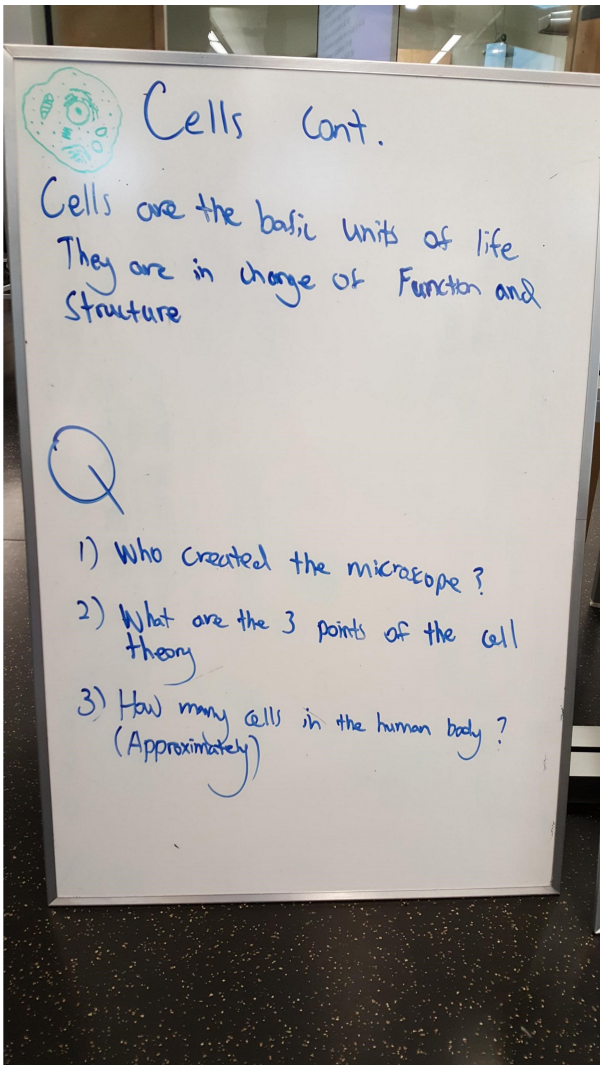


Group 1

November 30, 2018 1:42 PM






Cells Cont.
Cells are the basic units of life
They are in charge of Function and Structure
Q
1) Who created the microscope?
2) What are the 3 points of the cell theory
3) How many cells in the human body? (Approximately)

Group 2

November 30, 2018 1:42 PM

Cell structure: intro, membrane, and wall

Intro:

- Usually between 5 and 50 µm in diameter
- Physical limits on the flow of info through the cell and on the flow of materials into and out of the cell prevent most cells from being larger than this
- The cells of animals, plants, and related organisms have 3 basic structures: cell membrane, nucleus, and cytoplasm.
- Small: 0.2 µm (belonging to a group called *Mycoplasma*) in diameter
- Large: include ameba *Chaos chaos*, which is about 1000 µm in diameter
- Even larger: bird egg yolk - single cells containing stored food for the developing bird

Cell membrane:

- Cells separated from surroundings by cell membrane
- CM similar to walls to a house, regulate what enters/exits the cell (also protection + support)
- House analogy:
  - "Wall" seals house from outside environment
  - You still want fuel, power, messages from outside
    and
    bring in food + take out trash (doors would be needed for things to pass in and out)
  - Needs of cells are similar (such as communicate w/ other

cells, take in food/water, eliminate wastes)

- CM -> molecules
  - Lipids (bilayer - two layer of lipids): basic unit of CM
  - Proteins and Carbohydrates:
    - Some proteins are stuck to the surface of the bilayer, others move around within layer (some act as channels);
    - Carbohydrates attached to proteins/lipids at CM surface, many act as chemical ID cards (allows cells to recognize/interact w/ each other)
- Cell membrane is semi-permeable

Cell wall:

- In plants, algae, and some bacteria ← peptidoglycan
- Surrounds cell membrane
- Protects and supports cell
- Very porous, so water, CO2, O2, and other substances can pass through easily
- Made up of two or more layers (depending of the plant)
- 1st layer:
  - Where the two cells meet
  - Contains pectin (a sticky substance) which holds different cells together
- 2nd layer:
  - Primary cell wall belonging to each cell
  - Made of cellulose, a fibrous material which makes cell wall elastic so it can stretch as the cell grows
- 3rd layer (only some plants have this):
  - In woody plant stems
  - Composed of cellulose and lignin

Questions

1. Why are cells typically within 5 to 50 micrometers in diameter?

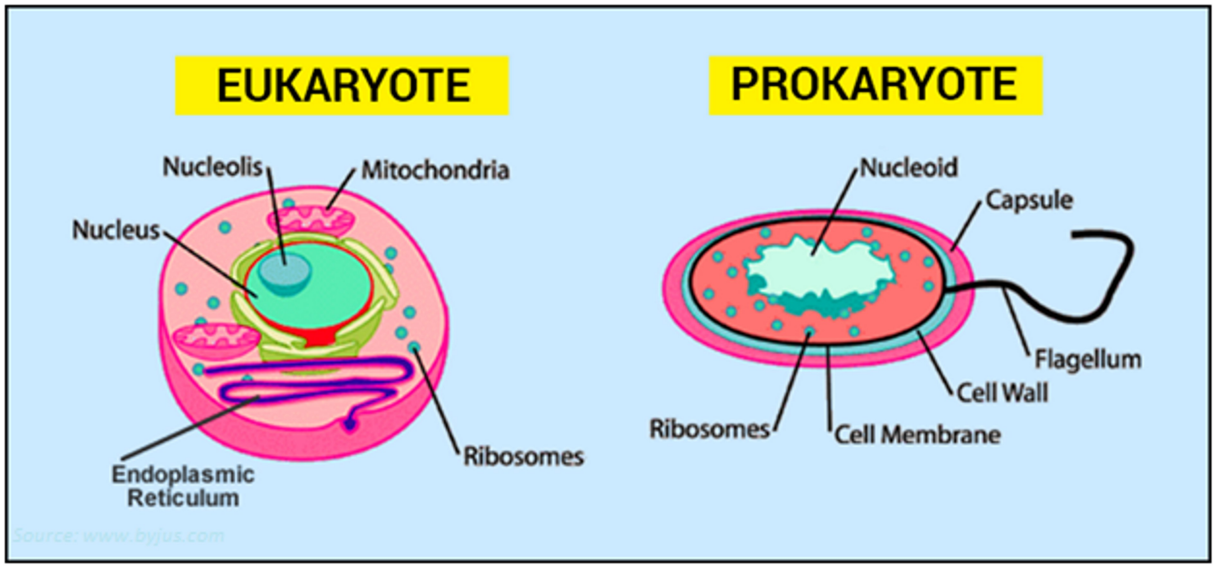
2. Which structure regulates what enters and exits the cell?
3. What are the three layers of the cell wall (assuming there are three layers) and what are their functions?
4. Besides chloroplasts, what is a cell organelle that exists in plant cells but not in animal cells?
5. How many cells is bird egg yolk composed of?
6. Name one cell that is one of the smallest cells. What is its average diameter?

Group 3

November 30, 2018 1:43 PM

Nucleus is a large dark structure found in eukaryotes. Other cells that don't have a nucleus are called prokaryotes.

Prokaryotes cells are usually small and unicellular
Eukaryotes cells are usually unicellular and/or multicellular.



The Nucleus contains DNA, which are instructions for processes important to the operation of the cell, such as protein synthesis.

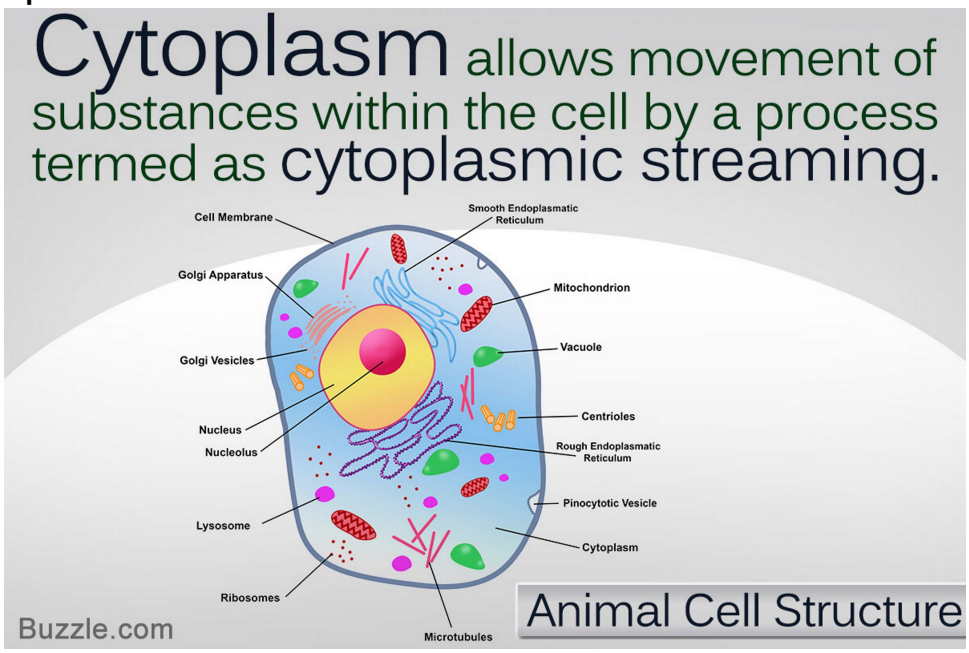
The nuclear envelope is a lipid bilayer surrounding the nucleus. This layer contains many nuclear pores, which allow important molecules to move in and out.

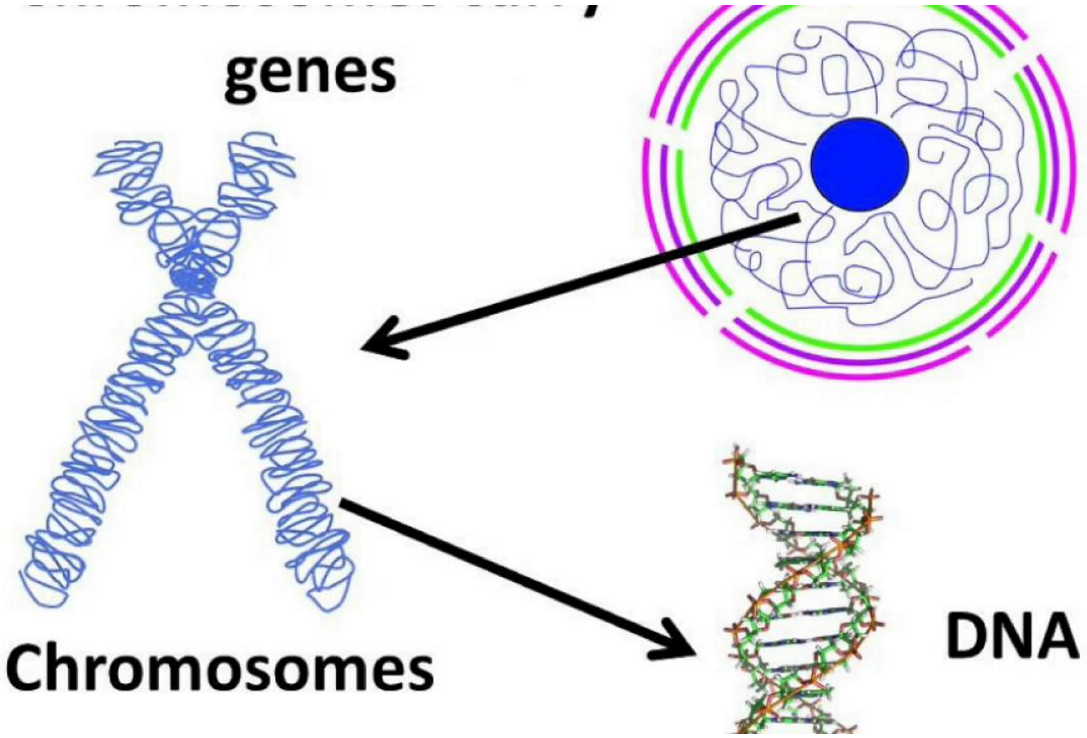
The nucleolus, located in the nucleus, is a small structure responsible for making ribosomes, which aid in the production of proteins in the cell. Ribosomes are made up of RNA and proteins. (not considered organelles)

Chromosomes are condensed forms of DNA that float in the

nucleus.

Cytoplasm:
The cytoplasm is an area that surrounds the nucleus and fills space inside the cell.





Section Questions

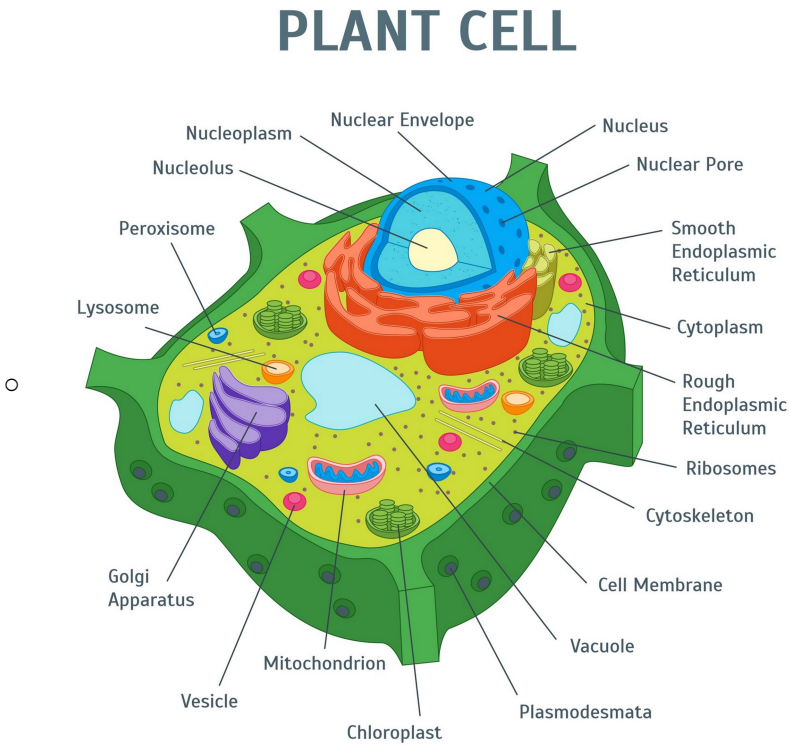
1. What is the difference between the nucleolus and the nucleus?
2. Where is DNA located in the cell?
3. Which structure is responsible for synthesizing ribosomes?

Group 4

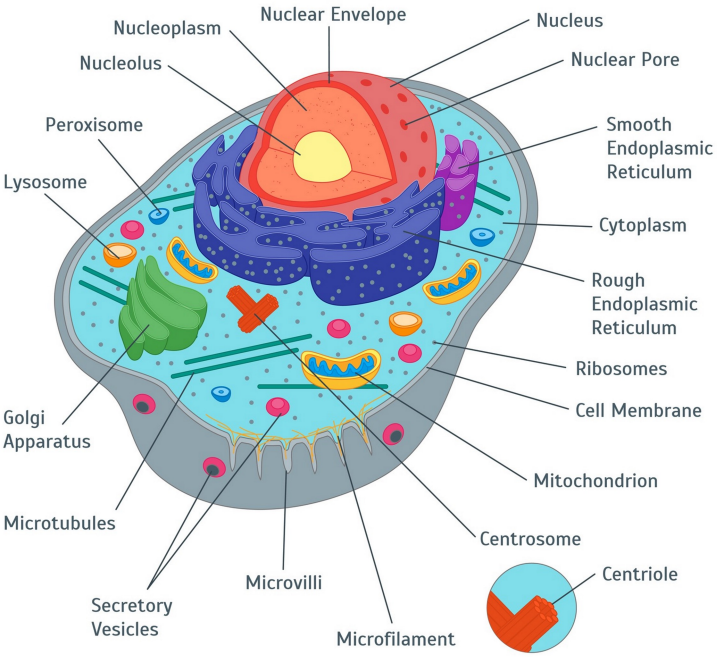
November 30, 2018 1:43 PM

Cytoplasmic Organelles: Mitochondria, Chloroplasts, Ribosomes, Endoplasmic Reticulum, Golgi Body/Apparatus (pgs. 94-96)

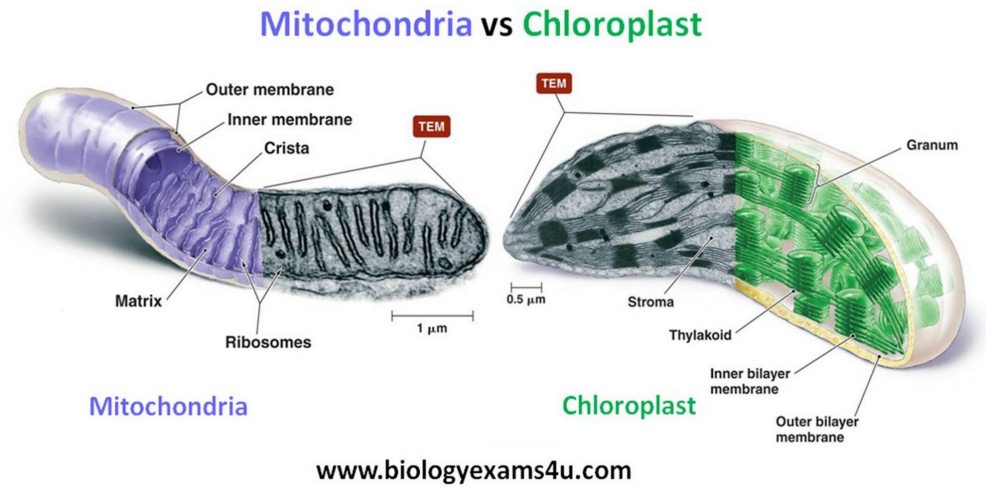
- Structures in the cytoplasm are called *organelles*
  - Each organelle has an individual specific function to help the cells survive

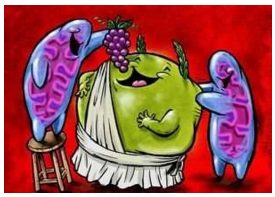


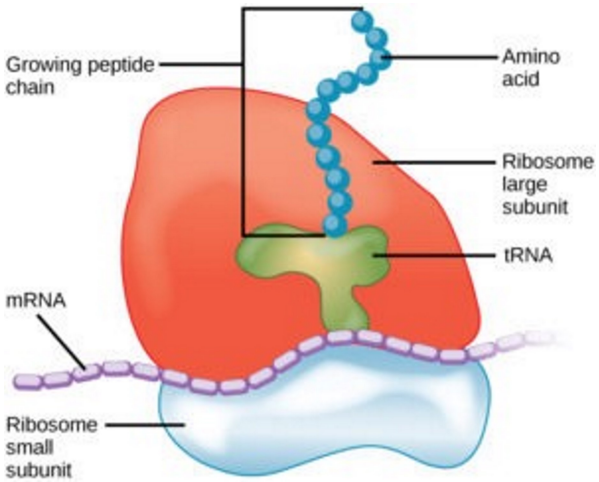
ANIMAL CELL

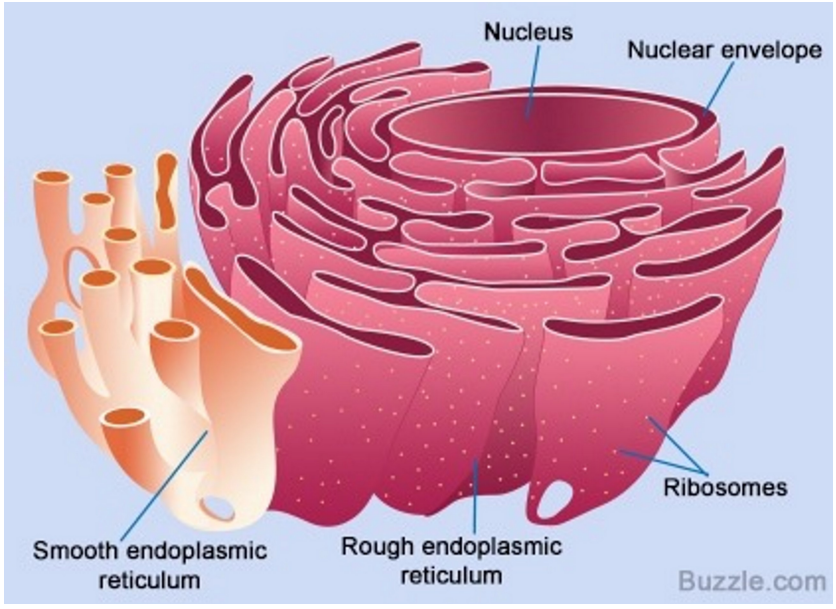


- Mitochondria and Chloroplasts: Power Stations (The Powerhouse of the Cell)
  - Mitochondria use chemical energy from food
  - Chloroplasts use energy from the sun and convert it into chemical energy
  - Mitochondria have two membranes
    - One increases surface area
    - One surrounds organelles
  - Chloroplasts have three membranes
    - Unique one converts sunlight into chemical energy
  - Chloroplasts are only found in plants and algae
  - Both are slightly independent from the rest of the cell

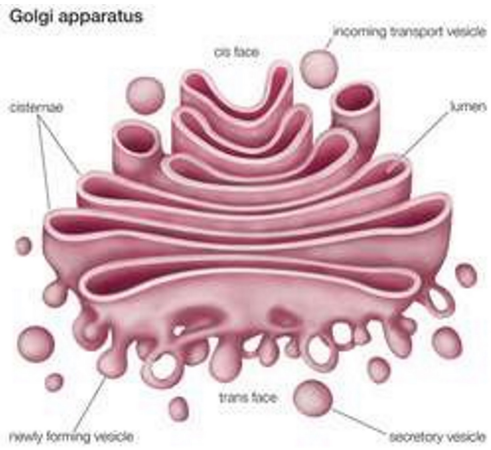


- 

- Ribosomes: Protein Factories
  - Produce proteins
  - One of the smallest organelles
    - Would need to look through *3 microscopes at max power* to locate/see
  - Found in both prokaryotes and eukaryotes
  - Composed of proteins and RNA (Ribonucleic Acid)
  - Cells that require more proteins have more ribosomes
  - 

- Endoplasmic Reticulum and Golgi Apparatus: Manufacturers and Shippers
  - Transports materials throughout the cell
  - 2 Types of ER
    - Rough - Have ribosomes studded on the outside so it appears rough. Newly made proteins are inserted into the rough ER, and modified with chemicals. Also synthesizes the proteins
    - Smooth - Aren't rough, sometimes may contain special enzymes and chemicals inside.
  - 

- Golgi Apparatus
  - Modifies proteins so they're ready for protein distribution
    - Attaches carbohydrates or lipids to proteins

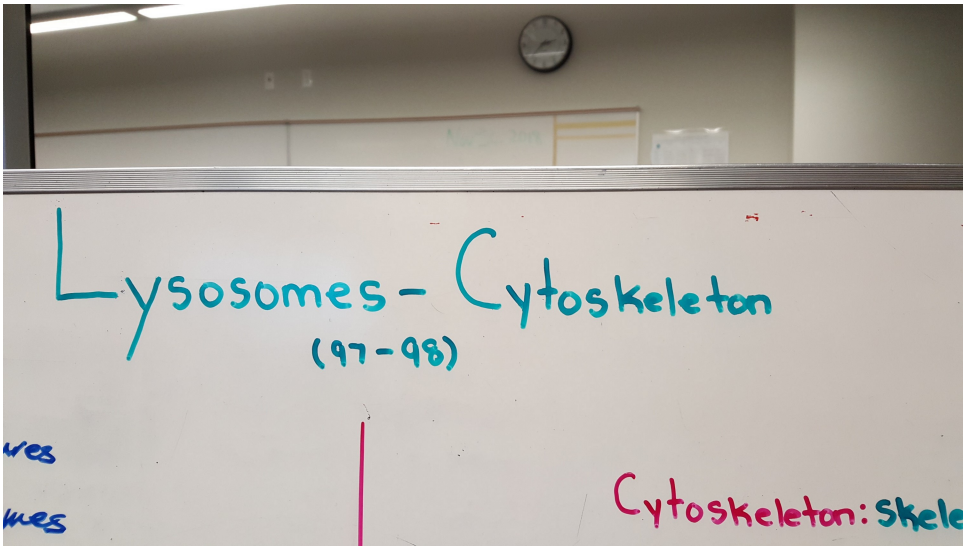


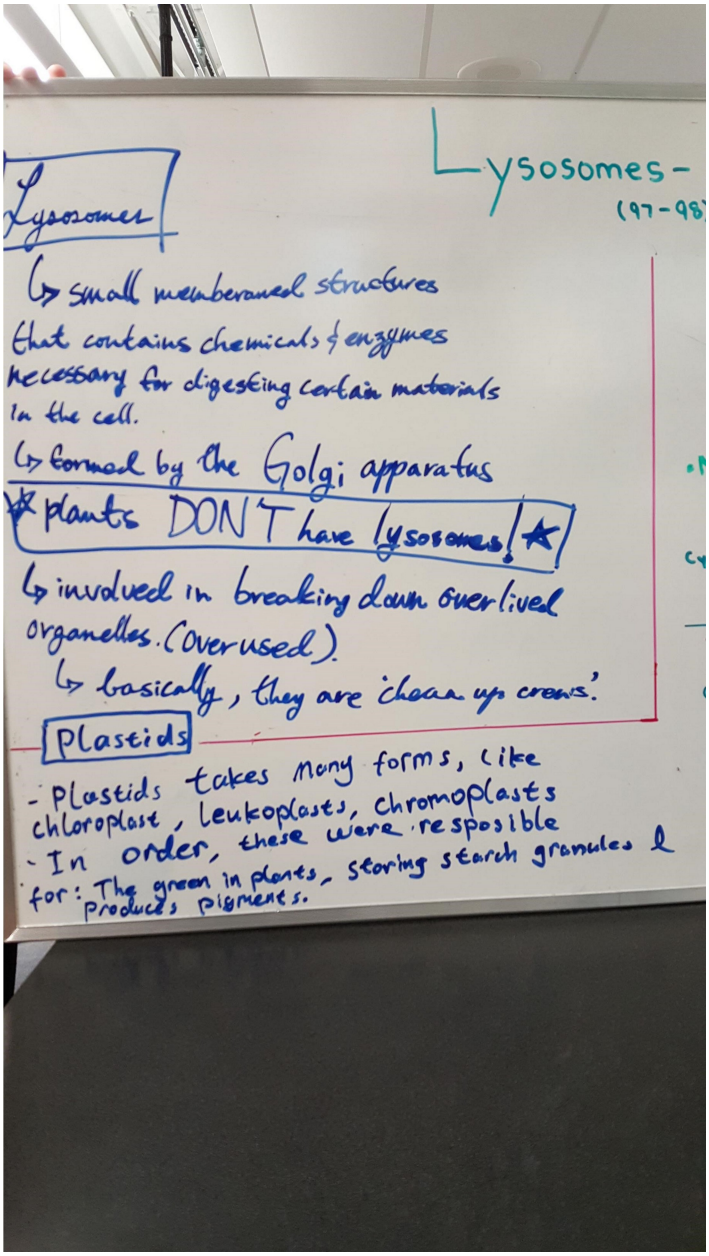
Section Questions:

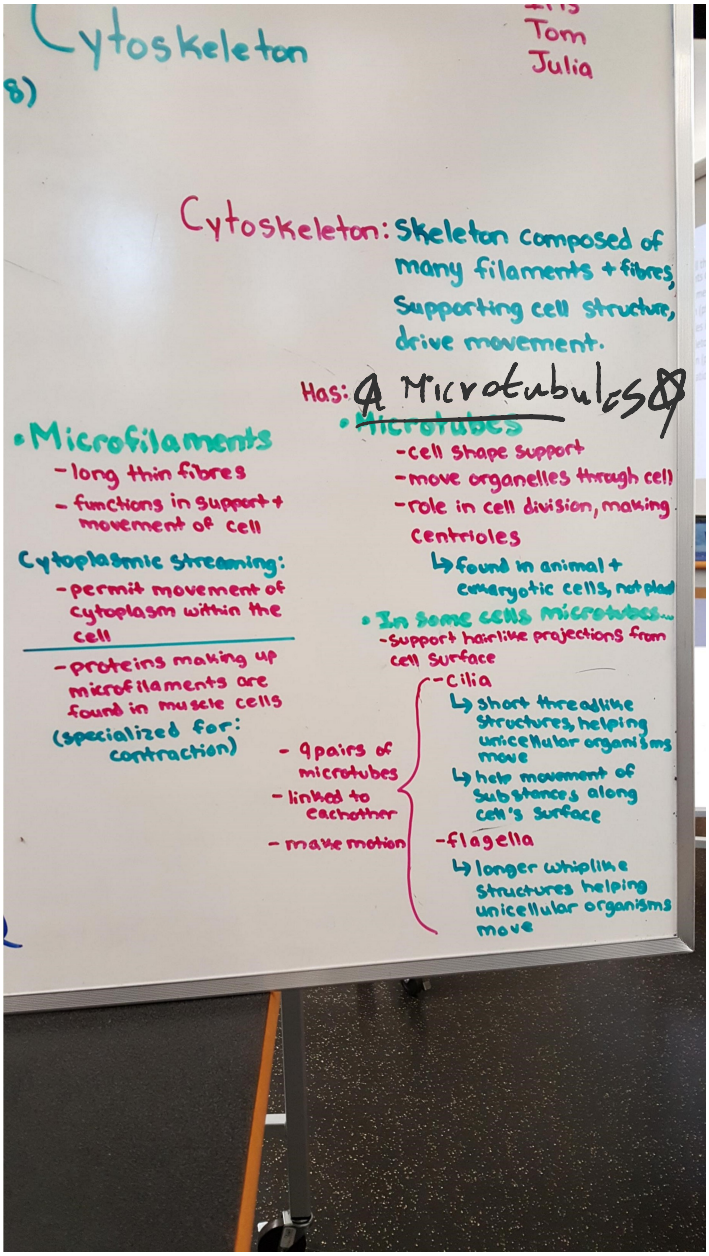
- What is the difference between the rough and smooth Endoplasmic Reticulum?
- What are the purposes of the two layers of membranes in mitochondria
- The largest difference between animal and plant cells is the absence of a specific organelle. Which one is it?

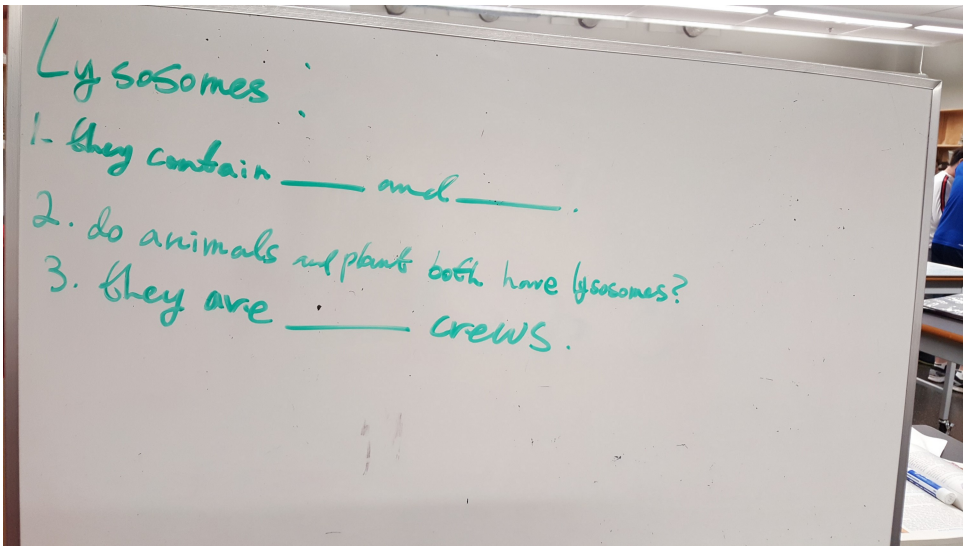
Group 5

November 30, 2018 1:44 PM



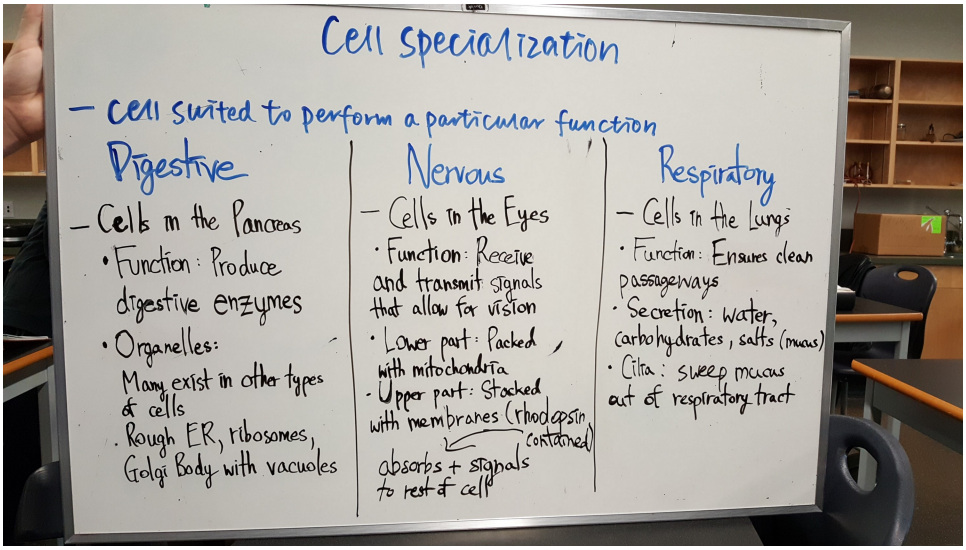

Lysosomes -
(97-98
Lysosomes
↳ small membraned structures that contains chemicals & enzymes necessary for digesting certain materials in the cell.
↳ formed by the Golgi apparatus
★ plants DON'T have lysosomes! ★
↳ involved in breaking down overlived organelles. (Overused).
↳ basically, they are 'clean up crews'.
Plastids
- Plastids takes many forms, like chloroplast, leukoplasts, chromoplasts
- In order, these were resposible for: The green in plants, storing starch granules & produces pigments.


Cytoskeleton
Tom
Julia
8)
Cytoskeleton: Skeleton composed of many filaments + fibres, supporting cell structure, drive movement.
Has: Microtubules
• Microfilaments
- long thin fibres
- functions in support + movement of cell
Cytoplasmic streaming:
- permit movement of cytoplasm within the cell
- proteins making up microfilaments are found in muscle cells (specialized for: contraction)
• Microtubes
-cell shape support
-move organelles through cell
-role in cell division, making centrioles
↳ found in animal + eukaryotic cells, not plant
• In some cells microtubes...
-support hairline projections from cell surface
- 9 pairs of microtubes
- linked to eachother
- make motion
-Cilia
↳ short threadlike structures, helping unicellular organisms move
↳ help movement of substances along cell's surface
-flagella
↳ longer whipline structures helping unicellular organisms move


Lysosomes
1. they contain ____ and ____.
2. do animals and plants both have lysosomes?
3. they are ____ crews.

Group 6

November 30, 2018 1:44 PM



Section Questions:

What is specialization?

What is the function of cells in the pancreas and where are they found?

What are some commonalities of cells in the pancreas and other cells in the body?

What is the function of eye cells?

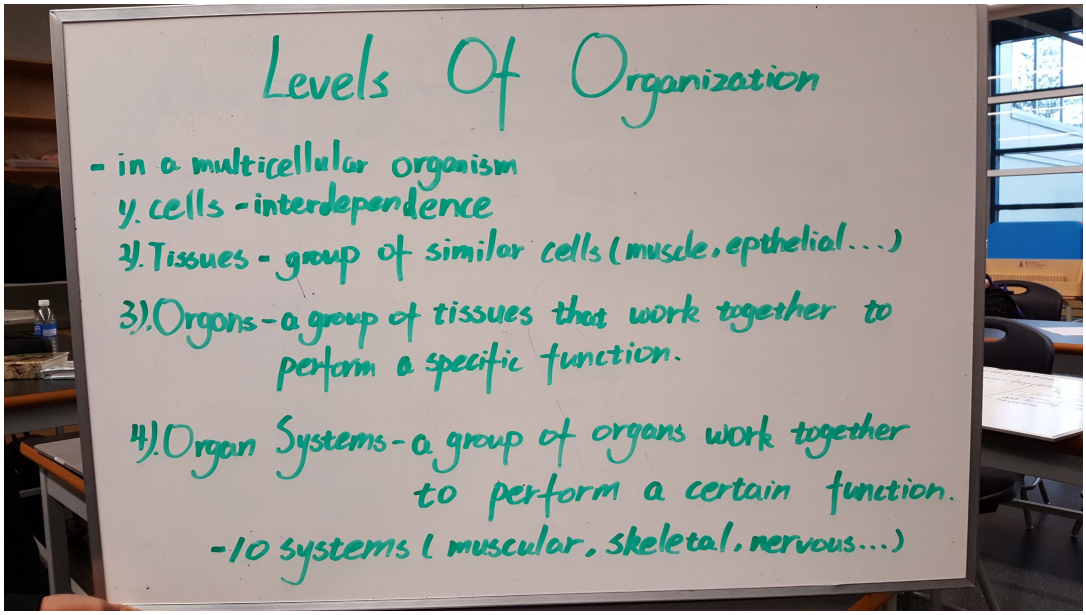
What's in the lower part of eye cells?

What is the function of lung cells?

What is found underneath the mucus and why is it important?

Group 7

November 30, 2018 1:44 PM



Levels of Organization

- Levels that are used to classify and describe cells within an multicellular organism (cells, tissues, organs, and organ systems).

Tissues:

- Organized, specialized groups of cells (cells that perform similar functions).
- Main types of tissue: muscle, epithelial, nerve, and connective.

Organs:

- A group of tissues that work together to perform a function.
- Multiple types of tissues can exist in an organ. Each tissue performs essential tasks to keep the organ function correctly. (e.x nerve and connective tissues exists in a muscle).

Organ Systems:

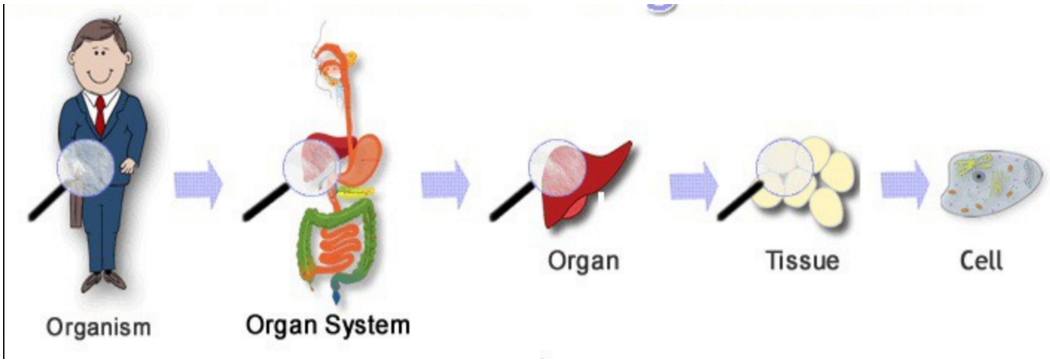
- Group of organs work together to perform a function.
- There are 10 organ systems in the body (e.x. muscular system, skeletal system, circulatory system, and nervous system).

- Cells are interdependent. Certain types of cells may depend on functions of other types of cells to provide what they need in order to function (e.x muscle cells rely on other cells to obtain the food and oxygen they need in

order to function).

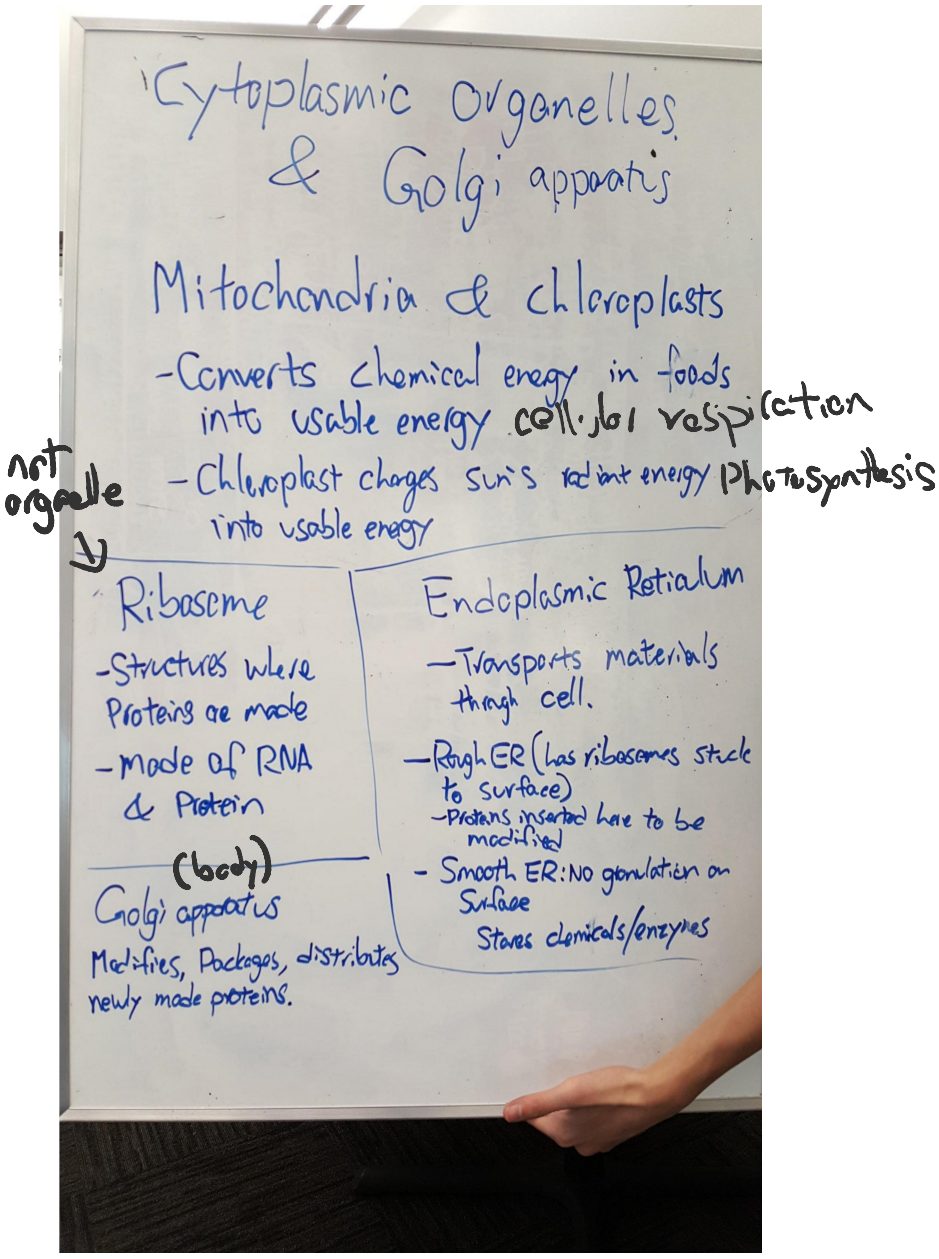
Questions:

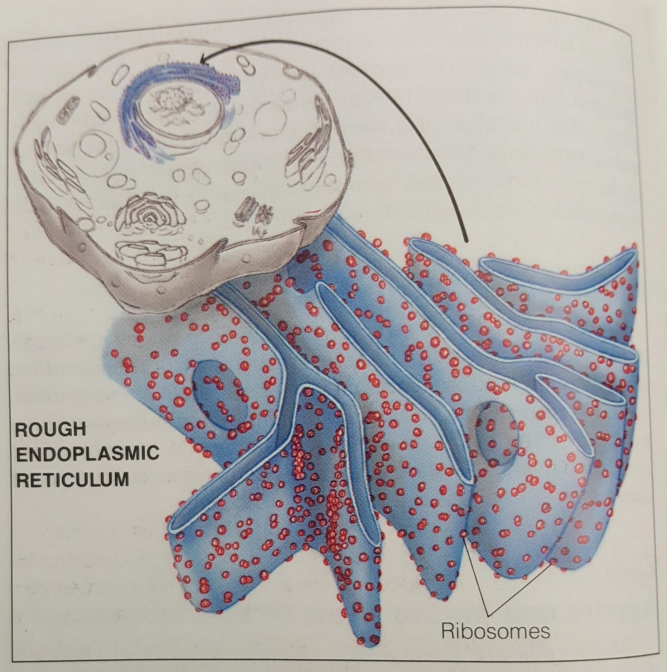
1. Levels of organization exists in which type of organisms?
2. List the four levels of organization from in order from smallest to greatest.
3. Can multiple types of tissues exist in an organ?
4. How are cells interdependent?



Group 4 - Cytoplasmic organelles

November 30, 2018 1:13 PM





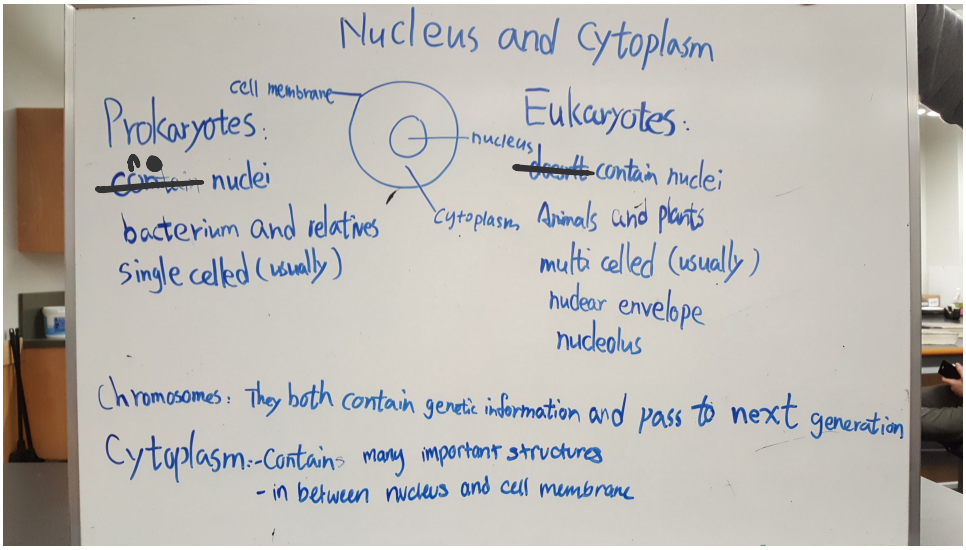
and are not studded with particles or granules. In some cells, special enzymes and chemicals are stored in the smooth endoplasmic reticulum.

The other form of endoplasmic reticulum is involved in the synthesis of proteins. This form is called the rough endoplasmic reticulum (rough ER) because the ribosomes that are stuck to its surface give it a rough appearance. Newly made proteins are inserted into the rough ER, where they may be chemically modified. Many proteins that are released, or exported, from the cell are synthesized on the rough ER.

Like automobiles to which enthusiasts attach chrome panels and hood ornaments, proteins often are modified by special enzymes that attach carbohydrates and lipids to them. In most cases, the proteins are first moved into special compartments known as the **Golgi apparatus**, because they were

Group 3 - Nucleus and Cytoplasm

November 30, 2018 1:23 PM



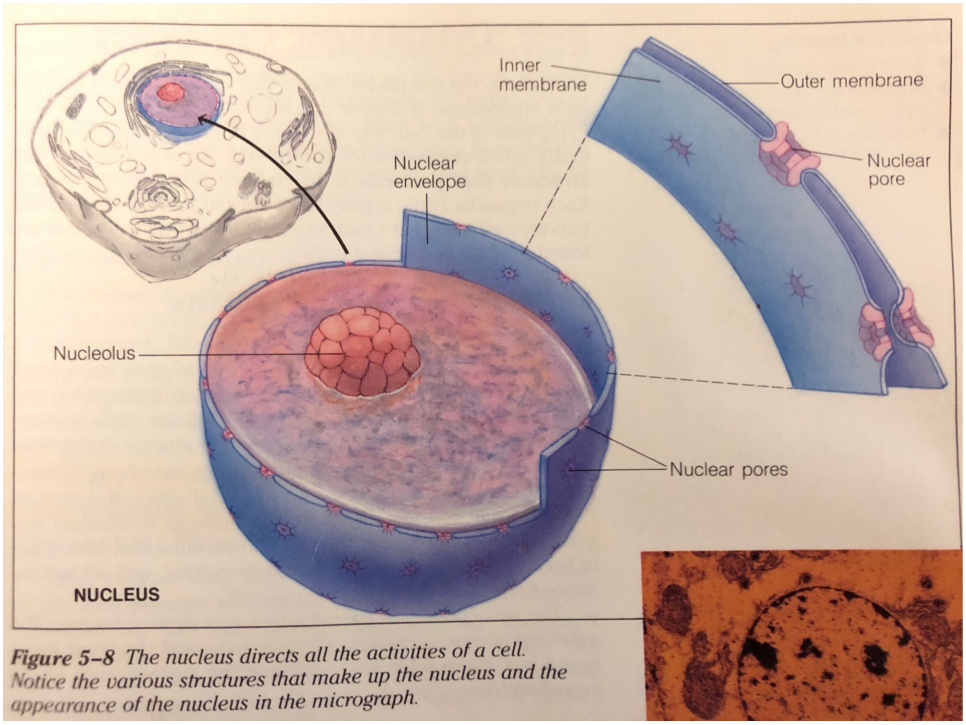
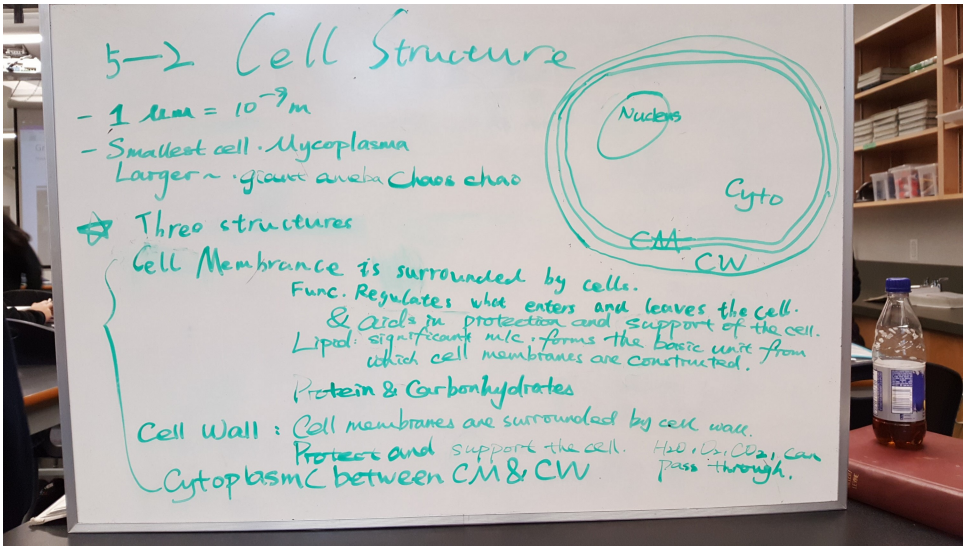


Figure 5–8 *The nucleus directs all the activities of a cell. Notice the various structures that make up the nucleus and the appearance of the nucleus in the micrograph.*

Group 2

November 30, 2018 1:22 PM



Group 1 - Introduction

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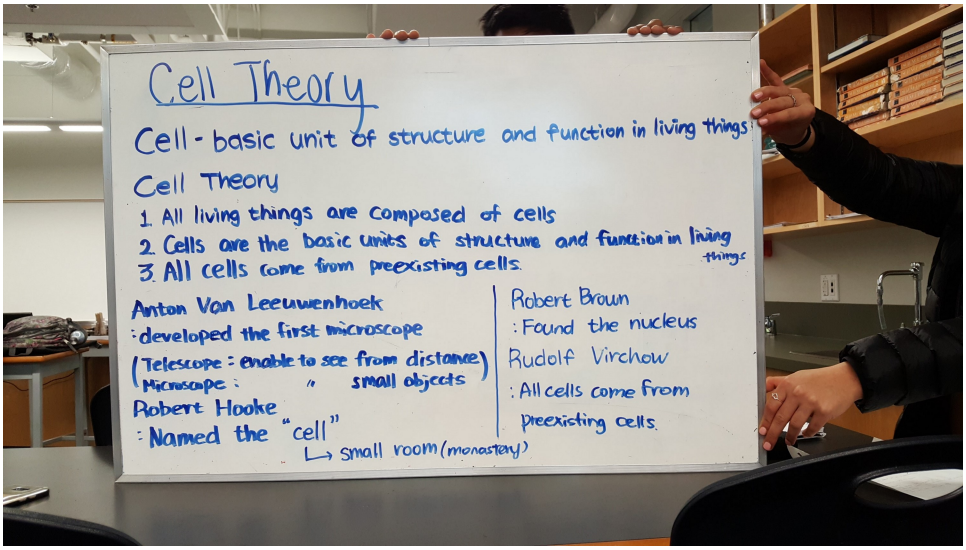

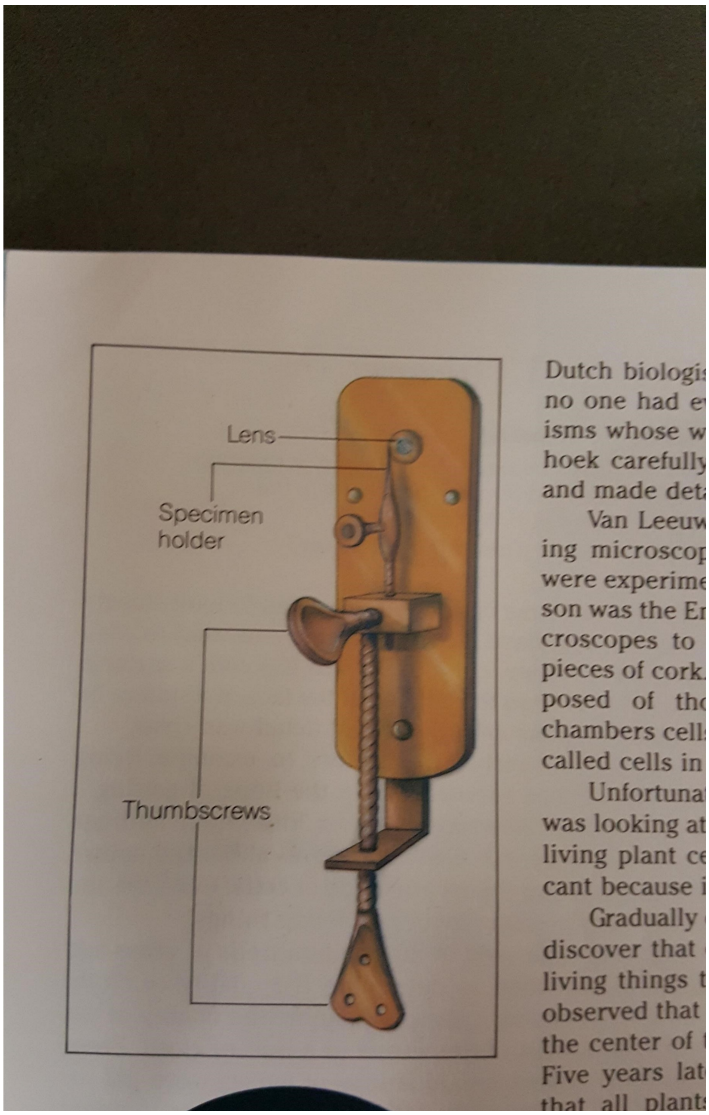

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Group 5 - Lysosomes to Cytoskeleton

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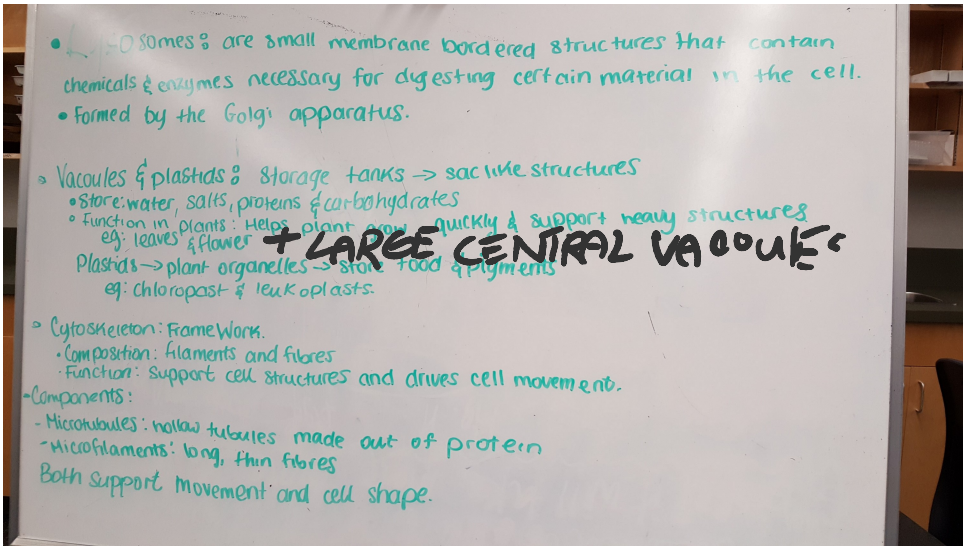
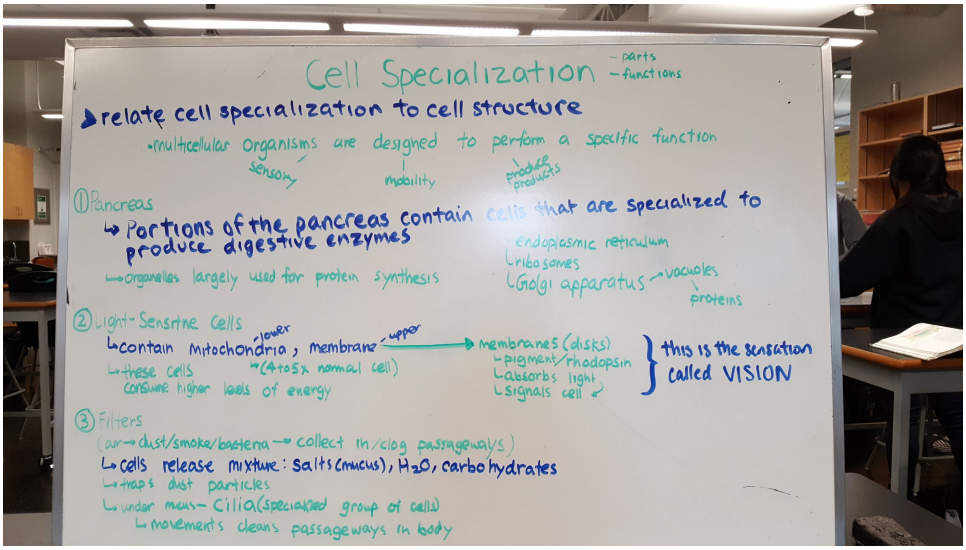


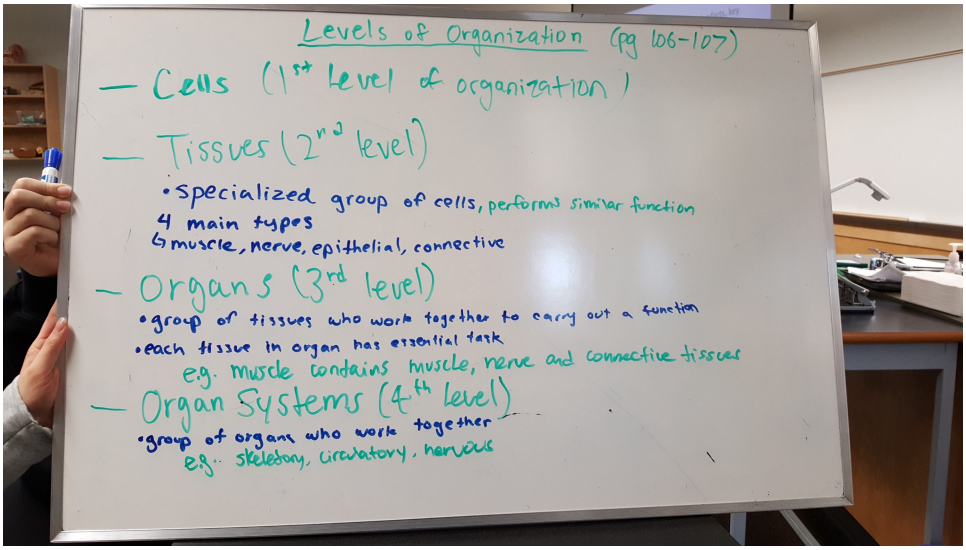
Group 6 - Cell Specialization

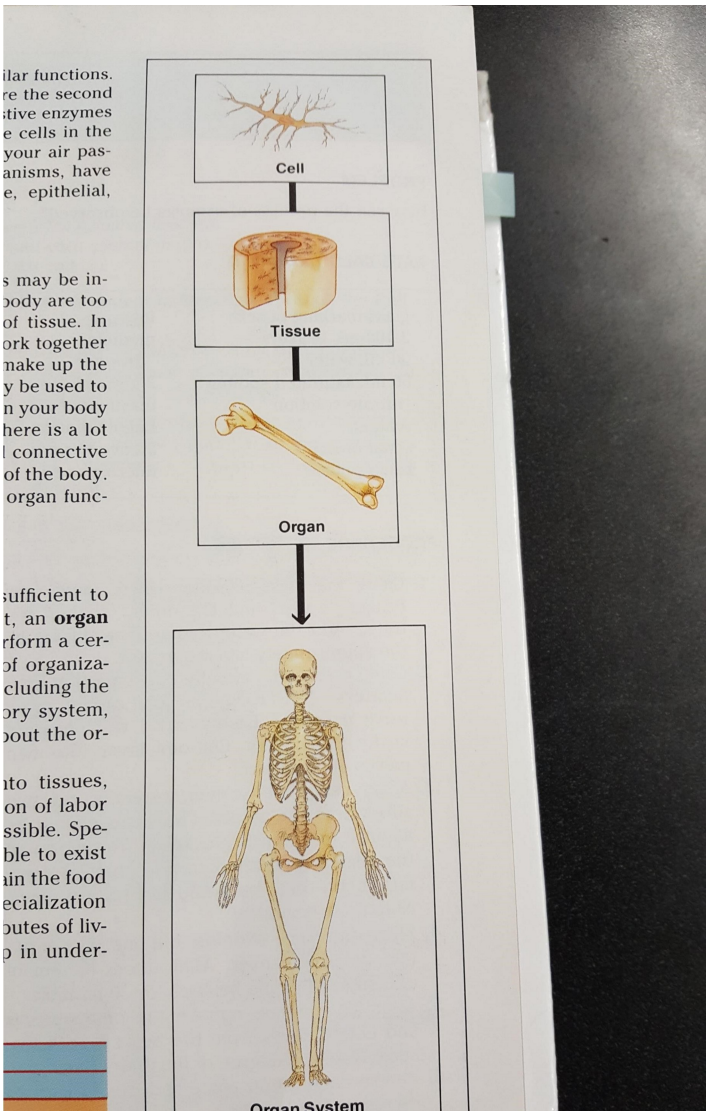
November 30, 2018 1:18 PM

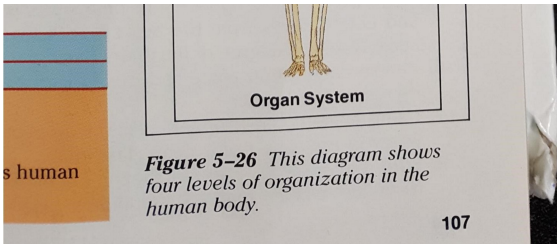


Group 7 - Levels of organization (p106 - 107)

November 30, 2018 1:08 PM







s human

Figure 5–26 *This diagram shows four levels of organization in the human body.*

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Ms. To

Name: _____

Date: _____ Block: _____

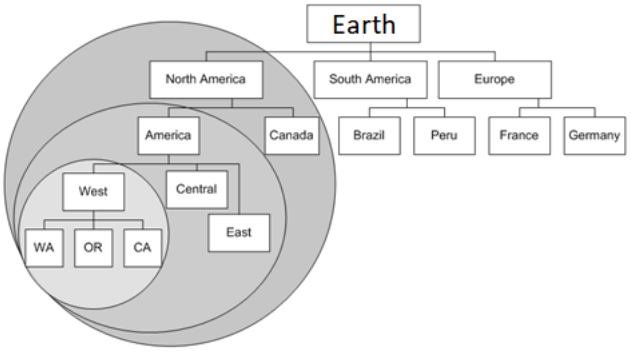
Taxonomy Questions

Questions

Add these to the questions you've already created.

1. Which taxon has a clear biological identity? Explain.
   species: can interbreed (produce fertile offspring). easy to tell if not of the same species
2. Why is it important to standardize binomial nomenclature? scientific name
   so scientists around the world can easily distinguish one species from another and not have confusion about which organism they're talking about (common names are different depending on place. Ex:
    is a roly poly, pill bug, sow bug, potato bug, or wood louse, depending on who you talk to.
   These birds are both "robins"  )
3. What is the proper way to write a scientific name?
   genus & species. both underlined, capitalize genus only
4. In a report, a scientist writes that two species of duckweed, *Lemna minor* and *L. gibba*, were grown in the same tank. What is the genus of *L. gibba*? How do you know?
   Lemna: both are duckweeds, so they should be closely related (in same genus); mentioned previously.
5. How can a study of biochemistry help taxonomists?
   taxonomy is the study of classifying organism. Biochemistry looks at DNA sequences (proteins, etc). So by using biochemistry, we can infer the degree of relatedness. The closer the relationship, the more taxa they should have in common.

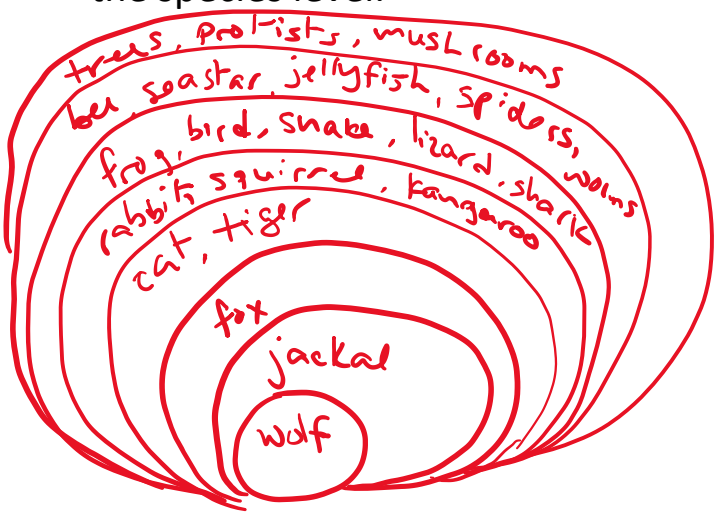
6. Consider the diagram below. If we equate the level of **continent** with **class**, complete the table with appropriate analogies.



domain	galaxy	Milky Way
kingdom	star system	Solar system
phylum	planet	Earth
class	continent	NA
order	country	America
family	region	West
genus	state	CA
species	city	San Diego

7. What is the significance of the nesting in the diagram above?
visual representation of classifications. What belongs in the same group, and what doesn't.

8. Draw a nested diagram for the biological taxa, from **species** to **domain**. Make the diagram large enough to include examples. It helps to start at the species level.



9. Summarize features of the 3 domains: Archaea, Bacteria, and Eukarya.
   Archaea: prokaryotic, unicellular, usually live in extreme environments
   Bacteria: prokaryotic, unicellular, cell wall made of _____
   Eukarya: eukaryotic (have nucleus and membrane-bound organelles)
10. Summarize the features of the kingdoms in domain Eukarya: Protista, Fungi, Animalia, Plantae. You may find it helpful to give each kingdom its own card.
    Do this on your own
11. A unicellular organism could be placed in the Eubacteria, Archaebacteria, or Protista kingdom. What factors would be the most significant for determining into which kingdom this organism should be placed?
    Is there a nucleus?
    What is the cell wall made of?

12. Kingdom Monera is part of an older classification system. It contained all prokaryotes. How were monerans reclassified in the three-domain system?

13. Generally, peas and beans appear somewhat similar.
    The pea is *Pisum sativum* and the bean is *Phaseolus vulgaris*. What do these scientific names indicate about the true relationship between peas and beans?
    They are not so closely related because they are in different genera (Phaseolus and Pisum)

14. Consider the following taxonomic information about 3 organisms:

	1	2	3
Kingdom	Staria	Staria	Staria
Species	*nalus*	*aper*	*ascis*
Class	Mallus	Mallus	Mallus
Phylum	Colbi	Colbi	Colbi
Family	Calfi	Hopus	Calfi
Genus	*Gozis*	*Alpis*	*Gozis*
Order	Daptus	Changus	Daptus

a. Name the two organisms that would be the most closely related. Explain.

Gozis nalus and Gozis ascis because they have 6 taxa in common

b. Which organism would have the fewest similarities to the others?

How do you know?

Alpis aper because it only has 3 taxa in common with the others.

15. Create a dichotomous key for the following organisms: dolphin, orca, blue whale, wolf, panther, sunflower, maple tree, *E. coli.*

Create your own. Each statement/question only has 2 choices.

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You look through 2 lenses in the microscope, and we multiply their magnifications to get total apparent magnification.

OCULAR X OBJECTIVE = TOTAL APPARENT MAGNIFICATION

Microscope Calculations

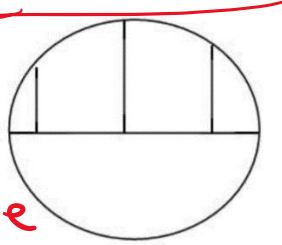
1. Complete the following table.

Ocular magnification	Objective magnification	Total apparent magnification
5X	a. 16X	80X
10X	40X	b. 400X
10X	100X	c. 1000X
d. 10X	50X	500X

Pro tip: circle the information in the question to help you focus

2. Calculate the diameter of the field of view (FOV) for each diagram. Field diameter (FD) and field of view (FOV) are often used interchangeably. The lines are ruler markings and the distance between lines is 0.4 mm. Objects in the field of view are usually measured in micrometers (µm), or microns for short. There are 1000 microns per millimetre.

A.



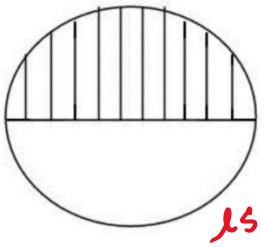
estimate a bit more or less is ok

# of ruler spaces: 2.8

FOV = 2.8 X 0.4 = 1.12 mm

FOV = 1120 µm

B.



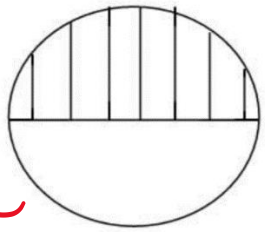
estimate

# of ruler spaces: 11

FOV = 4.4 mm

FOV = 4400 µm

C.



# of ruler spaces: 8

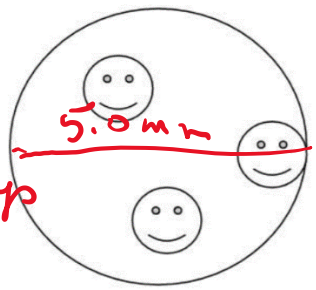
FOV = 3.2 mm

FOV = 3200 µm

These are images zooming in on the same (WEIRD) ruler. Lens A is the highest power lens. Lens B is the lowest power lens. Notice how the FOV is smaller at higher powers.

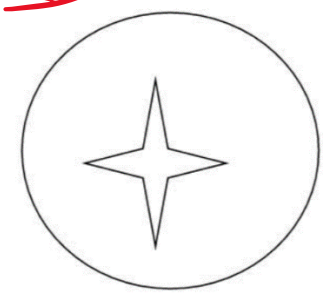
3. Calculate the size of each specimen. Assume the FD is 5.0 mm. Use the bottom of the page for work.

A.



about 4,5 smileys fit

B.



Estimate how many will fit across the fattest part of the circle. You always use the longest part of the specimen.

There will be disagreements about the EXACT size. When I mark, there is a range of correct answers.

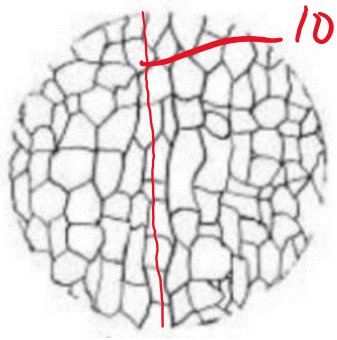
Actual size of one specimen: _____

AS = FD / f.t = 5.0mm / 4,5 = 1.1 mm or 1100 µm

Actual size of one specimen: _____

AS = 5.0mm / 2 = 2.5mm or 2500µm

4. Determine the average size of the following cells. The field diameter is 3.2 mm. Show work.



10 cells along this line

When you have a full field of view like this, it is easier to assume that the big and small cells will even out. Just count along the diameter for fit. If it is not specified, "size" means "length". For this example, length is vertical.

$AS = \frac{FD}{Fit} = \frac{3.2\,mm}{10} = 0.32\,mm$

Average cell size = 320 µm

5. Determine the size of each cell. The field diameter is 400 µm. Show work.

These are chains of pill-shaped cells. The chains are helpful for estimating how many will fit. For example, it looks like just a bit over 2 chains of 4 will fit on the diameter.

$AS = \frac{FD}{fit} = \frac{400\,\mu m}{9} =$

pointless extra info!

Size of cell = 44 µm

6. The following is a drawing of an amoeba. It was viewed under a compound light microscope at 100X. About three and half of these can fit across the field of view, which has a diameter of 1.8 mm. What is the drawing magnification of this illustration?

DM = ? measure

$DM = \frac{DS}{AS} = \frac{7.55\,cm}{?\ \text{calculate}}$

$AS = \frac{FD}{Fit} = \frac{1.8\,mm}{3.5} = 0.51428571\,mm$

convert!

$DM = \frac{7.55\,cm}{0.51428571\,mm} = \frac{75.5\,mm}{0.51428571\,mm}$

Drawing magnification = 147x

7. How do we determine the size of a cell with a compound light microscope?

Use your own words to explain what you do to calculate the actual size of a cell.

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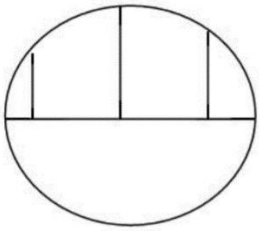
Microscope Calculations

1. Complete the following table.

Ocular magnification	Objective magnification	Total apparent magnification
5X	a.	80X
10X	40X	b.
10X	100X	c.
d.	50X	500X

2. Calculate the diameter of the field of view (FOV) for each diagram. Field diameter (FD) and field of view (FOV) are often used interchangeably. The lines are ruler markings and the distance between lines is 0.4 mm. Objects in the field of view are usually measured in micrometers (µm), or microns for short. There are 1000 microns per millimetre.

A.

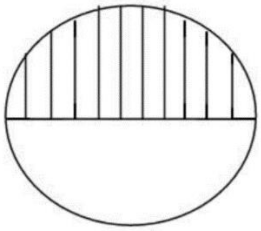


# of ruler spaces: _____

FOV = _____ mm

FOV = _____ µm

B.

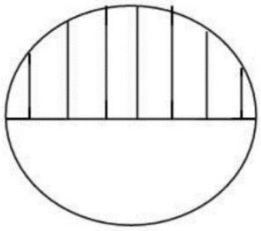


# of ruler spaces: _____

FOV = _____ mm

FOV = _____ µm

C.



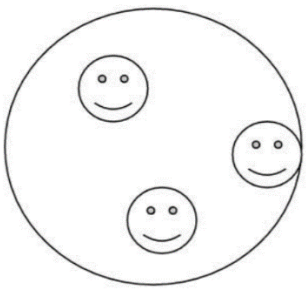
# of ruler spaces: _____

FOV = _____ mm

FOV = _____ µm

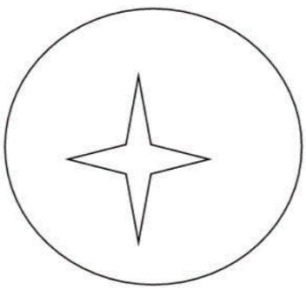
3. Calculate the size of each specimen. Assume the FD is 5.0 mm. Use the bottom of the page for work.

A.



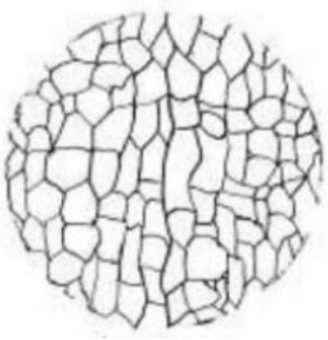
Actual size of one specimen: _____

B.



Actual size of one specimen: _____

4. Determine the average size of the following cells. The field diameter is 3.2 mm. Show work.

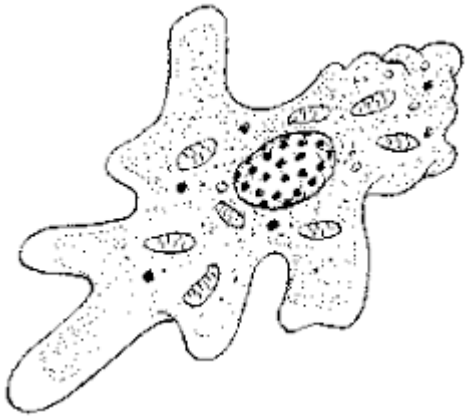


Average cell size = _____

5. Determine the size of each cell. The field diameter is 400 µm. Show work.

Size of cell = _____

6. The following is a drawing of an amoeba. It was viewed under a compound light microscope at 100X. About three and half of these can fit across the field of view, which has a diameter of 1.8 mm. What is the drawing magnification of this illustration?



Drawing magnification = _____

7. How do we determine the size of a cell with a compound light microscope?

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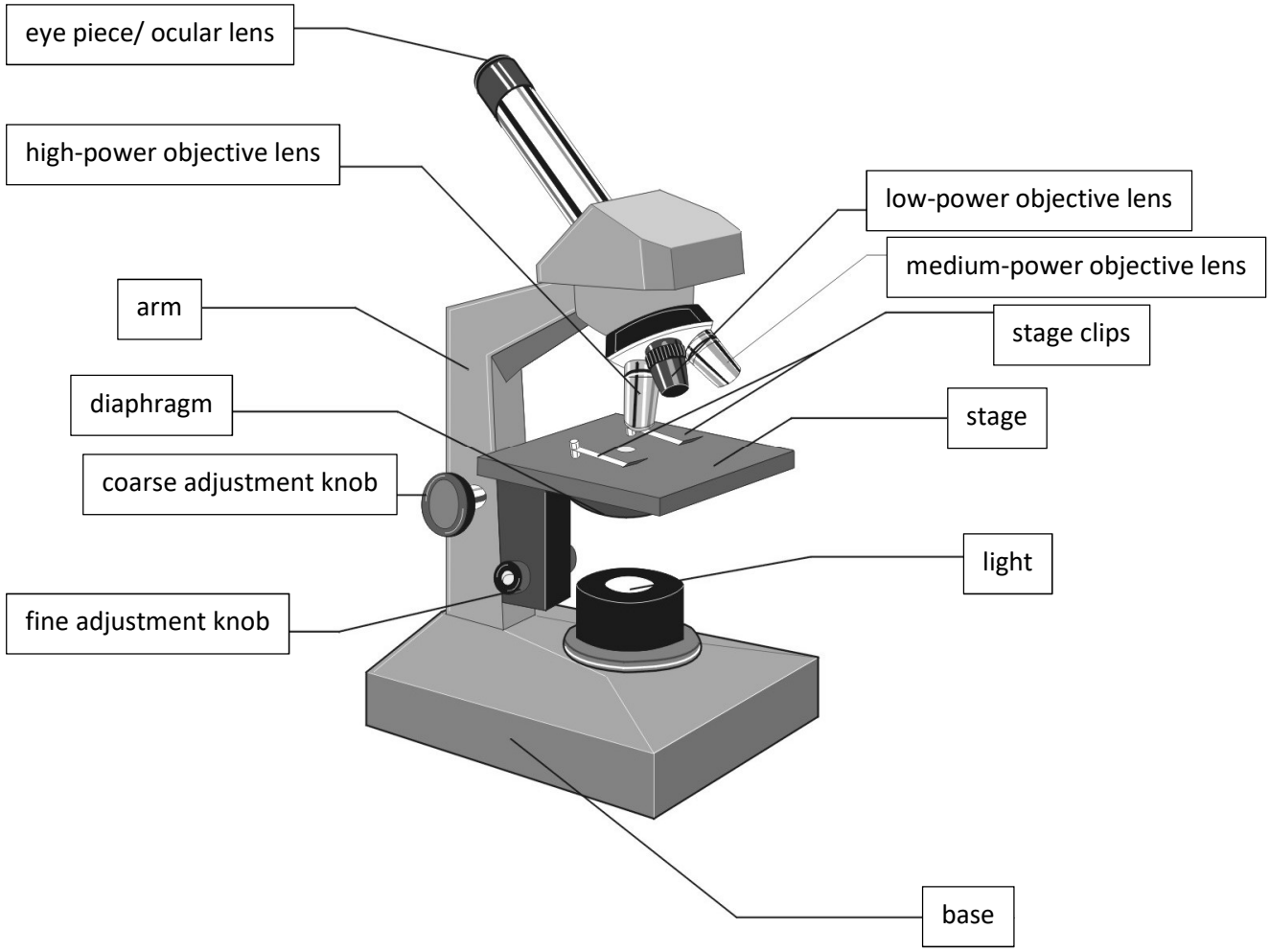
Parts of a compound light microscope

Label the diagram. Be specific with the objectives



How do you calculate the total apparent magnification on a compound microscope? What is the total apparent magnification of our microscopes on low, medium and high power?

total apparent magnification = ocular x objective

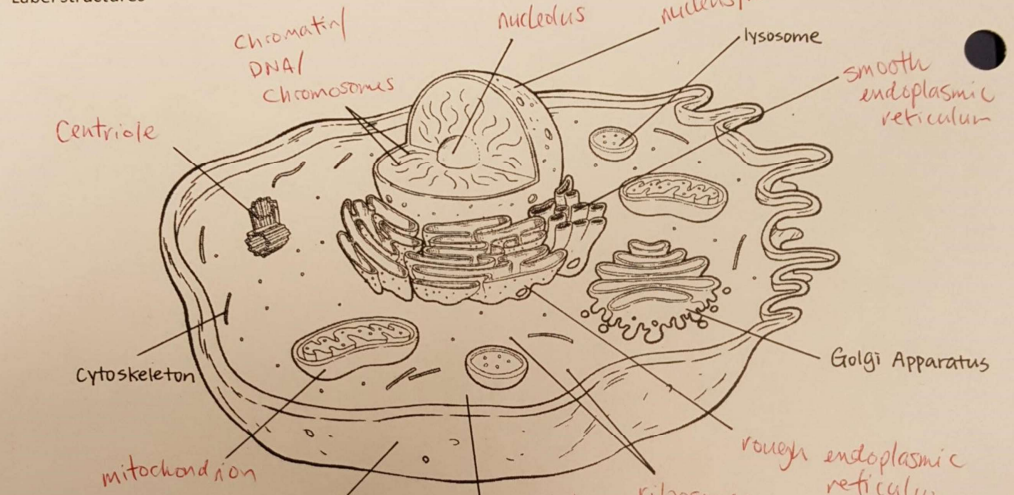
low = 40X, med = 100X, high = 400X

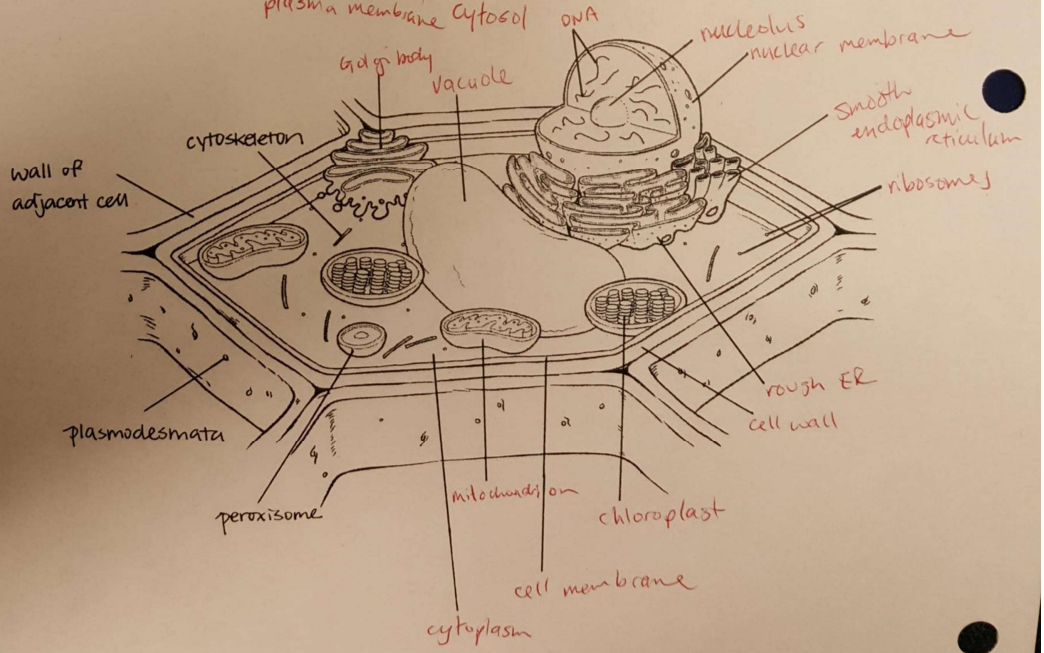
What is the difference between apparent magnification and drawing magnification?

Apparent magnification is how much bigger an object appears (looks like) from the microscope. Drawing magnification compares the size of the drawing to the actual size of an object.

Parts of eukaryotic cells

Label structures





Energy Flow in an Ecosystem

- photosynthesis:
  $CO_2 + H_2O + energy \rightarrow C_6H_{12}O_6 + O_2$
- aerobic cellular respiration:

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + ATP\ (energy)$

- Earth is an open system for energy

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Factors of Population Size

- Rate of Change in Populations

  = I + N – E – M
  - Immigration: rate of moving into area
  - Emigration: rate of leaving the area
  - Natality: birth rate
  - Mortality: death rate
- What could limit population growth?

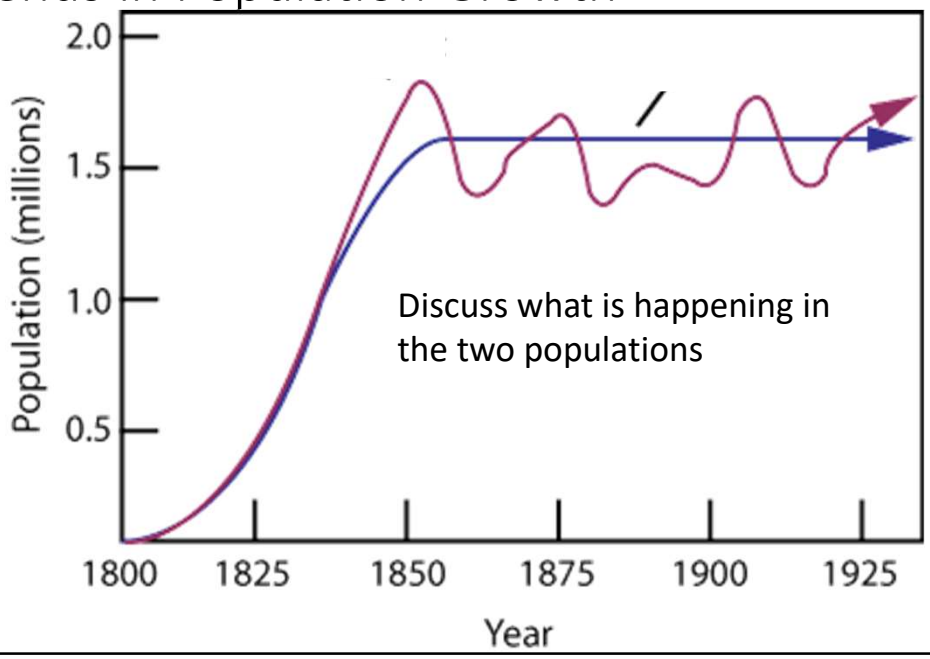
24

Effect of Population Density

- What is density?
  - → What is population density?
- Go back to the factors that limit growth. Which factors are
  - density-dependent?
  - denisty-independent?

25

Trends in Population Growth

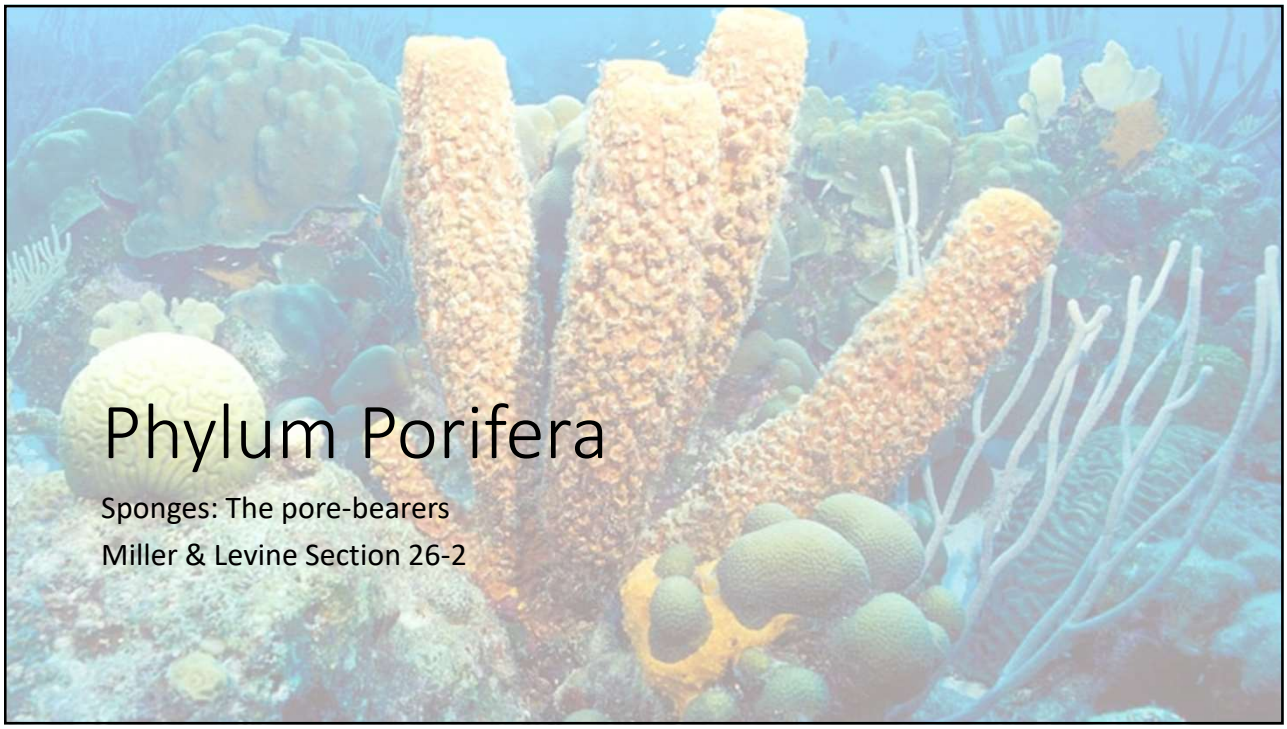


26

Population Growth Rates

- Exponential:
  - competition not a factor → population rapidly increases
- Logistic:
  - competition and other interactions
    → environment has a limited carrying capacity
    →population will plateau/reach steady state/equilibrium
- Cyclic:
  - pattern of overshooting carrying capacity → decline → recovery
- Irruptive: rapid growth, then population suddenly decreases, often to the point of no-recovery (without interference)

27



Phylum Porifera

Sponges: The pore-bearers

Miller & Levine Section 26-2

22

Video: Sponge Intro

23

Characteristics

- aquatic; mostly marine
- most are asymmetrical
- no organized tissues; have specialized cells instead
- larvae can swim
- most are sessile
  - some species can creep about 1 mm a day

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Video: Spicules

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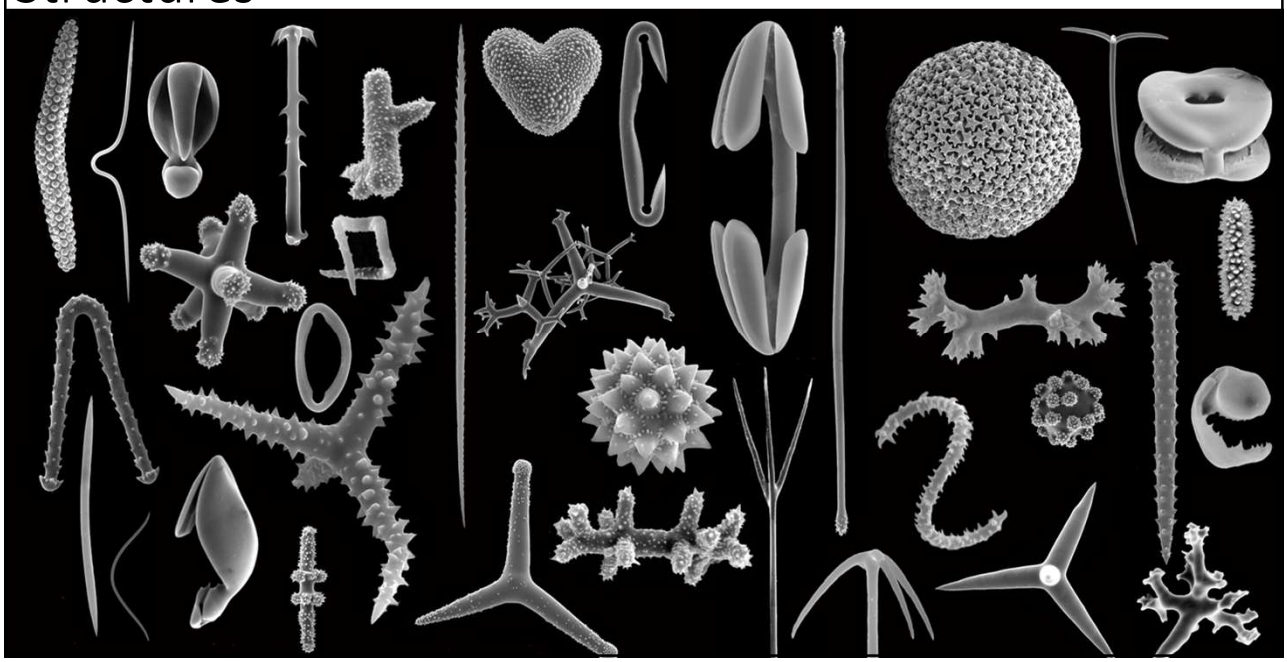
Structures

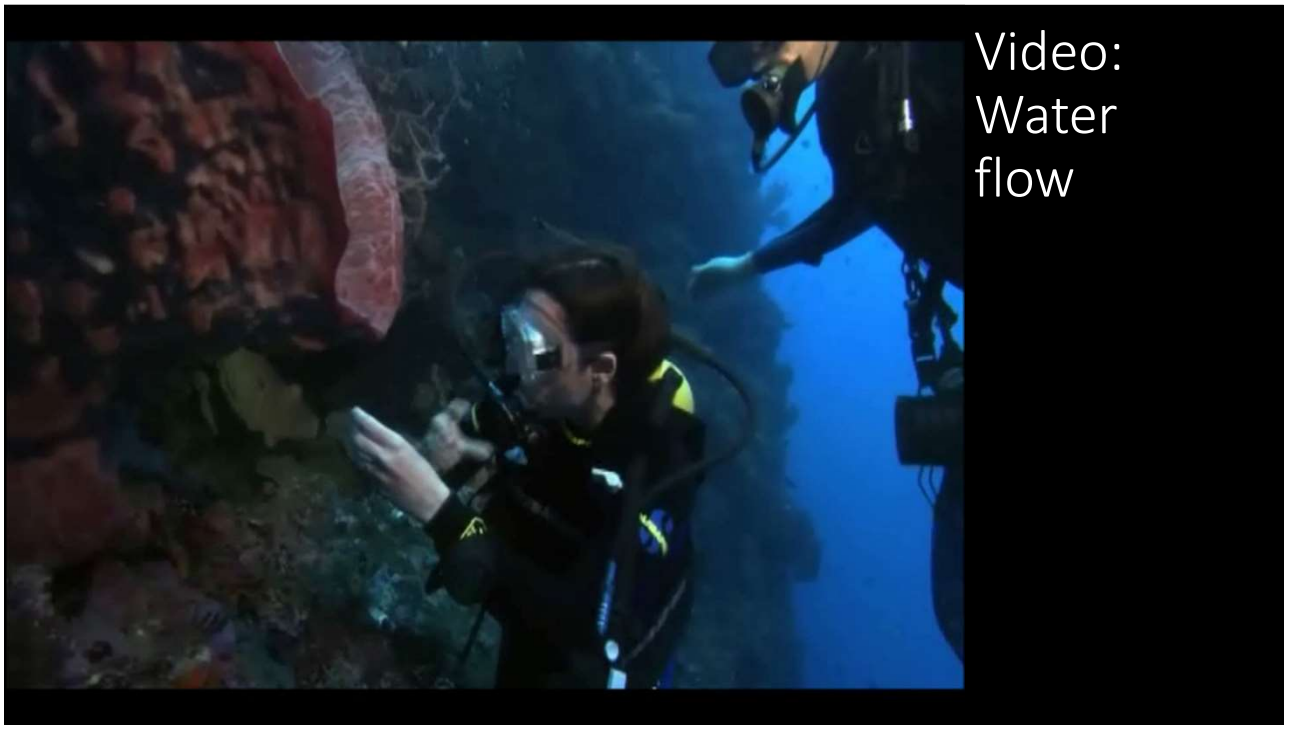
- spicules
  - sharp, hard pieces
  - made of calcium carbonate or silica
  - one way to identify species
- choanocyte (collar cell)
- amoebocyte (wandering cell like an amoeba)
- pores
- osculum
- mesohyl

26

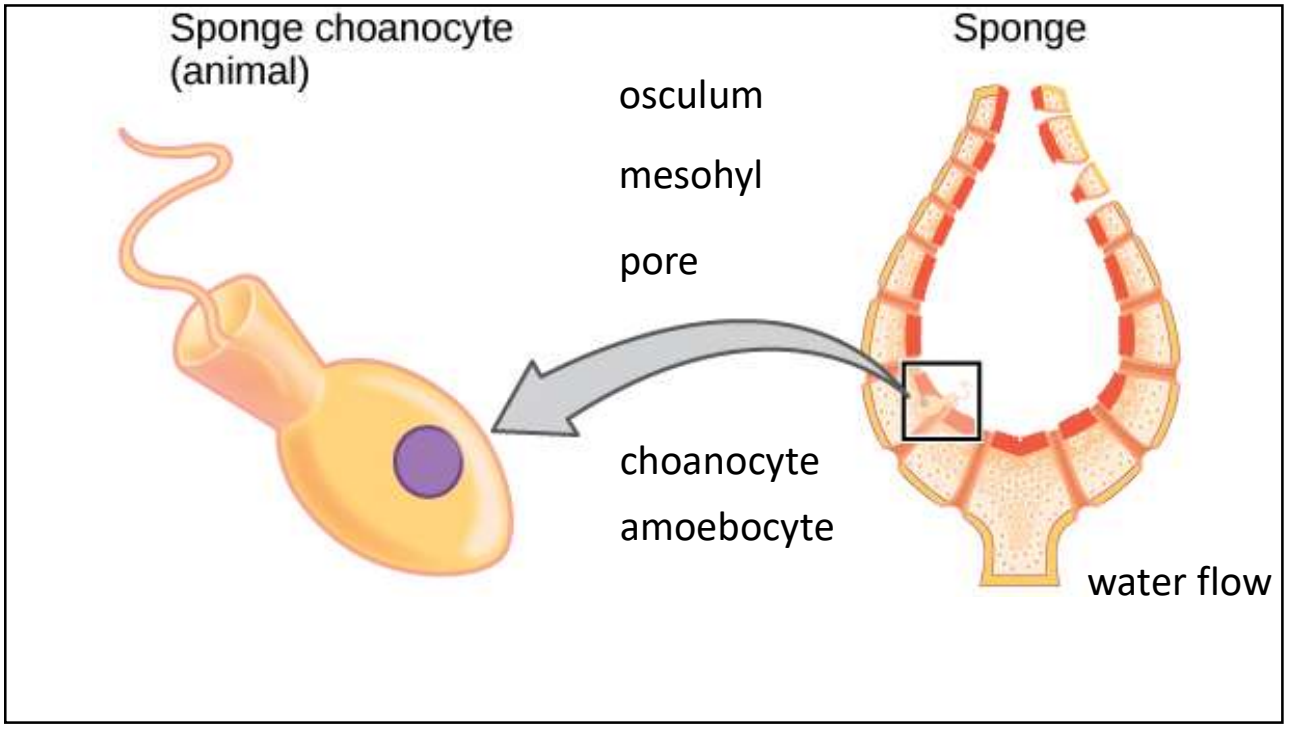
Structures



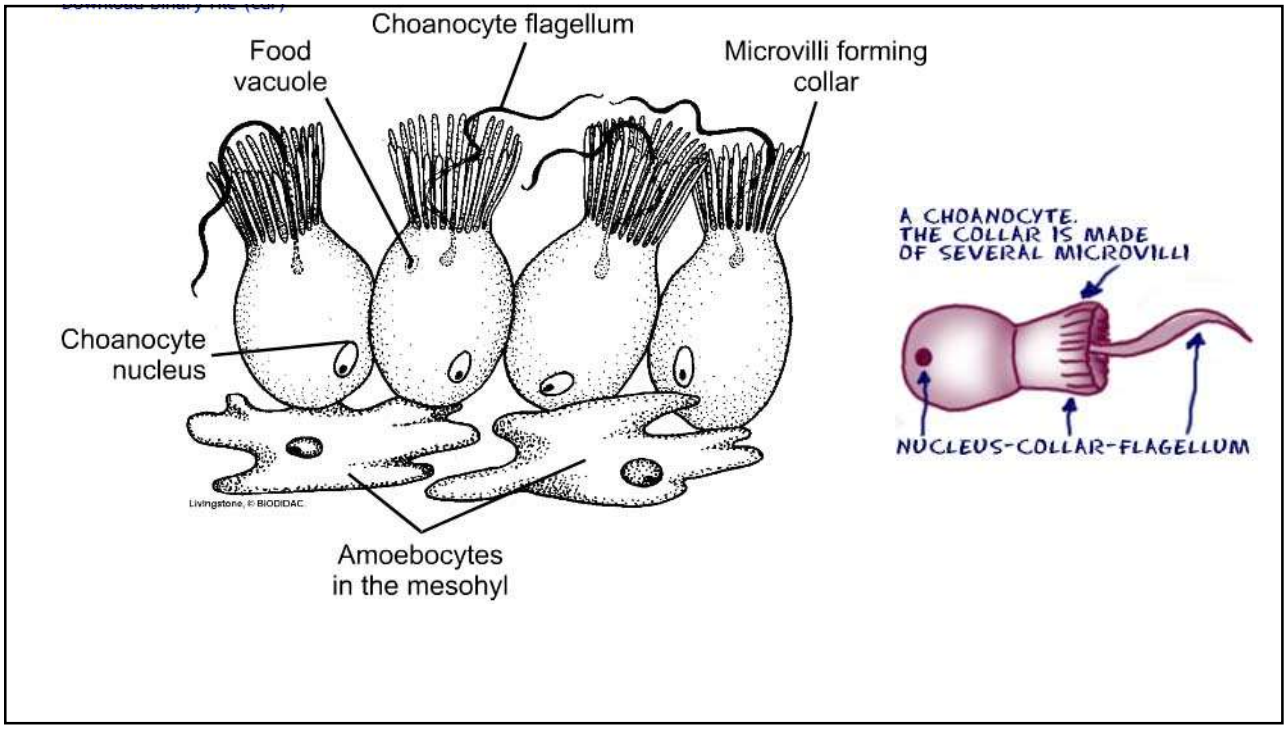
27


Video:
Water
flow

28


Sponge choanocyte
(animal)
Sponge
osculum
mesohyl
pore
choanocyte
amoebocyte
water flow

29


Choanocyte flagellum
Food vacuole
Microvilli forming collar
Choanocyte nucleus
Amoebocytes in the mesohyl
Livingstone, © BIODIDAC
A CHOANOCYTE. THE COLLAR IS MADE OF SEVERAL MICROVILLI
NUCLEUS-COLLAR-FLAGELLUM

30


Video: cell workings

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Feeding

- most are filter-feeders
- carnivorous ones found in nutrient-poor places
- some produce fecal pellets

32

Excretion, Respiration, Internal Transport

- by diffusion: from high concentration to low concentration

33

Response

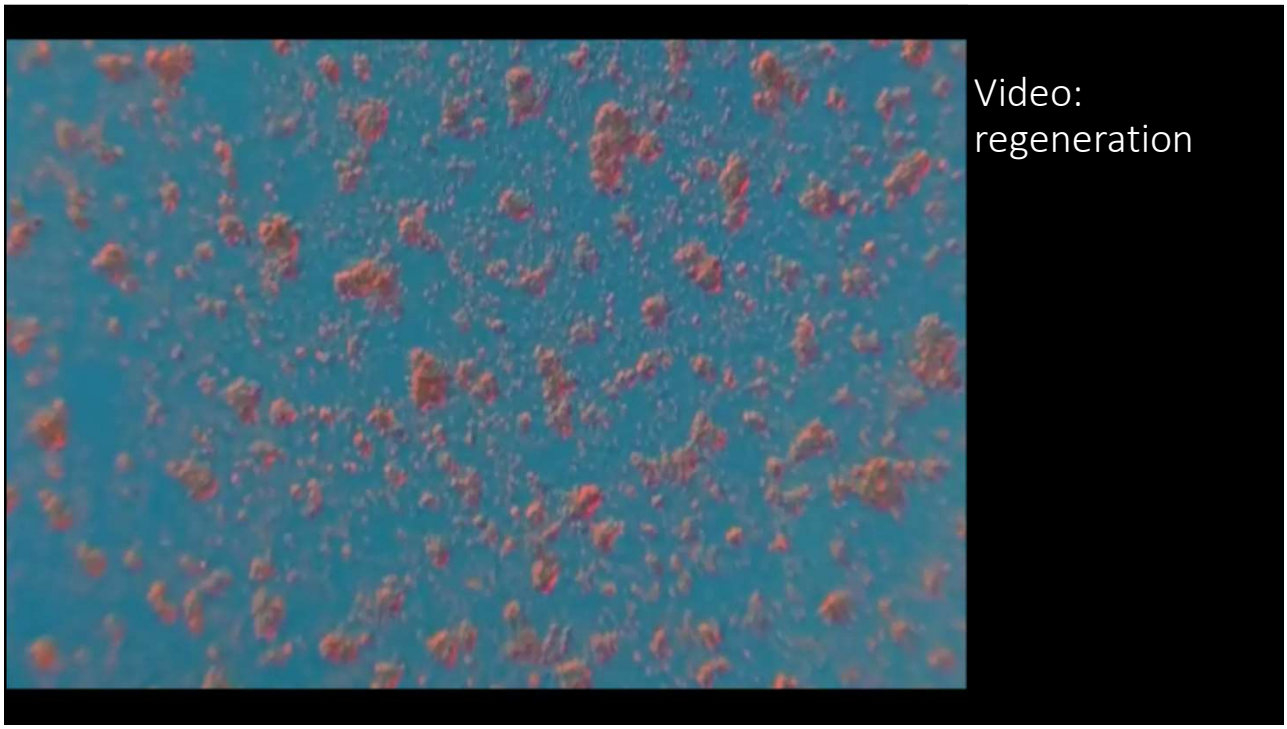
- no nerve cells
- can close pores and stop water flow

34

Reproduction

- sexual
  - most species are hermaphroditic (produce both eggs and sperm)
- asexual
  - regeneration
  - budding
  - gemmules (freshwater species)
    - resistant to freezing and drying; dormant during winter

35



Video: regeneration

36

4 Classes

- Demospongiae (demosponges)
  - about 90% of sponges
  - includes commercial sponge (*Spongia officinalis*)
  - spongin, a type of protein. Some have spicules as well
- Hexactinellida (glass sponges)
  - lattice-like skeletons of fused silica spicules
- Calcarea (calcareous sponges)
  - calcium carbonate spicules
- Homoscleromorpha (encrusting sponges; recently recognized)
  - simple in form; small spicules

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Clara Cánovas Pérez

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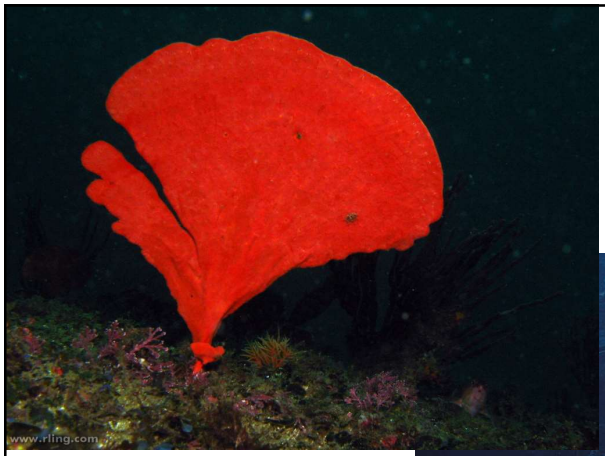
www.rling.com


gettyimages
Jeff Rotman
a0106-000550

39

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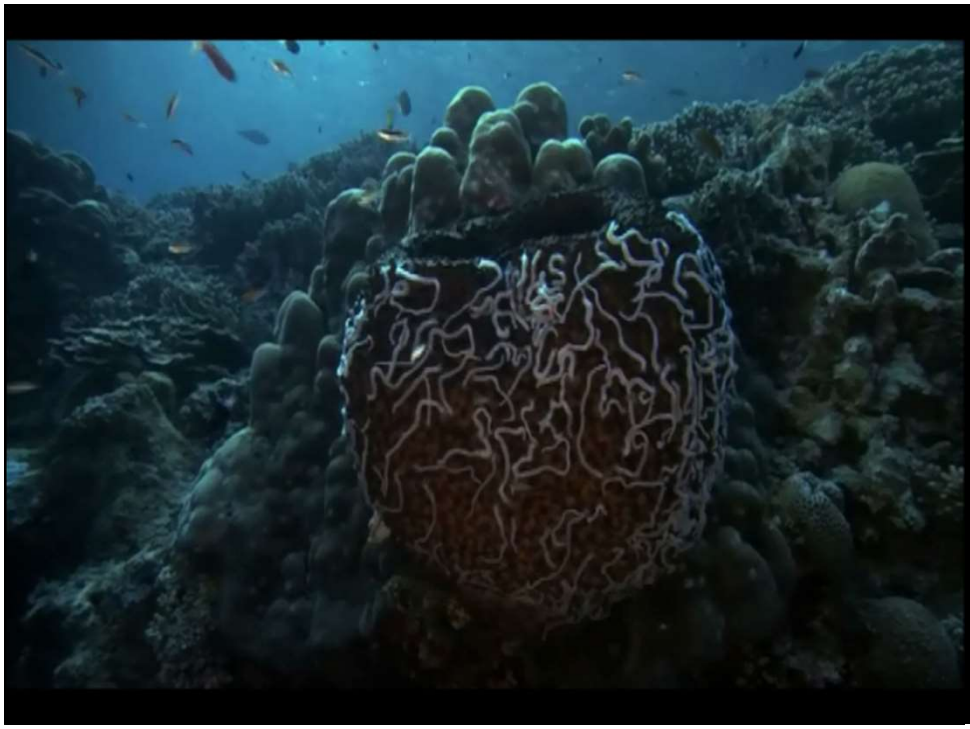
41

42



Video: biotic relationships

43

Work

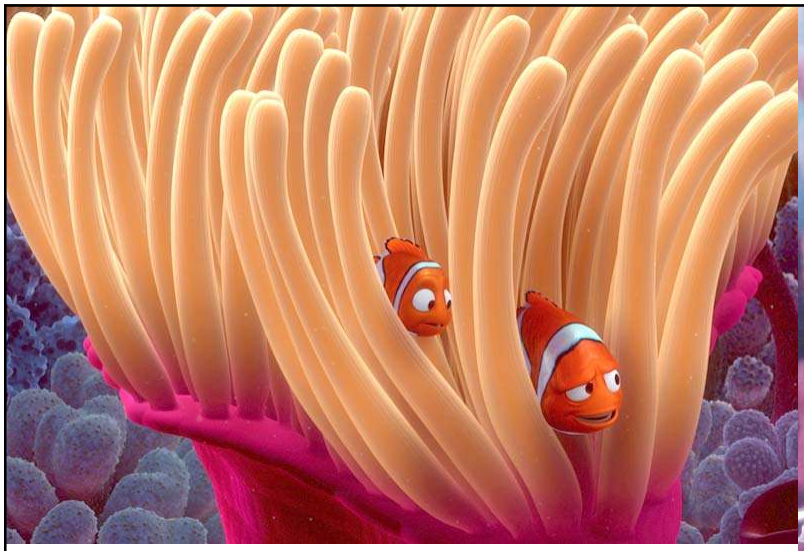
- Read “Trends in Animal Evolution” in section 26-1.
  - Write down the thee basic trends in animal evolution
- Read section 26-2
  - make a vocabulary list and write down the definitions (I am weaning you off unit overviews). I recommend flash cards, but whatever works for you is fine.
- NOTE: Porifera & Cnidaria test is scheduled for Jan 17
- Aquarium make up assignment due Jan 31

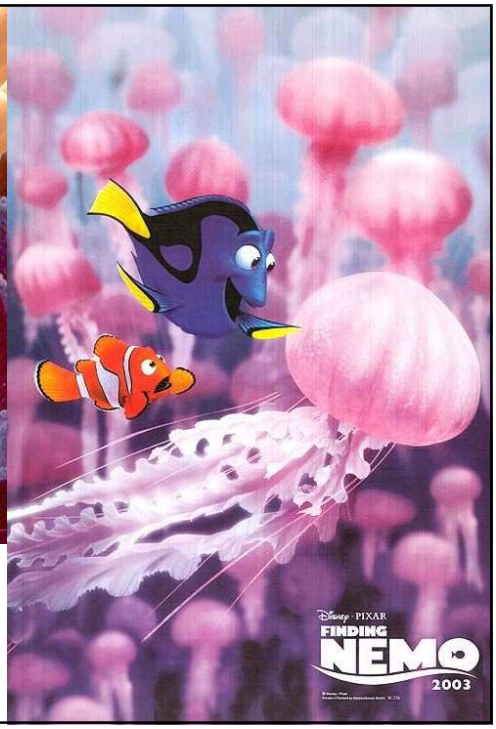
44

Review. Take turns telling your partner the following:

- What qualifies an organism as an animal?
- Symmetry of sponges
- Phylum name of sponges, and meaning
- Main structures of sponges
- Functions of choanocytes and amoebocytes
- How sponges carry out
  - feeding
  - internal transport
  - respiration
  - excretion

4



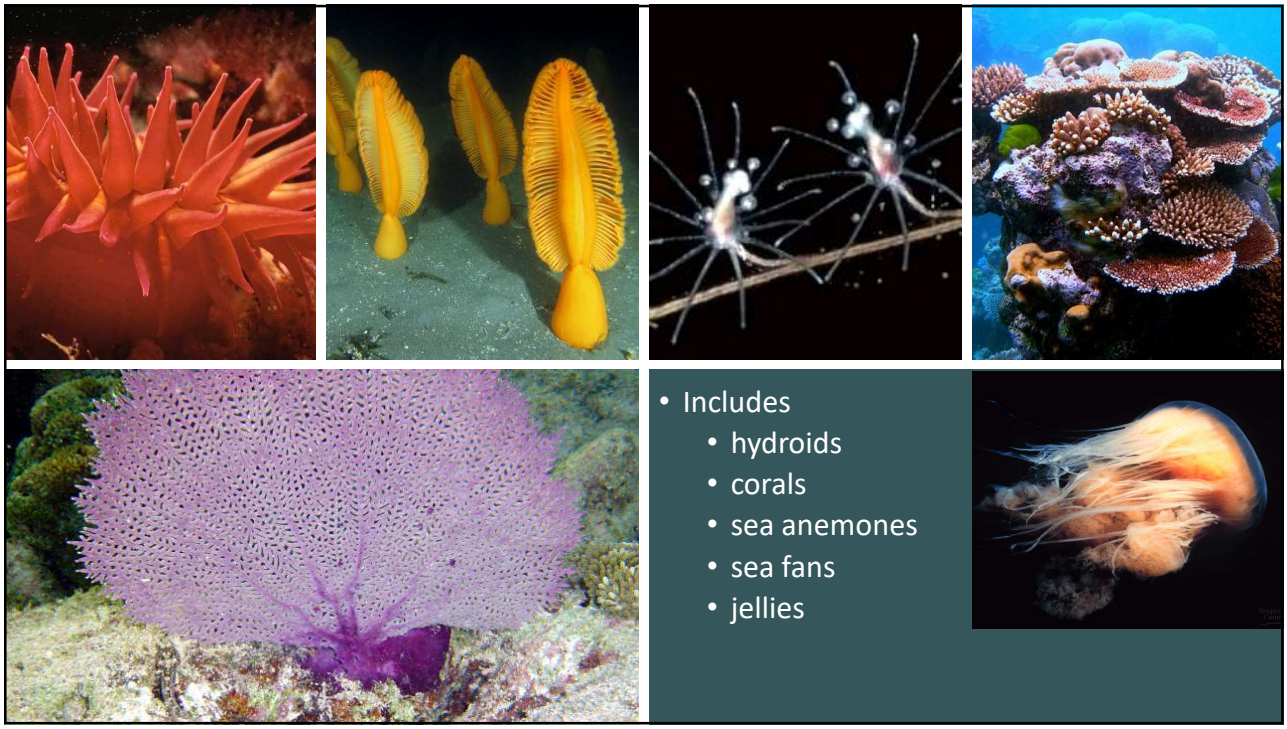


Phylum Cnidaria

The stinging creatures

Miller & Levine Section 26-3

5



- Includes
  - hydroids
  - corals
  - sea anemones
  - sea fans
  - jellies

6

Characteristics

- aquatic; mostly marine
- radial symmetry
- stinging tentacles around the mouth
- 2 tissue layers
- specialized cells and tissues

7

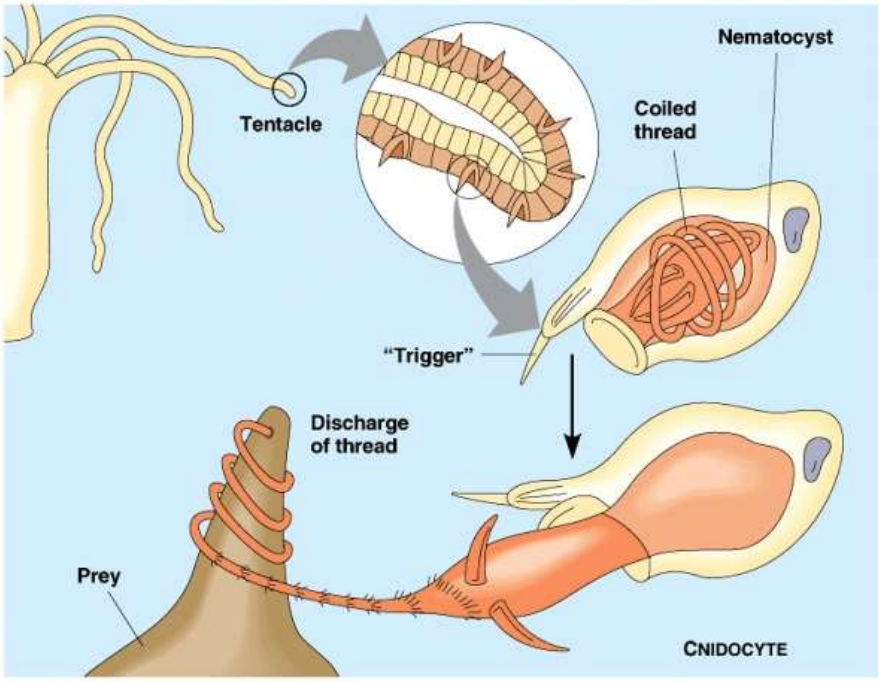

Dude, I'll bet you ten bucks I can make that guy pee on his friend.
you're on.

8

9

Cnidocytes

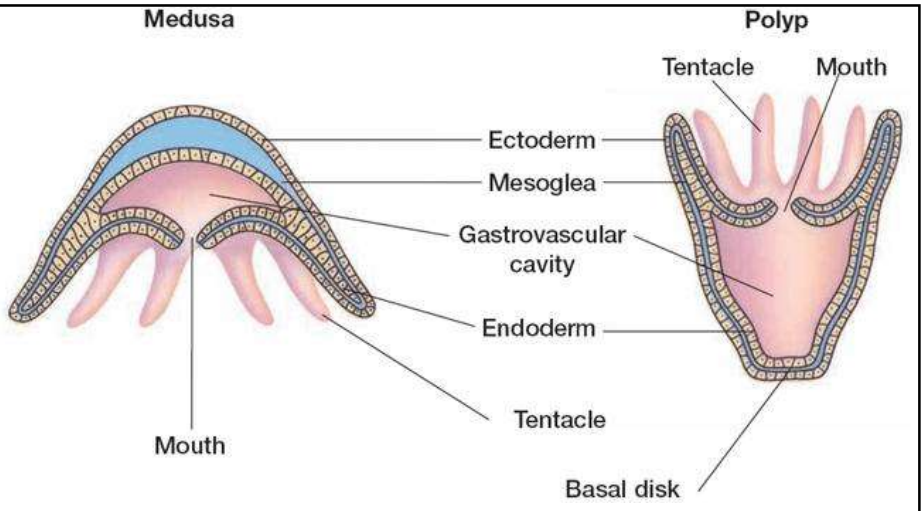
- characteristic stinging cells in tentacles
- have organelles called nematocysts
- TED animation: How does a jellyfish sting?



10

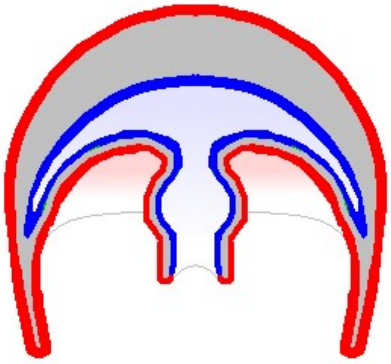
Body Forms

- medusa
  - bell-like
  - motile
  - mouth faces down
- polyp
  - generally sessile
  - mouth faces up



11

Body Plan

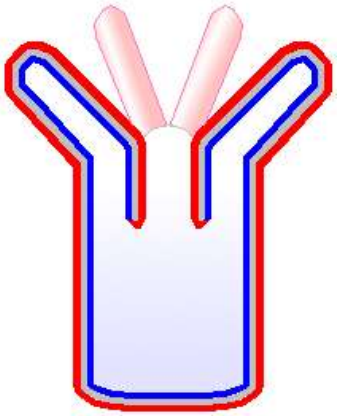


ectoderm

mesoglea

endoderm

gastrovascular cavity



12

Body Plan

- 2 tissue layers
  - endoderm (AKA gastrodermis)
  - ectoderm (AKA epidermis)
- mesoglea: jelly-like, acellular layer
- one opening (mouth) to digestive tract
- tentacles around mouth
- one cavity (gastrovascular cavity)

13

Video: Anemone Feeding

14

Feeding and Digestion

- mouth is surrounded by tentacles and connected to digestive cavity (gastrovascular cavity)
- food captured by tentacles and brought to mouth
- digestion can be both intracellular and extracellular
  - extracellular advantage: can feed on larger particles
- incomplete digestive tract: one opening only
- some have symbiotic algae

15

Excretion, Respiration, Internal Transport

- by diffusion
- most cnidarians are only a few cells thick

16

Video: Medusa Movement

17

Locomotion

- no muscle cells, but epidermal cells can serve muscle function
- medusa:
  - contraction of bell causes jet propulsion
  - not strong swimmers; mostly carried with currents
- polyp:
  - basal disc keeps organism anchored
  - some creep; some swim (badly)
- ciliated larva swim

18

Video: Stomphia

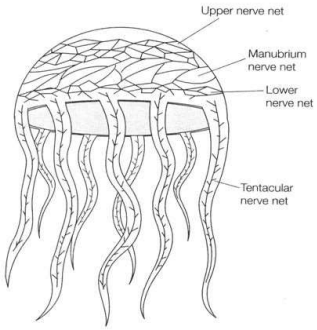
19

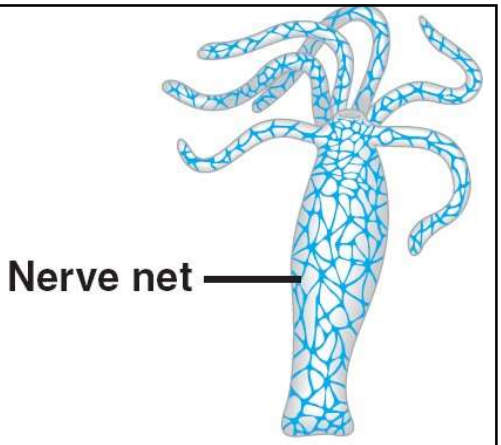
Response

- nerve net: diffuse network of nerve cells
  - no central nervous system
  - conducts impulses in all directions
- sensory cells can detect chemicals and pressure changes
- simple sensory organs
  - statocysts
  - ocelli

20

Nerve Nets In Jellyfish





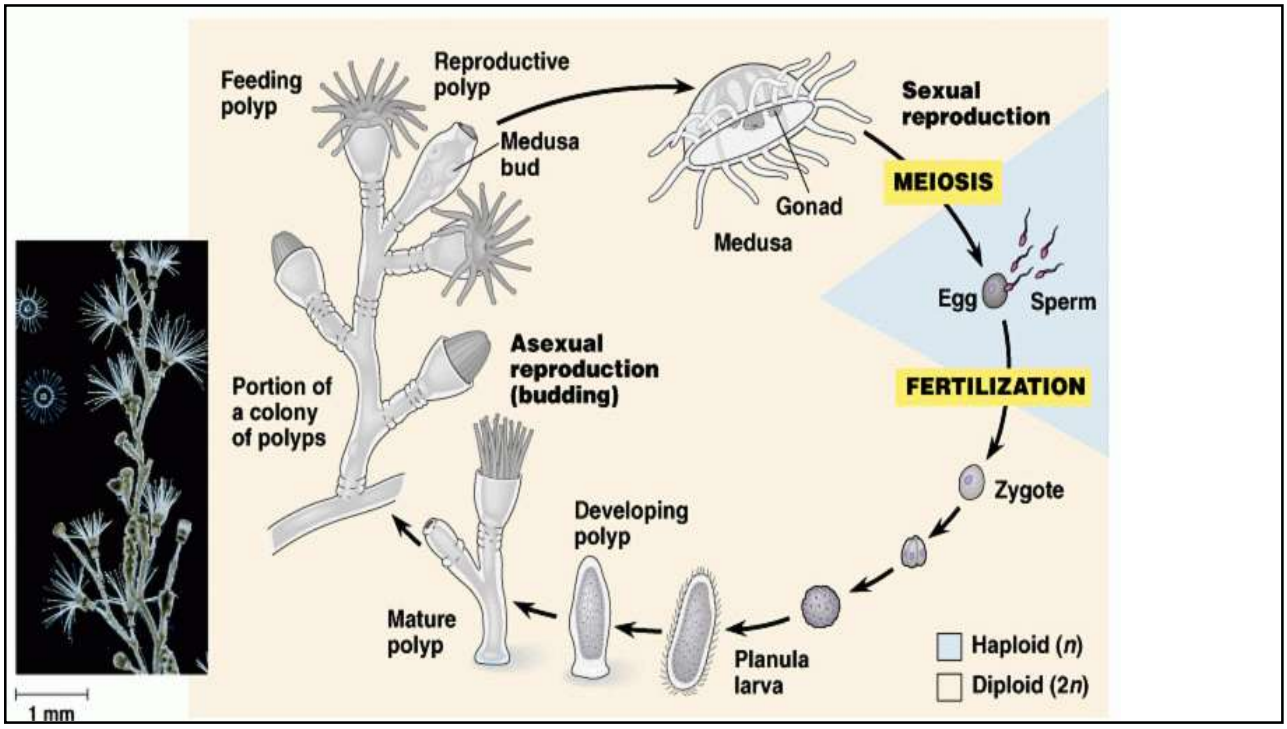
(a) Hydra (cnidarian)

21

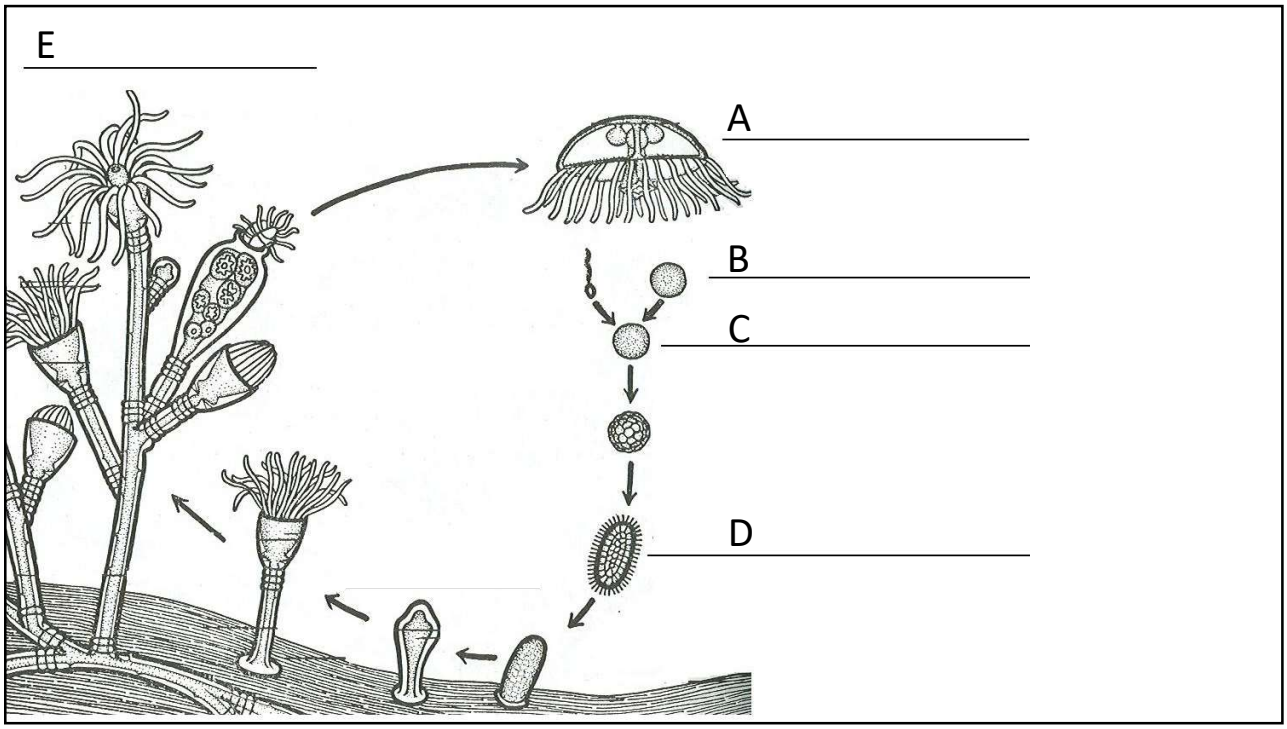
Reproduction

- asexual
  - budding
  - regeneration
- sexual
  - often involves alternation of generations

22



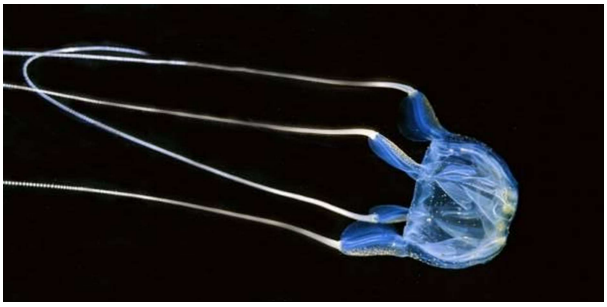
23



24

Some classes of cnidarians

- Class Hydrozoa – polyp, small medusa
  - Eg. hydra
- Class Schyphozoa – small polyp, large medusa
  - Eg. jellyfish, Portuguese man o'war (blue bottles)
- Class Anthozoa – large fleshy polyp, no medusa
  - Eg. sea anemone, coral
- Class Cubozoa – small polyp; agile medusa
  - Eg: box jellies



25

26

27

28

Work

- Skim over section 26-1
  - make notes if necessary
  - you are expected to know the 7 essential functions and 3 evolutionary trends in animals
- Read sections 26-2 and 26-3
  - add notes as needed
- Create a list of vocabulary
  - write down the definitions (flash cards work well if you use them properly)

29

Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

More Practice: Microscope Calculations

1. A microscope has the following objective lenses: 50X, 20X and 10X. It has an ocular lens of 4X. What is the total apparent magnification at high power? total apparent magnification = ocular X objective
high power = 200 X

2. Calculate the size of each specimen. Assume the FD is 5.0 mm. Use the bottom of the page for work.

AS = FD/fit

= 5/6.5

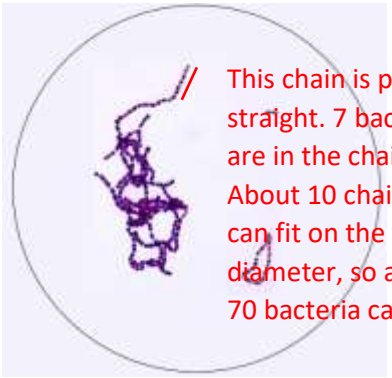
AS = FD/fit

= 5/3

Actual size of one specimen: 769 µm (better answer is 770 µm because of sig figs)

Actual size of one specimen: 1.7 mm or 1700 µm

3. These chains of bacteria were viewed at 400X. The field diameter is 450 µm. What is the size of each bacterial cell? Show work.



This chain is pretty straight. 7 bacteria are in the chain. About 10 chains can fit on the field diameter, so about 70 bacteria can fit

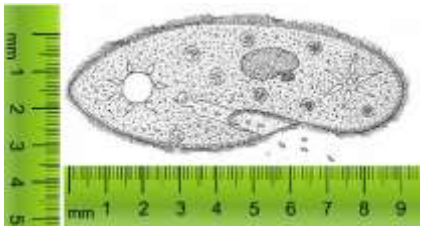
AS = FD/fit

= 450 µm /70

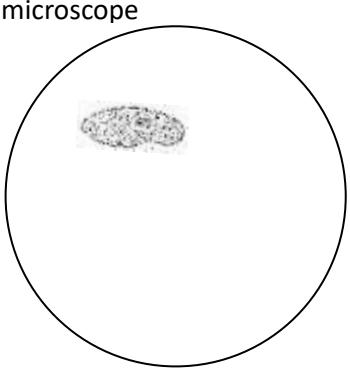
Size of cell = 6 µm

4. The following is a drawing of a protist. It was viewed under a compound light microscope at 100X, which has a diameter of 1.8 mm. What is the drawing magnification of this illustration? Use the ruler provided.

Drawing of protist



View of protist through microscope



DM = DS/AS

the drawing size (length) is about 9 cm, but we don't have actual size.
Calculate: AS = FD/fit

= 1.8 mm /3 = 0.6 mm

DM = 9cm / .6mm → convert!

= 90 mm /.6 mm

= 150X

Drawing magnification = 150X

Biology 11
Ms. To

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Date: _____ Block: _____

More Practice: Microscope Calculations

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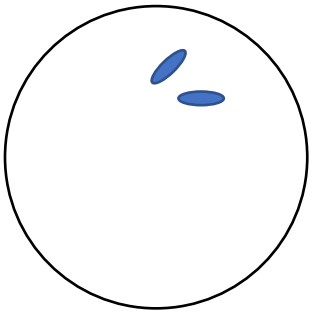
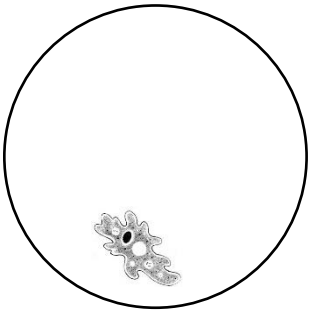


Actual size of one specimen: _____



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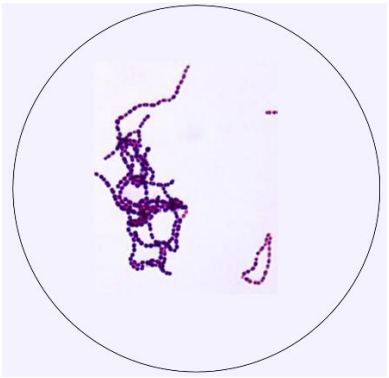
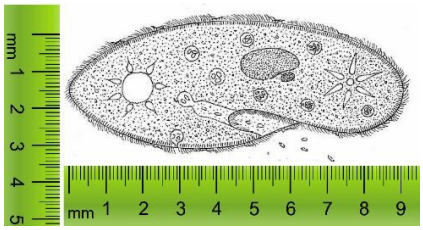


Size of cell = _____

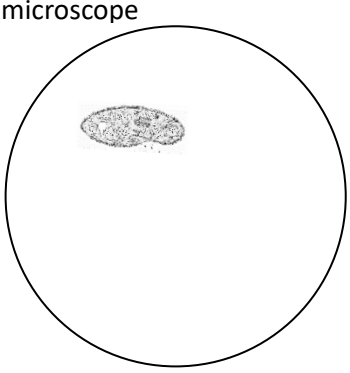
4. The following is a drawing of a protist. It was viewed under a compound light microscope at 100X, which has a diameter of 1.8 mm. What is the drawing magnification of this illustration? Use the ruler provided.

Drawing of protist



Drawing magnification = _____

View of protist through microscope



Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

Porifera & Cnidaria

1. How can you recognize a choanocyte?
   has flagellum (tail-like structure)
   has a collar

2. What are three functions of choanocytes?
   create current to move water through sponge
   trap and engulf food
   digest food or pass them to amoebocyte

3. How can you recognize an amoebocyte?
   it's a blobby cell in the mesohyl
   it looks like an amoeba (it has a nucleus)

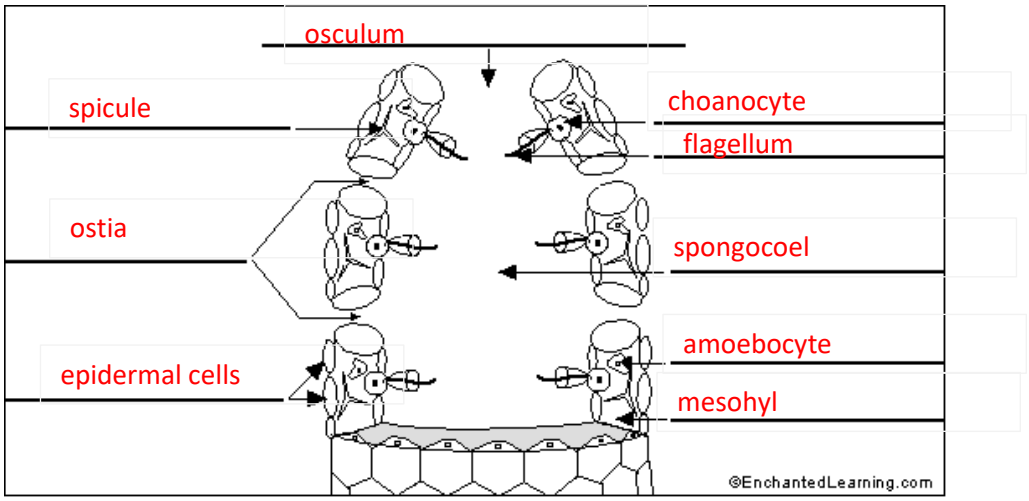
4. What are three functions of amoebocytes?
   make spicules
   digest food
   move nutrients to other cells

5. What is spongin?
   a type of protein that forms the structure of most sponges

6. What minerals are spicules made of?
   silica (glass like)
   calcium carbonate (like in seashells)

7. What is the function of spicules?
   provides structure (like a skeleton)

8. On the diagram below of a longitudinal section of a sponge, draw the flow of water through the sponge. Label the following structures: **osculum** (excurrent opening), **choanocyte** (collar cell)**, ostia** (incurrent pores), **epidermal cells** (outer layer of cells), **spicule, amoebocyte, spongocoel** (central cavity)**, mesohyl** (jelly-like material), **flagellum**



9. How have sponges been helpful in medical research?
chemicals might be helpful as antibiotics or antitumour medicine

10. What major evolutionary advancement do cnidarians have over poriferans?
true tissues: they are more organized and specialized

11. Label the following examples of cnidarians as **hydras, jellyfish, corals** or **sea anemones.** Classify each as a **polyp** or a **medusa**.

sea anemone

polyp

coral

polyps

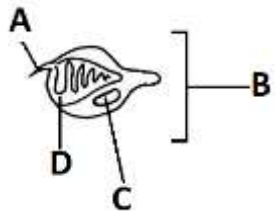
jellyfish

medusa

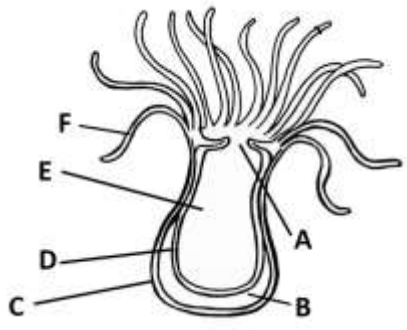
hydra

polyps

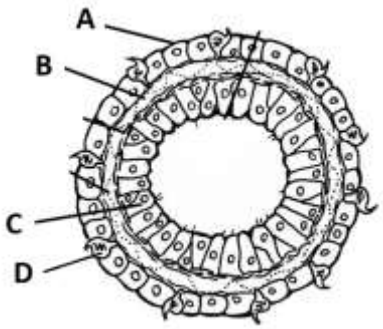
12. Label the following diagram.	A: trigger B: cnidocyte C: nucleus D: nematocyst



13. Label the following as a medusa or polyp. Then label the parts indicated.	Body type: polyp A: mouth B: mesoglea C: ectoderm (formerly known as epidermis) D: endoderm (formerly known as gastrodermis) E: gastrovascular cavity F: tentacle



14. Label the following cross section of a tentacle.



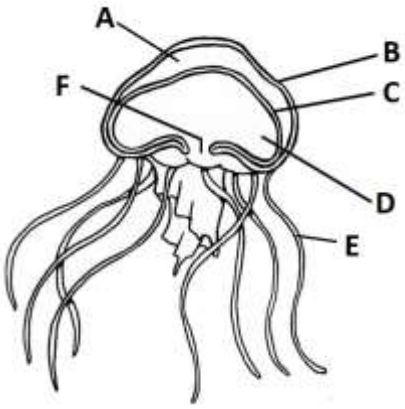
A: ectoderm

B: mesoglea

C: endoderm

D: cnidocyte

15. Label the following as a medusa or polyp. Then label the parts indicated.



Body type: medusa

A: mesoglea

B: ectoderm

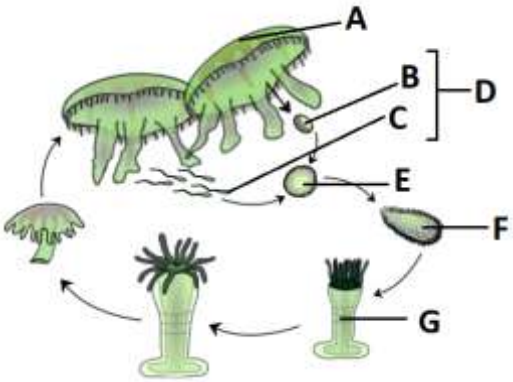
C: endoderm

D: gastrovascular cavity

E: tentacle

F: mouth

16. Label the following diagram of a life cycle.



What type of life cycle is this?

How are the medusae formed?

Which are the haploid labels?

A: medusa

B: egg

C: sperm

D: gametes

E: zygote

F: larva

G: polyp

Type of life cycle: alternation of generations (polyp-medusa-polyp-medusa…)
Formation of medusae by: asexual reproduction (budding)
Haploid labels: B, C, D

Name _____

Date _____ Block _____

Summarize poriferans and cnidarians on the table below.

	Porifera	Cnidaria
General characteristics common to both phyla		
Meaning of phylum name		
Example organisms		
Symmetry most common to phylum		
Tissue layers		
General body plan		
Specialized cells that are characteristic of the phylum		

	Porifera	Cnidaria
Feeding and digestion		
Internal transport		
Respiration		
Excretion		
Response		
Locomotion		
Reproduction		

Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

Porifera & Cnidaria

1. How can you recognize a choanocyte?

2. What are three functions of choanocytes?

3. How can you recognize an amoebocyte?

4. What are three functions of amoebocytes?

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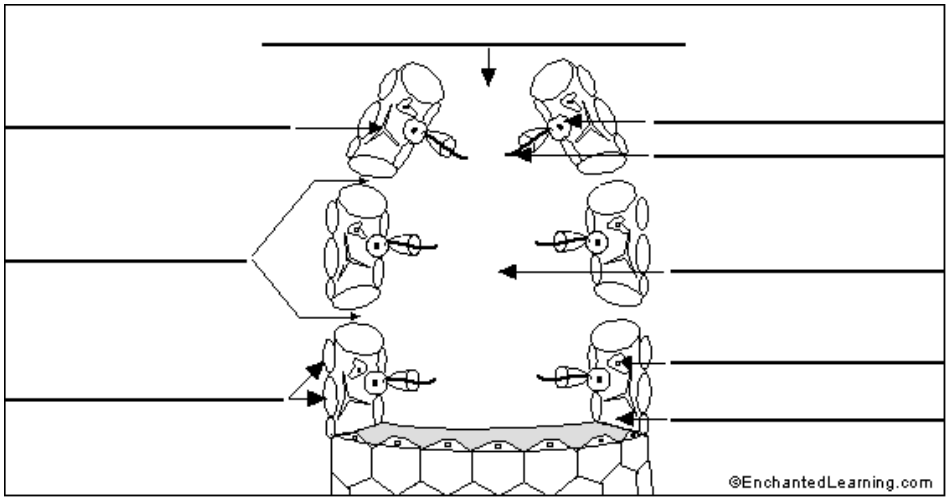
6. What minerals are spicules made of?

7. What is the function of spicules?

8. On the diagram below of a longitudinal section of a sponge, draw the flow of water through the sponge. Label the following structures: **osculum** (excurrent opening), **choanocyte** (collar cell)**, ostia** (incurrent pores), **epidermal cells** (outer layer of cells), **spicule, amoebocyte, spongocoel** (central cavity)**, mesohyl** (jelly-like material), **flagellum**

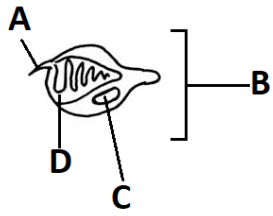


9. How have sponges been helpful in medical research?

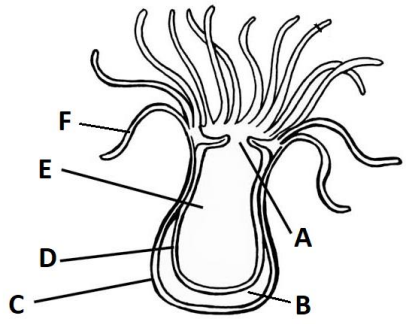
10. What major evolutionary advancement do cnidarians have over poriferans?

11. Label the following examples of cnidarians as **hydras, jellyfish, corals** or **sea anemones.** Classify each as a **polyp** or a **medusa**.

12. Label the following diagram.	A: B: C: D:



13. Label the following as a medusa or polyp. Then label the parts indicated.	Body type: A: B: C: D: E: F:



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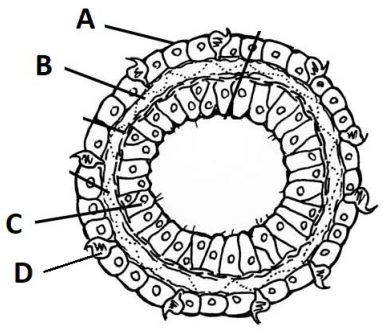


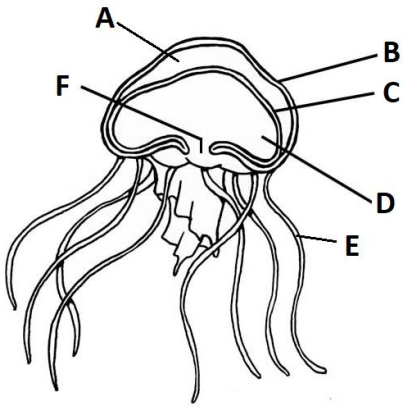
A:

B:

C:

D:

15. Label the following as a medusa or polyp. Then label the parts indicated.



Body type:

A:

B:

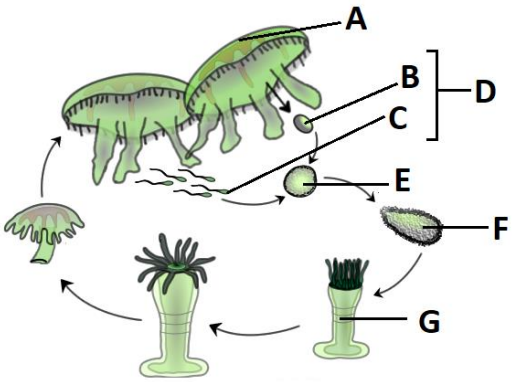
C:

D:

E:

F:

16. Label the following diagram of a life cycle.



What type of life cycle is this?

How are the medusae formed?

Which are the haploid labels?

A:

B:

C:

D:

E:

F:

G:

Type of life cycle:

Formation of medusae by:

Haploid labels:

Aquarium Debrief & Review

- go to blog (tobio11.weebly.com) and fill out the survey

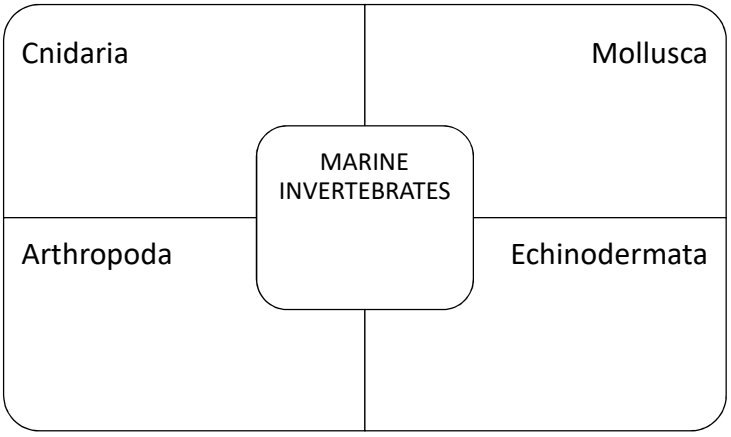
1

Aquarium Debrief & Review

centre: common to all

each phylum:

- example organisms
- symmetry
- major characteristic from the phylum name
- other characteristics
  - structures
  - specialized cells



2

Phylum Platyhelminthes

The Flatworms

Miller & Levine Section 26-4

3

Video:Tapeworm

4

What similarities do you notice?

5

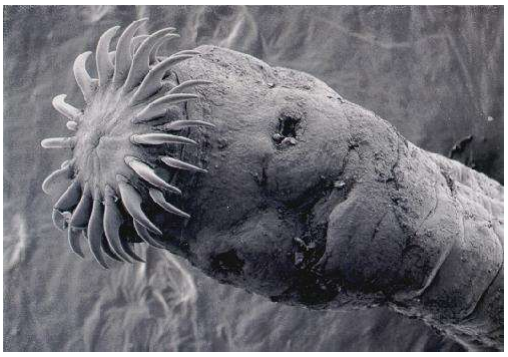
Body Plan

- Bilaterally symmetrical
- Dorsoventrally flattened
- Cephalized
- Acoelomate
  - coelom: body cavity between intestine and body wall
- 3 tissue layers: endoderm, mesoderm, ectoderm

6

Some classes

- Turbellaria (ex: planarians)
  - mostly free-living
- Cestoda (tapeworms)
  - have scolex and proglottids
- Trematoda (flukes)



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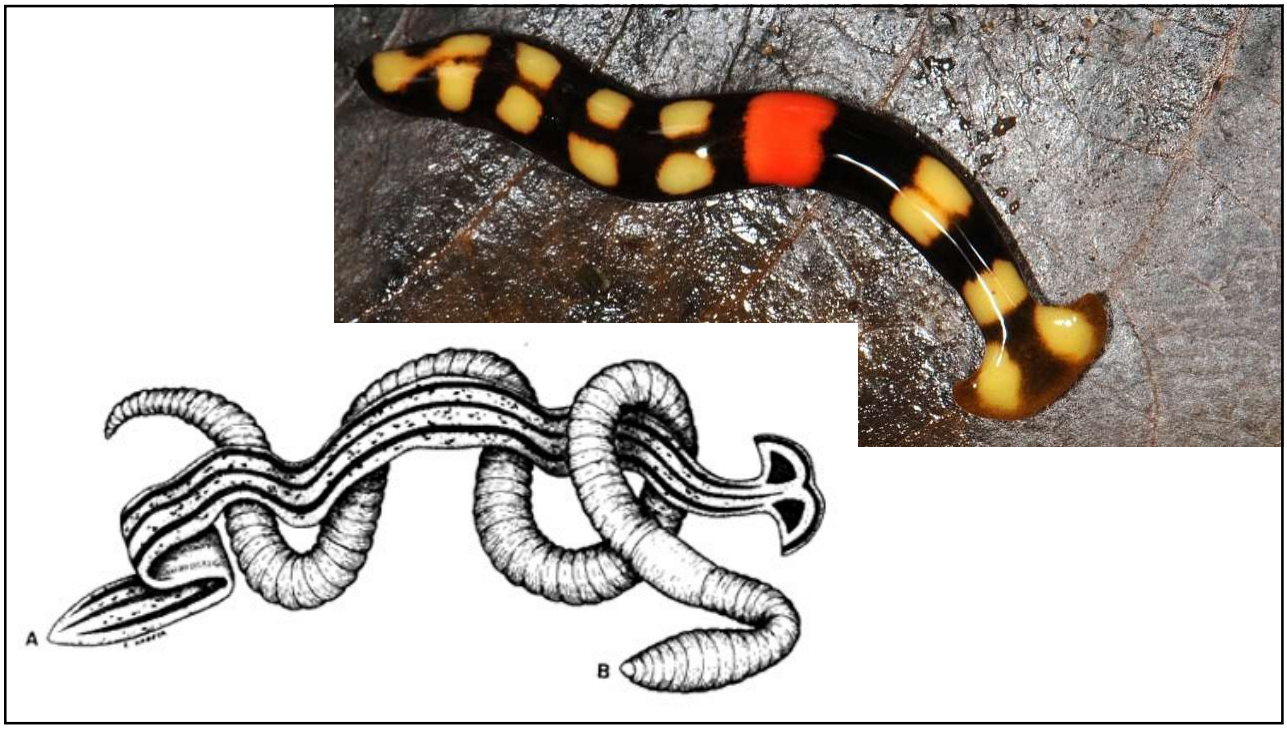
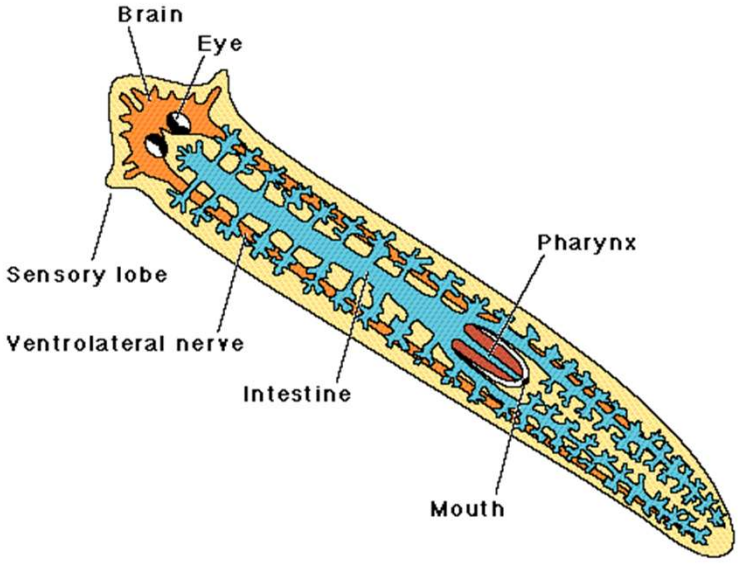


9

Feeding and Digestion

- Free-living species
  - Incomplete digestive tract: one opening to a branched gut
  - Mostly predators and scavengers
  - Muscular pharynx extends to suck in food
    - some feed on large food and use external digestion
- Parasites (tapeworms, flukes)
  - lack digestive system
    - nutrients absorbed directly from host



10

Internal Transport

- free-living: diffusion from intestine
- parasitic: diffusion through body wall

11

Respiration

- diffusion through body wall

12

Excretion

- ammonia removed mostly through diffusion
- flame cells (part of protonephridia)
  - act like kidneys in osmoregulation, especially in freshwater species
    - gets rid of excess water through ducts and pores
  - look like flickering flames when cilia are beating
    - https://www.youtube.com/watch?v=Rb_3KIB4CmE

13

Video: Nervous system and movement

14

Planarian Nervous System

How would you describe their nervous system?

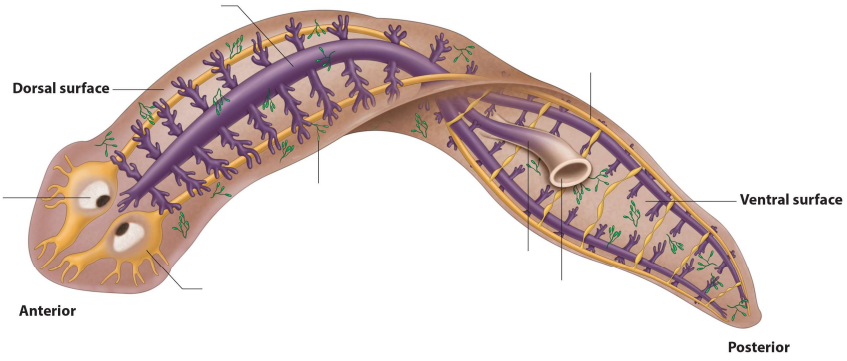
15

Nervous System

- complexity depends on species
- longitudinal nerves run length of body
  - more advanced: ladder-like nervous system
- concentration of nerves in head
  - more advanced: ganglia – clusters of nerve cells (sing.: ganglion)
    - primitive brain
  - sensory:
    - chemoreceptors (especially to find food)
    - photoreceptors (ocelli/eyespots)

16

What are the structures and functions?



purple: digestive system
yellow: nervous system
green: excretory/osmoregulation

Terms can refer to the same structure. Not all have a label line.

auricle
brain
eyespot
flame cell
ganglion
gastrovascular cavity
gut
intestine
longitudinal nerve
mouth
ocellus
pharynx
protonephridia
transverse nerve

17

Locomotion

- muscle cells controlled by nervous system
  - react to environment quickly
- free-living flatworms have cilia as well

18

Fragmentation

- https://youtu.be/m12xsf5g3Bo (0:09-2:38)

19

Video: Flatworm Sex

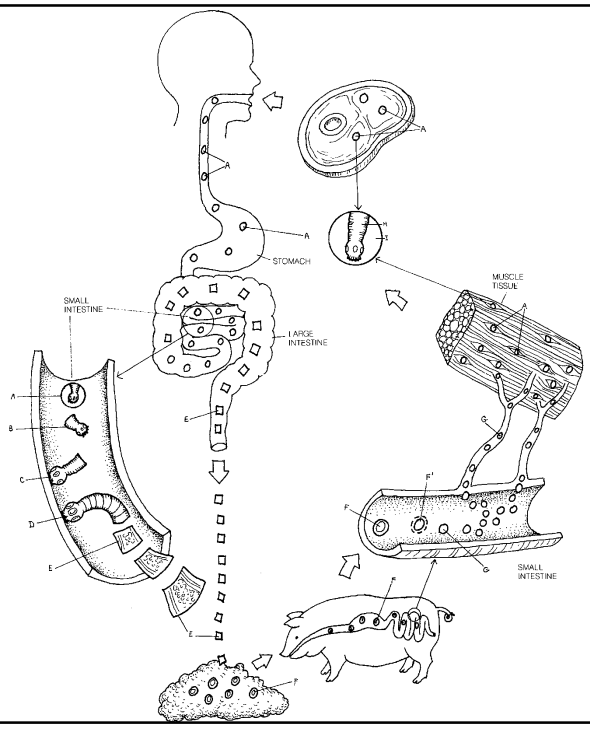
20

Reproduction

- some asexually by fragmentation or fission
- sexual reproduction:
  - most are hermaphrodites
  - some cross-fertilize, some self-fertilize
  - parasites may need secondary hosts for larval stage(s)
  - tapeworms (cestodes) have proglottids

21

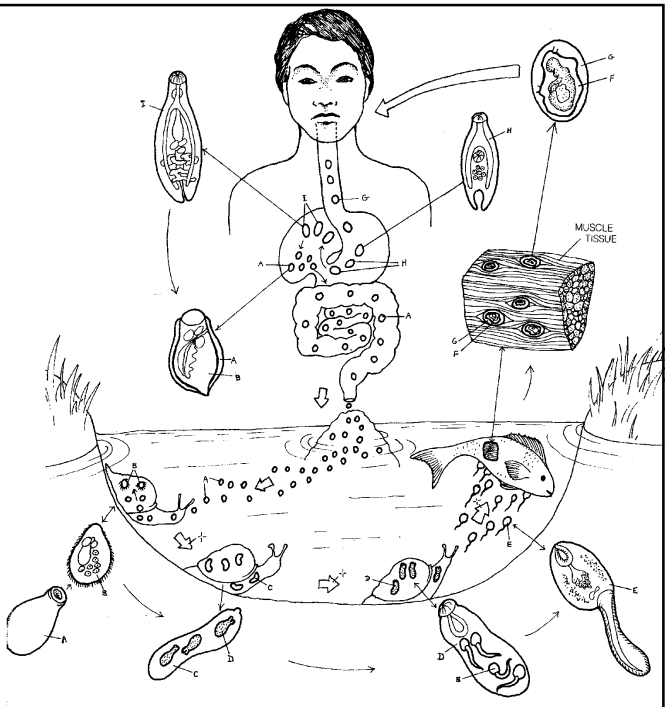
Pork Tapeworm Life Cycle



22

Asian Liver Fluke Life Cycle

- describe the events of the life cycle



23

Tapeworm Diet Pill: Urban Myth?

- Why would having a tapeworm cause a person to lose weight?
- Parasites generally do not kill their hosts. Explain this from an evolutionary standpoint.

24

Summary

- What is the general body plan of Phylum Platyhelminthes?
- What is the evolutionary significance of flatworms?
- How are parasites particularly well-adapted?

25

Work

- Read Section 26-4 on flatworms
  - add to notes
    - include a simplified flow chart of the life cycles of the blood fluke and beef tapeworm
  - underline new vocabulary and define them

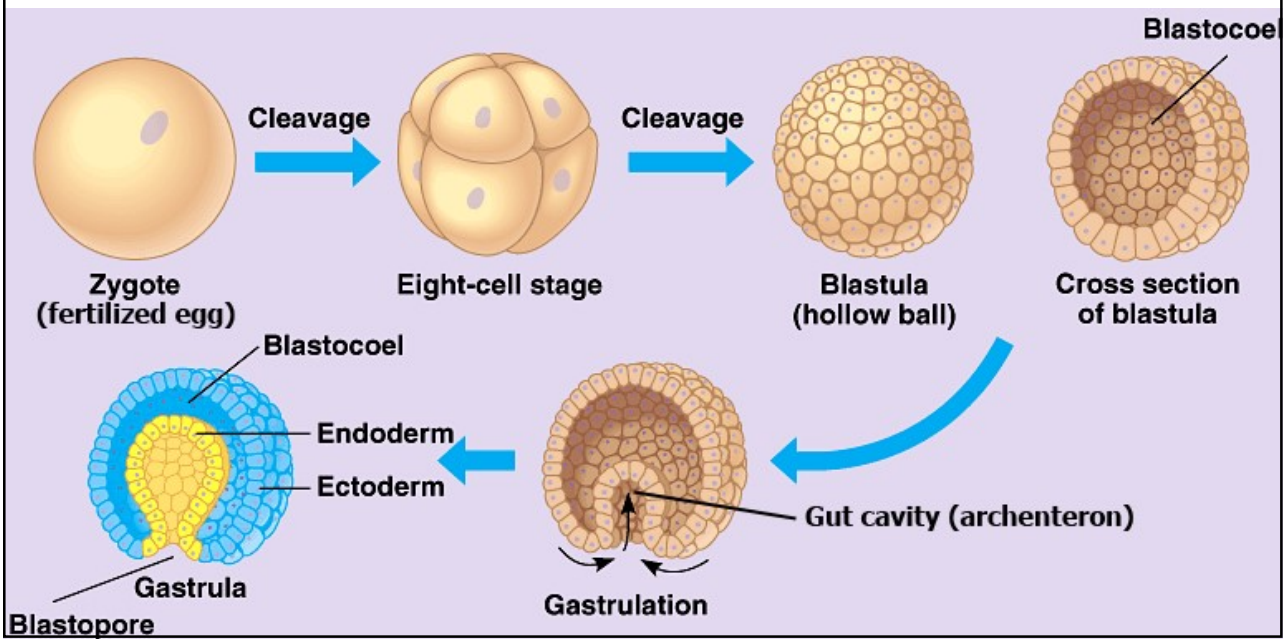
26

Brief Aside: Germ Layers

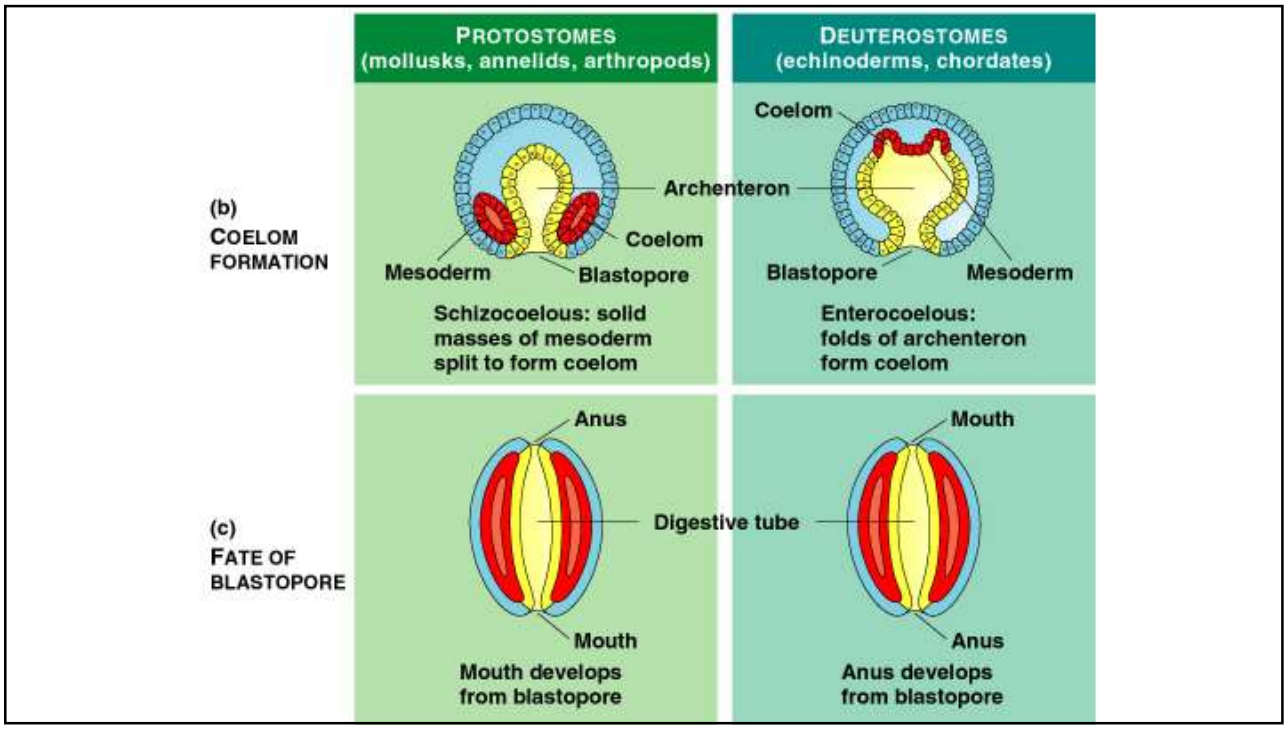
What do we mean by 2 or 3 tissue layers?

1

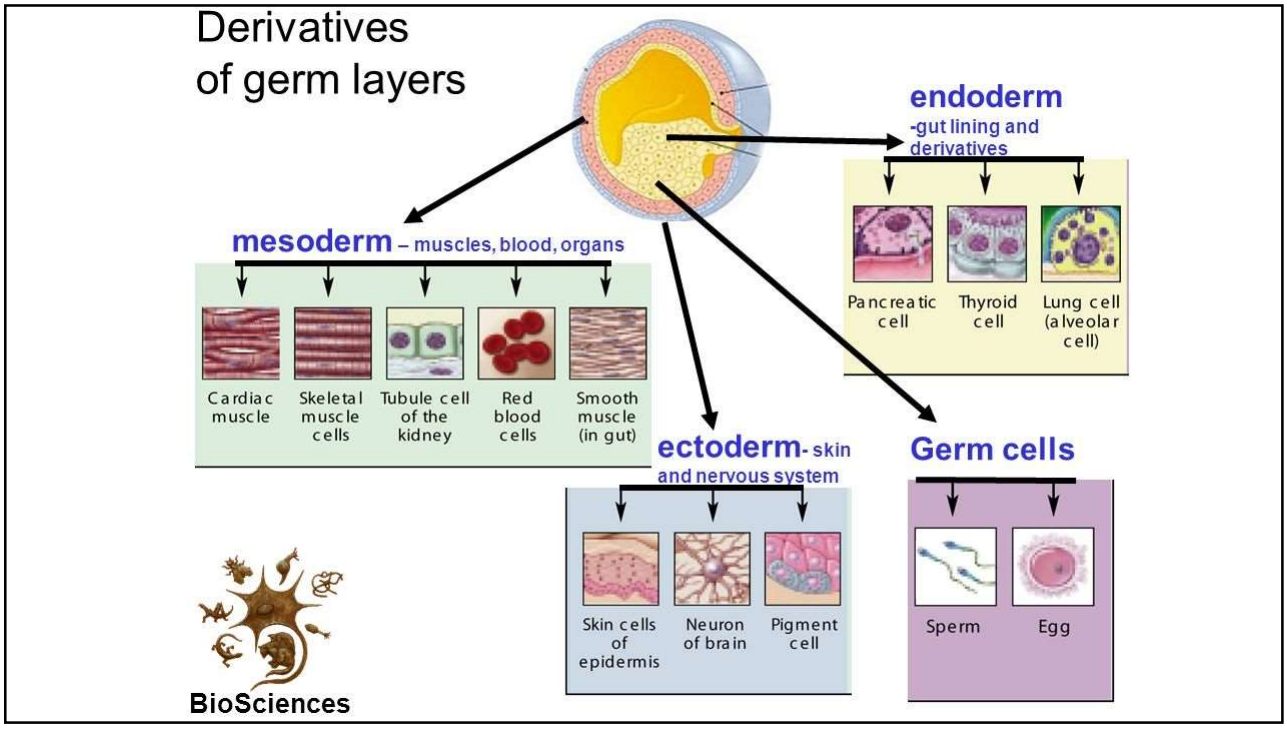
Embryonic Development



2


PROTOSTOMES
(mollusks, annelids, arthropods)
DEUTEROSTOMES
(echinoderms, chordates)
(b)
COELOM
FORMATION
Archenteron
Coelom
Mesoderm
Blastopore
Schizocoelous: solid masses of mesoderm split to form coelom
Coelom
Blastopore
Mesoderm
Enterocoelous: folds of archenteron form coelom
(c)
FATE OF
BLASTOPORE
Anus
Digestive tube
Mouth
Mouth develops from blastopore
Mouth
Anus
Anus develops from blastopore

3


Derivatives
of germ layers
endoderm
-gut lining and
derivatives
Pancreatic cell
Thyroid cell
Lung cell (alveolar cell)
mesoderm – muscles, blood, organs
Cardiac muscle
Skeletal muscle cells
Tubule cell of the kidney
Red blood cells
Smooth muscle (in gut)
ectoderm- skin
and nervous system
Skin cells of epidermis
Neuron of brain
Pigment cell
Germ cells
Sperm
Egg
BioSciences

4

Sponges have 1 germ layer. The zygote develops into a solid ball of cells. However, they don't have true tissues. True tissues are integrated cells with a common structure and function.

Cnidarians have 2 germ layers and 2 tissue layers. The zygote develops into a hollow ball of cells that then folds inward.

Beyond that (flatworms and other animal phyla in this course), there are 3 germ layers, each of which go on to become specific tissues and organs. Their zygote forms a hollow ball that folds inward, and some cells from the endoderm and ectoderm migrate to form the mesoderm, a middle layer.

I have been using tissue layers and germ layers interchangeably, and I shouldn't. I will make sure tests and quizzes are clear on what I'm asking.

5

animation on gastrulation (for your interest only. lots of terminology that you don't need for this course)
https://www.youtube.com/watch?v=ADlYn0ImTNg

6

Phylum Nematoda

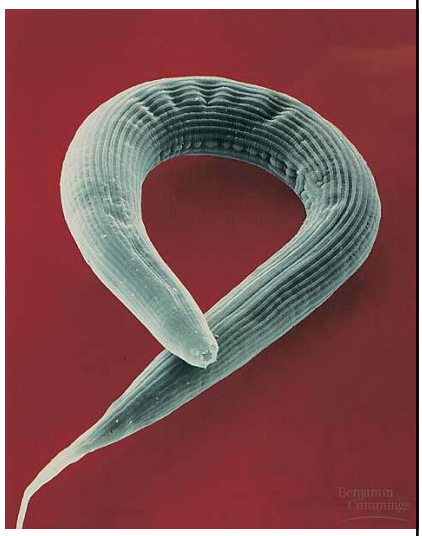
The Roundworms

Miller & Levine Section 26-4

7

Characteristics

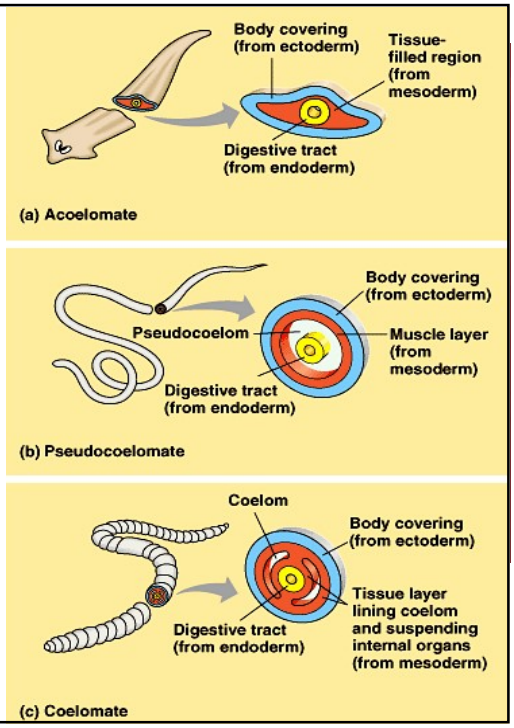
- *nema* = "thread"
  - threadlike worms, more commonly known as roundworms
  - round cross sections
- cylindrical body tapered at both ends
  - internal pressure to maintain shape
- body not segmented
  - segments = repeating parts
- cuticle – outer covering made mostly of collagen-like proteins
  - protective
  - helps maintain shape
  - moulted for worm to grow



8

Characteristics

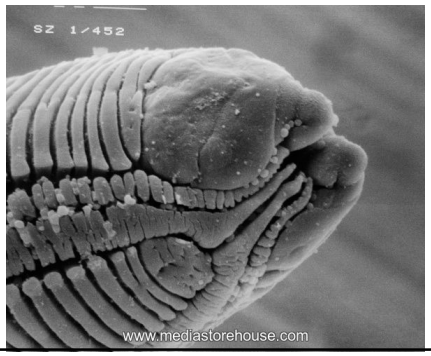
- pseudocoelomate
  - pseudocoelom: fluid-filled space between mesoderm and internal organs
    - *pseudo* = "sort of" or "false"
    - not a true coelom because cavity is not lined completely by mesoderm
  - traditionally thought of as a bridge between higher and lower invertebrates

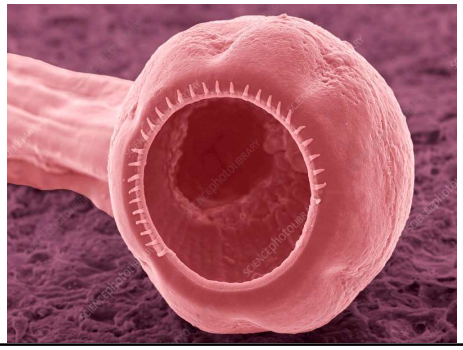


9

Feeding and Digestion

- complete digestive tract
  - mouth at one end, anus at the other
  - "tube within a tube" body plan
- some have teeth to break off food
- muscular pharynx (throat) pulls in food





10

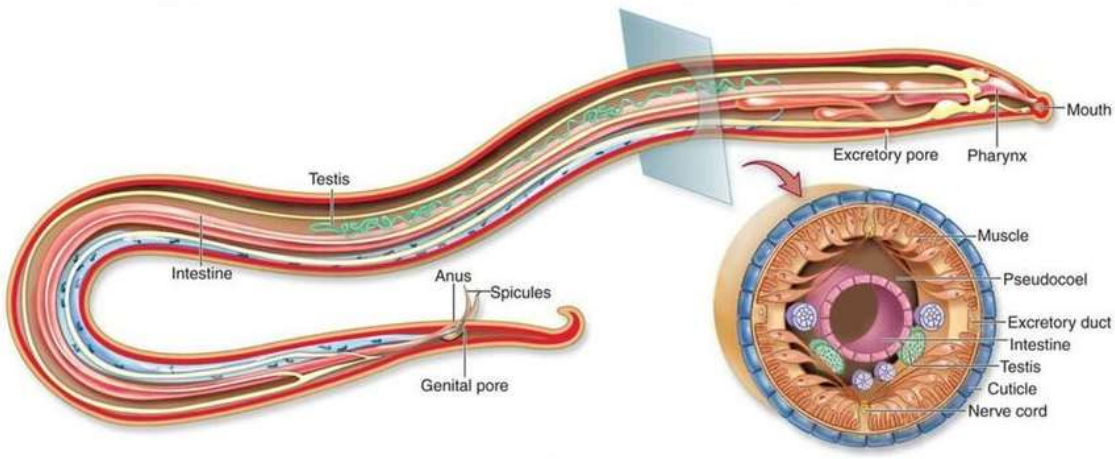
Internal Transport and Respiration

- by diffusion

11

Excretion

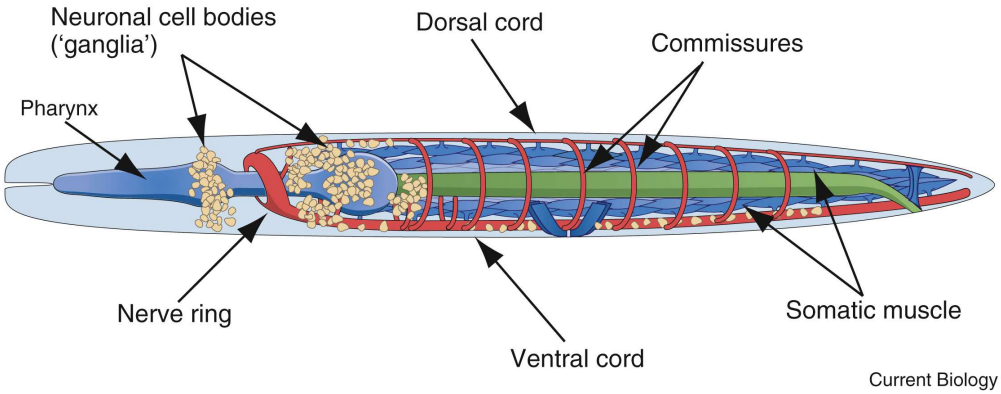
- diffusion of ammonia through body wall
- osmoregulation can include specialized cells or ducts and an excretory pore, depending on species



12

Nervous System

- anterior ganglia & anterior nerve ring
- dorsal and ventral nerve cords, connected by nerves
  - ventral nerve is the largest



13

Locomotion

- longitudinal muscles only
  - makes whip-like movement
  - sometimes described as flailing
  - https://www.youtube.com/watch?v=SpgjnXEFadg

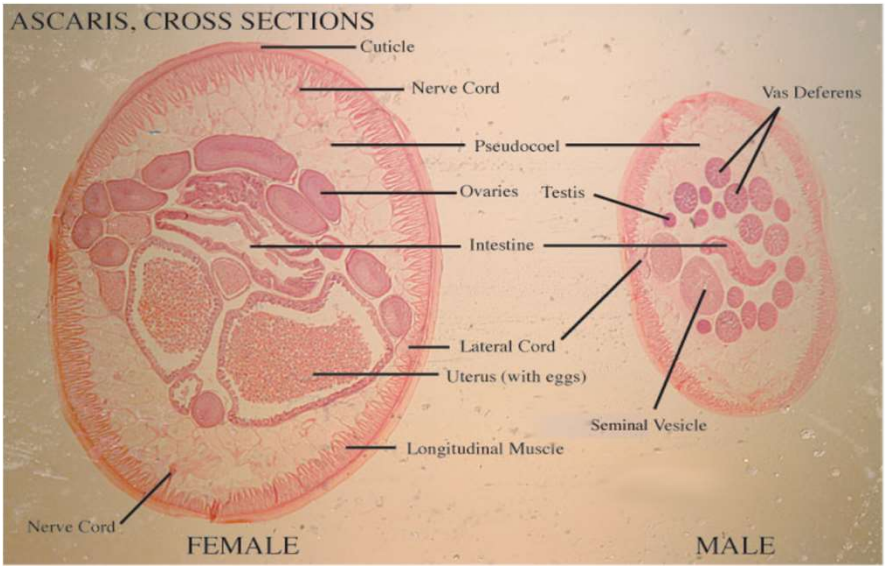
14

Reproduction

- most species are dioecious
  - males are usually smaller
- tubular gonads
- mostly oviparous, a few species are ovoviviparous
  - juveniles look like adults
  - some ingest the parent when they hatch

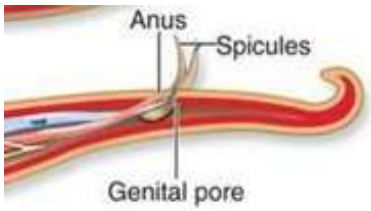
15

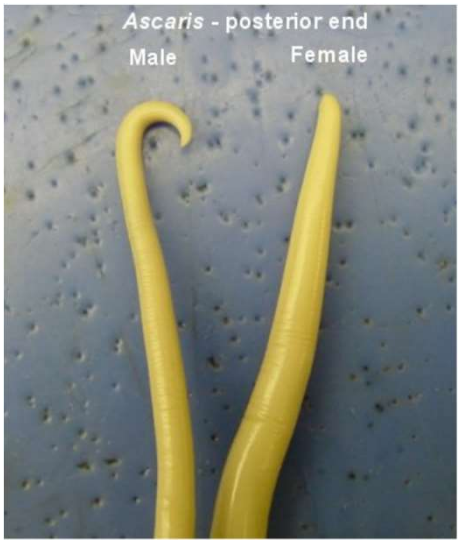
Consider the structures in these cross sections. What is the main focus of these worms?



16

Ascaris





Draw: Posterior end of male and female *Ascaris*

17

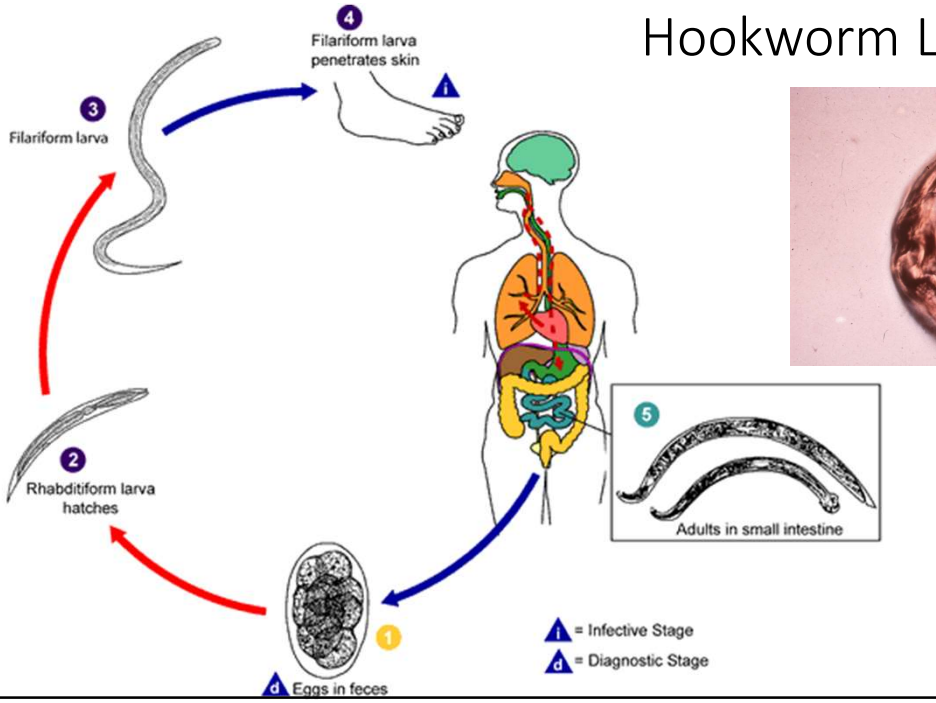
18

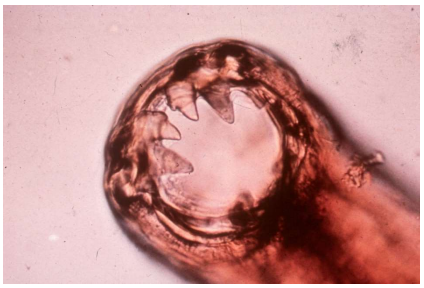
Ecology & Impact

- widespread
- free-living in soil and water
  - a small scoop (100 mL) of soil can have thousands of nematodes
  - predatory ones can be used as pest control for crops
- *C. elegans* is often used in genetic studies
- parasites of plants and animals
  - some human parasites:
    - hookworm
    - pinworm
    - filarial worm
    - Guinea worm
    - *Ascaris*

19

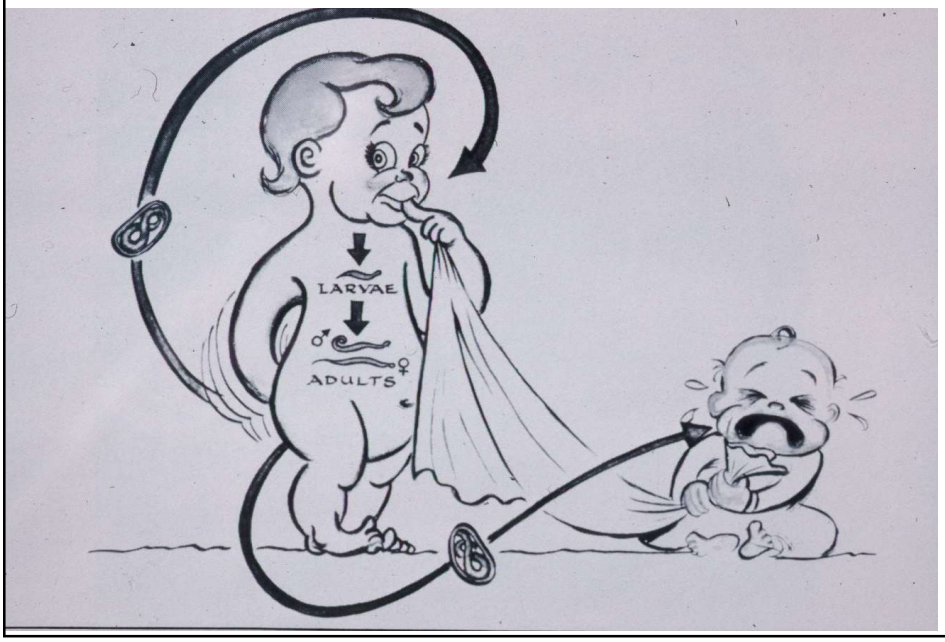
Hookworm Life Cycle





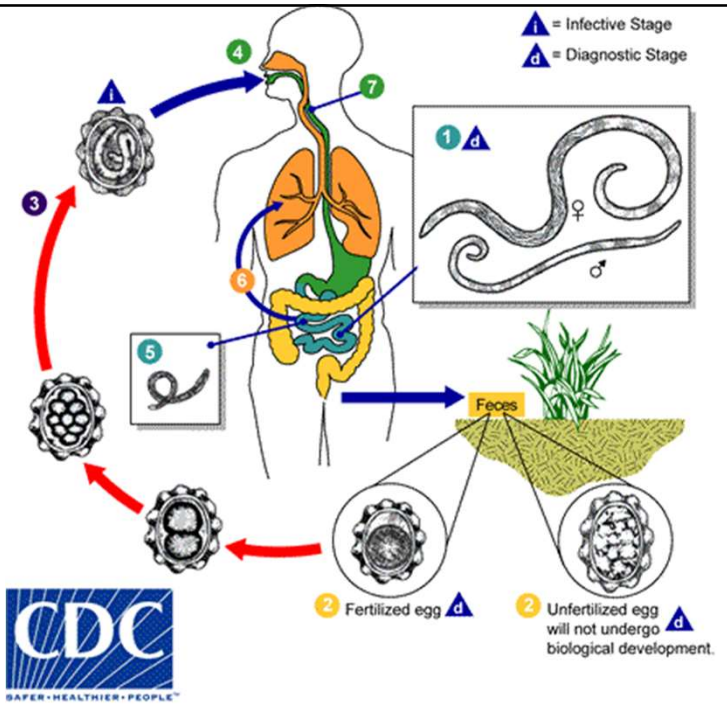
20

Pinworms



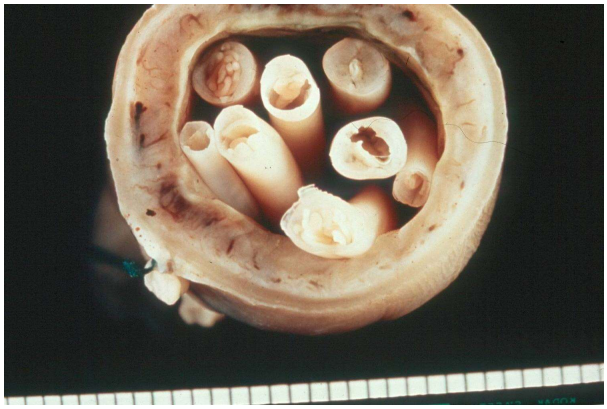
21

Ascaris



24

Ascarisis



25

Work

- Read Section 26-4 on roundworms
- add to notes
- underline unfamiliar vocabulary and define them

- Reminder: end of seating plan.
- Quiz next class:
  - major trends/development from Porifera to Nematoda
  - life functions & characteristics of Platyhelminthes & Nematoda

27

Live Earthworm Observation. Keep an eye on the timer! (20 minutes)

- Rinse your hands, a small beaker and a dropper. Bring the **beaker with water, the dropper, a magnifying glass, and a wet paper towel** to your desk. Your hands will be damp for this lab.
- Put a worm in your hand and feel its movements. Describe the texture of the skin. What do you think causes the tickling sensation as it moves? **Regularly drop water on the worm** to keep it moist and alive.
- Put the worm on the paper and observe.
  - Describe the main characteristics (body plan) of the earthworm
  - Which end is anterior? How do you know?
  - You can usually see the dorsal blood vessel. Do you think it has hemoglobin or hemocyanin?
  - Describe its movements. Guess how the muscles work to create that movement. Muscles have 2 states: contracted and relaxed. They only exert a **pulling force.** Muscles don't push.
- Gently poke at different parts of its body and record the reaction. Give it time between pokes to relax. Compare your results with other groups. Is there a pattern?
- Design and execute **a simple experiment** to test one of the following:
  - preference for dry or wet conditions
  - preference for light or dark conditions
  - food preferences
- Record your findings and procedures. (Everyone; we will use this another class)
- Clean up. Put paper towels into the wire basket for composting.

4

Foreword

- Slides will be available as always, but they purposefully have gaps so that when you study, you need to look for information elsewhere.
- Getting into a habit of questioning and finding answers to those questions is important for learning.
- Anything covered in class activities and in available videos are fair game for tests.

5

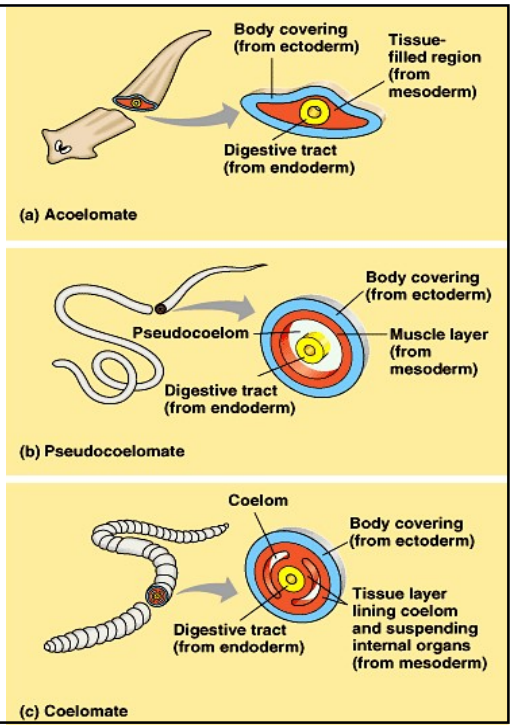
Phylum Annelida

The Segmented Worms

6

Characteristics

- segmented
  - named derived from *annellus* for "little rings"
  - allows for specialization of portions of the body without negatively affecting other parts
- bilateral symmetry
- coelomate
  - true coelom: because fluid-filled cavity between intestine and body wall is lined completely by mesoderm
  - coelom:
    - space for organs to develop
    - cushioning: keeps body movements from intruding on organs
- closed circulatory system



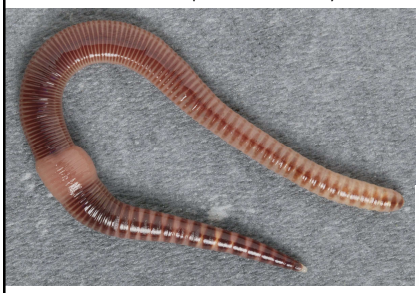
7

Major Groups of Annelids

(classification changes with molecular data, so we will refer to them as groups rather than class or subclass)

- Polychaeta (many marine worms)
  - "many bristles"
  - sand striker (bobbit worm) https://youtu.be/K_7ByiYbCYM
- Oligochaeta (mostly earthworms)
  - "few bristles"
  - https://youtu.be/kQtXriMDRvw (Ecuador)
  - https://www.youtube.com/watch?v=uO4lkv-jLRs (Gippsland; egg casing at 1:15)
- Hirudinea (leeches)
  - Latin for "leech"
  - https://youtu.be/4QJt2BYkdiw (Shape of Life 0:45-2:30)
  - 2 chemicals help it feed successfully

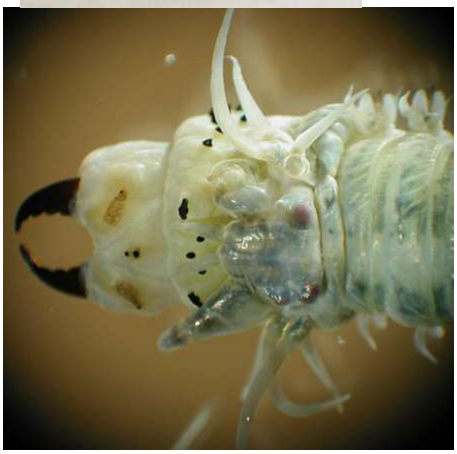




8

Ragworm





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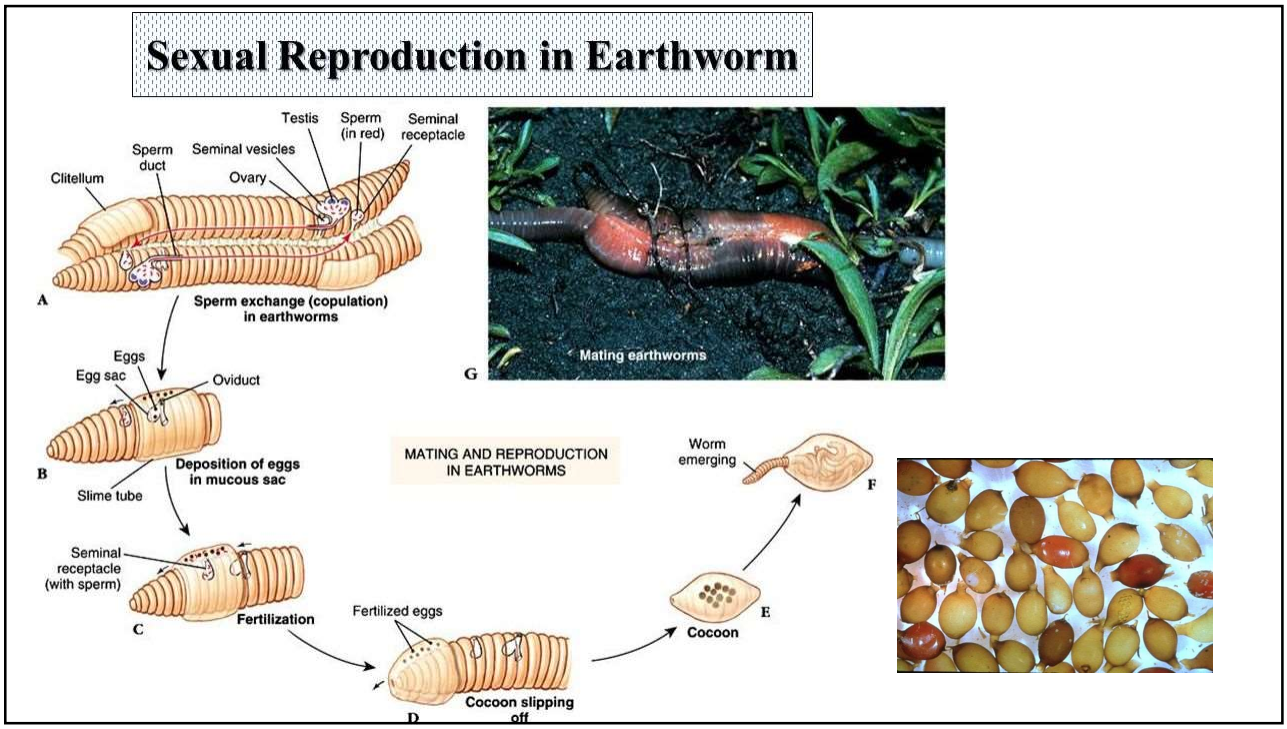


10

Dissection Next Class

- VERY limited time; must be prepared to start immediately!
- watch this video and make notes on the various structures (https://youtu.be/8p-GAX4Xb2A)
  - You do not need to know the name given to the intestinal fold
  - Before pinning the worm, you will be asked to look at the exterior to locate pores and bristles.
  - The video does not talk about nephridia, which you will need to know about

11

Biology 11
Ms. To

Name: _____

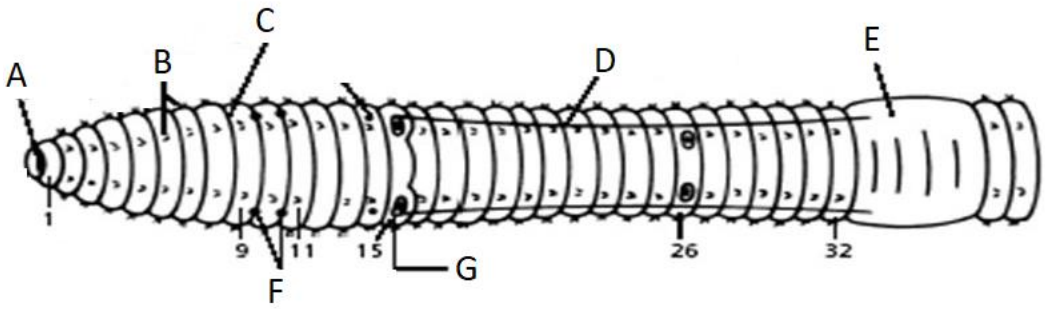
Date: _____ Block: _____

Earthworm Dissection

Focus on the dissection first. Read the procedures and follow them. It will tell you to come back to this sheet at regular intervals. Most of the answers are in the procedures sheet or the video that you were supposed to watch as a prelab activity. Some of them will require you think back to the beginning of the year about body systems. Others can be inferred based on observation.

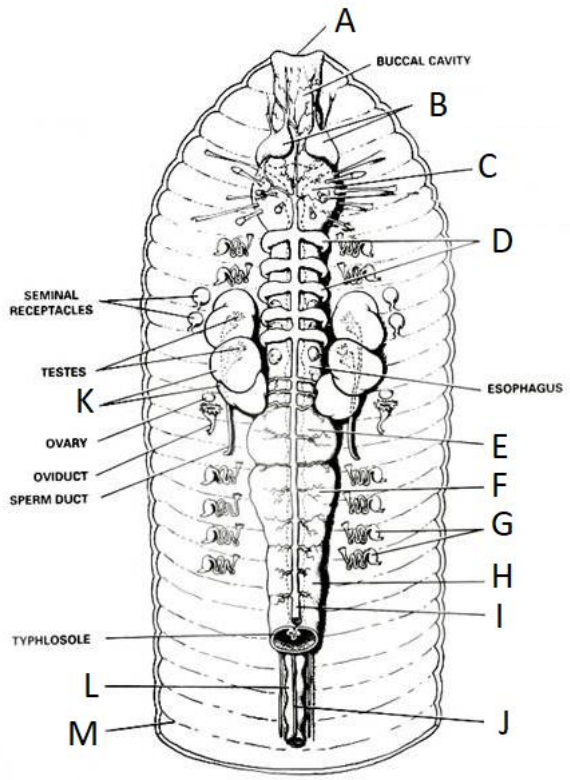
The diagrams have tables under them. Name the structures and add notes about the functions.

Ventral View of External Anatomy



Structure	Notes
A.	
B.	
C.	
D.	
E.	
F.	
G.	

Dorsal View of Internal Anatomy



A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

G. _____

H. _____

I. _____

J. _____

K. _____

L. _____

M. _____

Digestive System

Structure	Notes
A.	
C.	
E.	
F.	
H.	
Typhlosole	

Circulatory System

Structure	Notes
D.	
I.	
J.	

Reproduction

Structure	Notes
K.	
seminal receptacles	
testes	
ovary	

Nervous System

Structure	Notes
B.	
L.	

Excretion

Structure	Notes
G.	

Other

Structure	Notes
M.	

1. What major features separate earthworms from roundworms and flatworms?

2. Considering the contents of the intestine, why are earthworms important to the ecosystem?

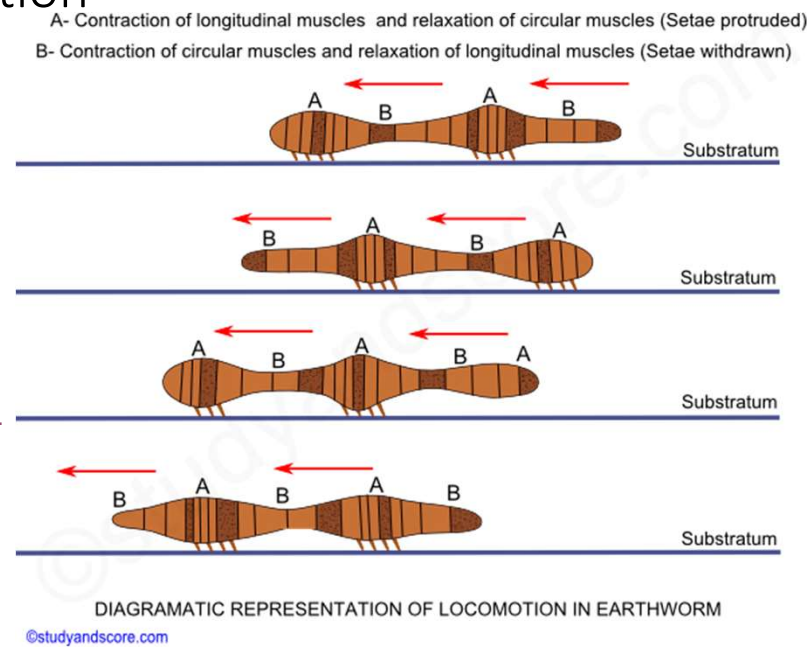
3. How is the reproductive strategy of earthworms adapted to a terrestrial lifestyle?

4. In terms of structures in the digestive tract, which vertebrate group has common structures to the earthworm? Name the common structures and compare their functions in both groups.

5. Do you think marine worms and earthworms create the same forms of metabolic wastes? Explain.

Earthworm locomotion

- What are the two types of muscles? How do they work to produce forward motion?
- What causes the anterior end to lift?
- What would happen without setae?
- https://www.youtube.com/watch?v=0Texxu3p7I8
- Why is the movement different from that of a roundworm?



16

Test Feb 20

- 3 worm phyla (Platyhelminthes, Nematoda, Annelida)
- evolutionary trends from Porifera to Annelida
- 16 MC (no scantron)
- 41 marks on short answers
  - 5 diagrams (major one is of earthworm)

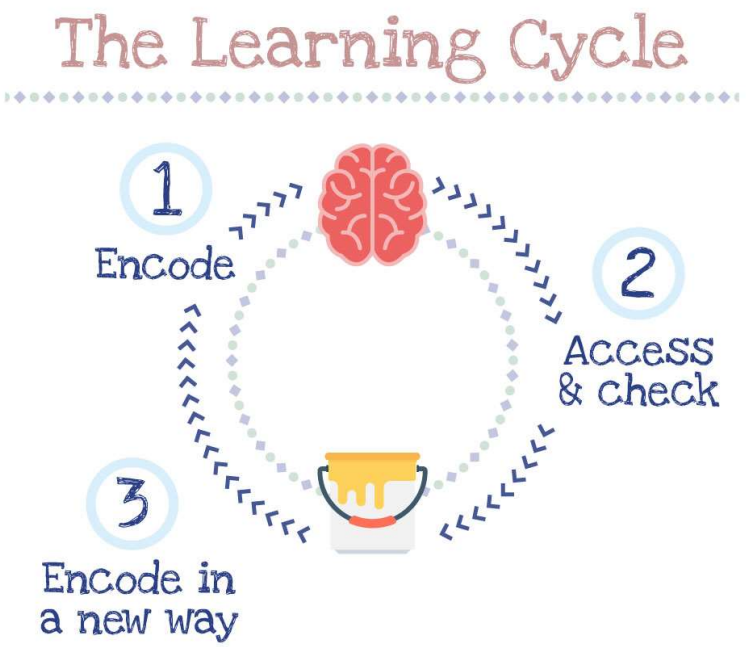
17

The Golden Equation of Knowledge:

Variation + Repetition = Learn Anything!

source: https://www.northcoastprep.com/blog/studymethods

18



19

Phylum Mollusca

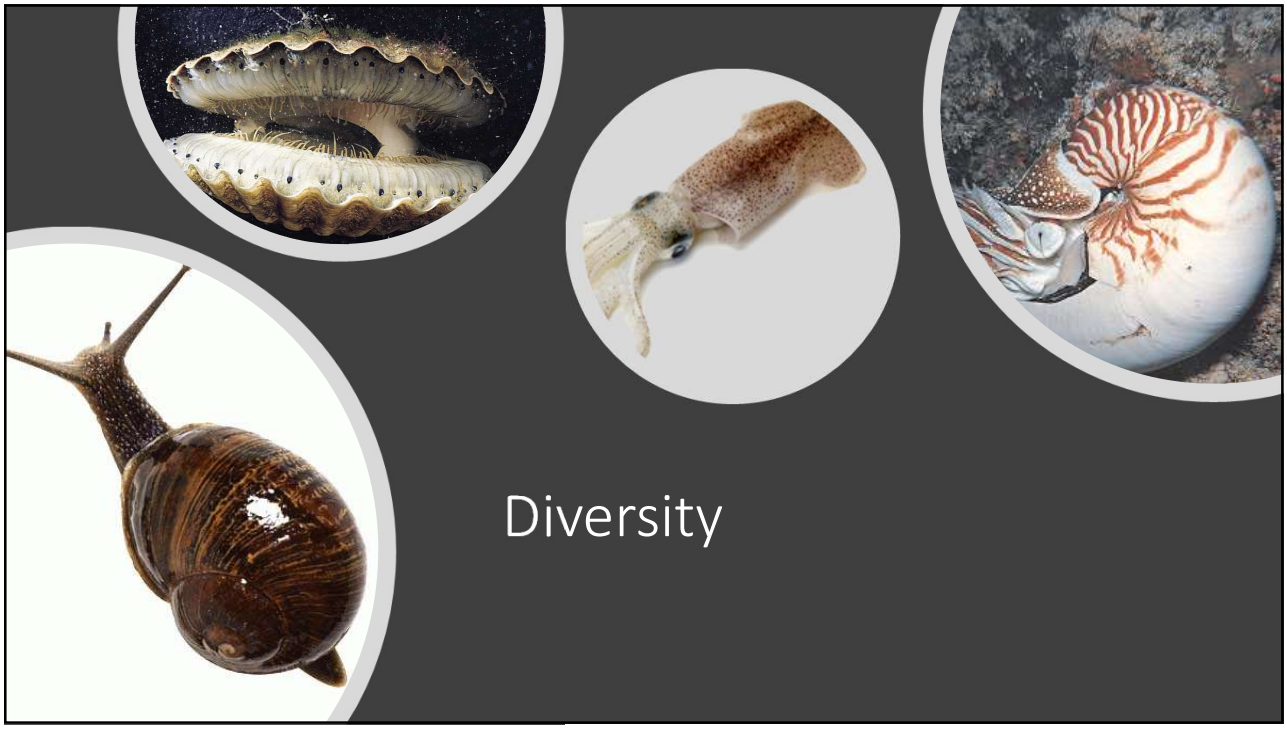
The Soft-Bodied Animals

1

2


Strengthened Self-Recovery Ingredients
'Snail Secretion Filtrate 92%' contained
Manage your Multiple Skin Concerns just in One
Anti-Wrinkle Functional Cosmestic
Recovery Ingredient Upgrade!
MIZON
What is your biggest skin concern of todays?
Excessive sebem! getting little bumps by trouble!
Widened & Drooping pores!
Resilience decreases but wrinkles increases?
Moisturizing, nourishing, or protecting is not enough!
Generously invest for your skin!
Add the chewy texture of Snail Slime ingredient!

3


Diversity

4

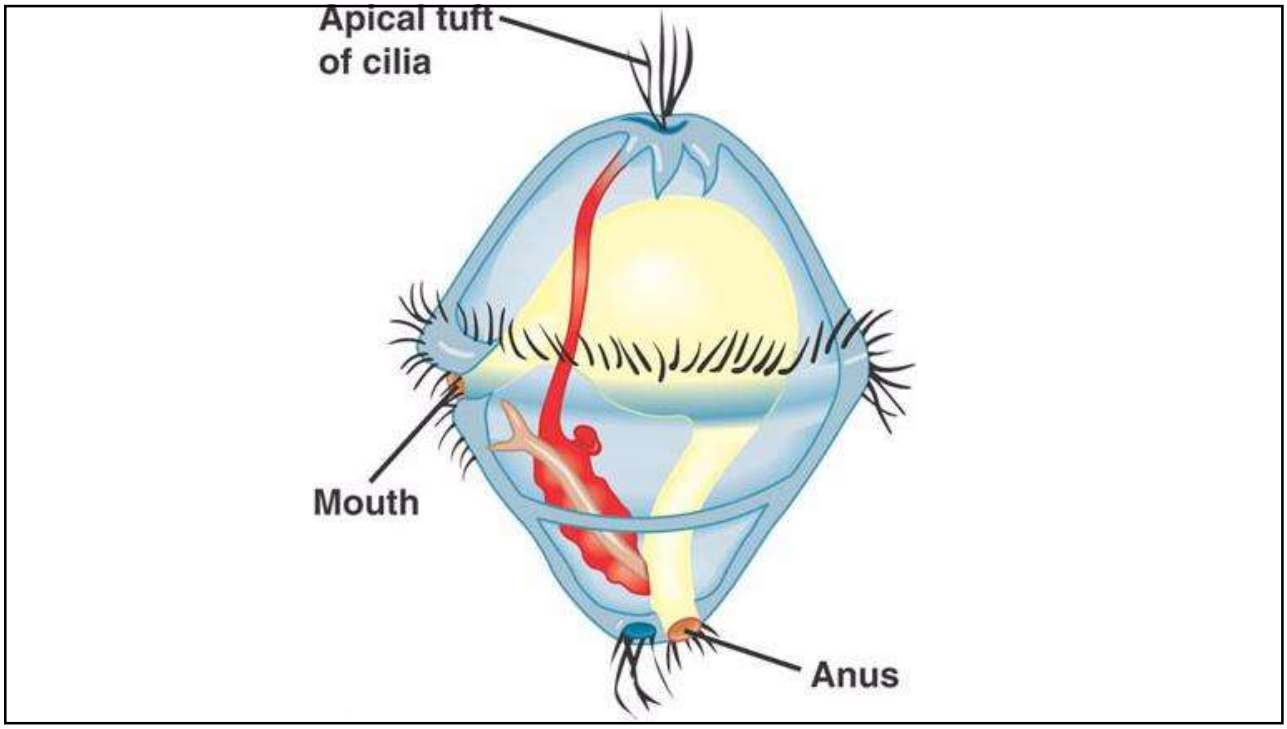
Three classes that we will study:

- Class **Gastropoda**
  - "**stomach-foot**"
  - ex: snail, abalone, slug
- Class **Bivalvia**
  - "**two shells**"
  - ex: clam, mussel, oyster, scallop
- Class **Cephalopoda**
  - "**head-foot**"
  - ex: squid, octopus, nautilus, cuttlefish

5

Video: Mollusk Body Plan

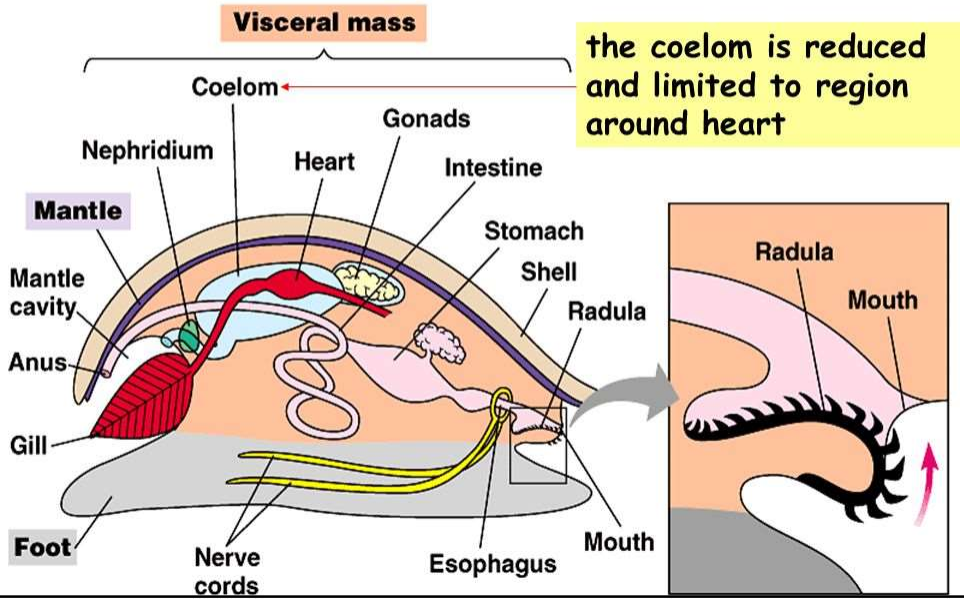
6



7

Protostome coelomates

-3 main body parts: Foot, Mantle, Visceral Mass



the coelom is reduced and limited to region around heart

8

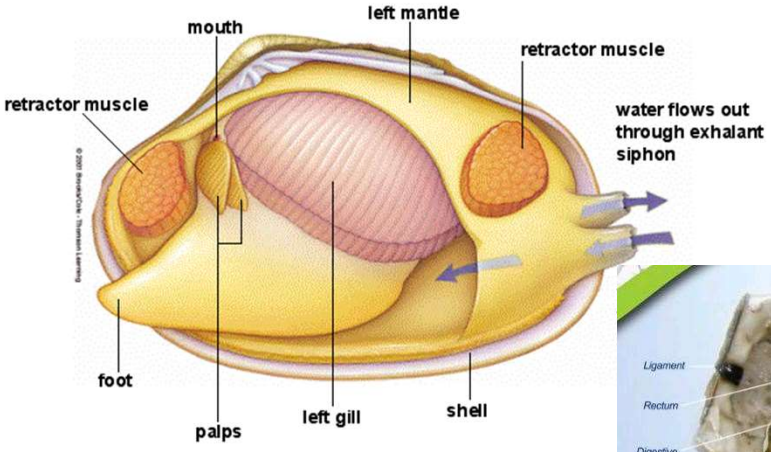
Video:
Radula

9

Video:
Abalone
Locomotion

10

Body Plan of a Clam



11

12

Video: Cockle Movement

13

Video: Scallop Movement

14

Anyone watch Finding Dory?

15

Video: Nautilus and Squid

16

Lab Next Class

- Watch this video so you have a good idea of what you'll be looking for. There are more details than needed for this course. https://www.youtube.com/watch?v=HG7g7c7gyxA
- Wear dark colours. Last year, some liquid sprayed and made a new pattern on someone's shirt.
- Tie up long hair.
- Bring a fork or chopsticks for eating. (allergy alert: wheat, corn, milk, egg)

17

Work

- Read about molluscs (Section 27-1)
- Complete Reading Guide
- Squid Pre-lab

18

Biology 11
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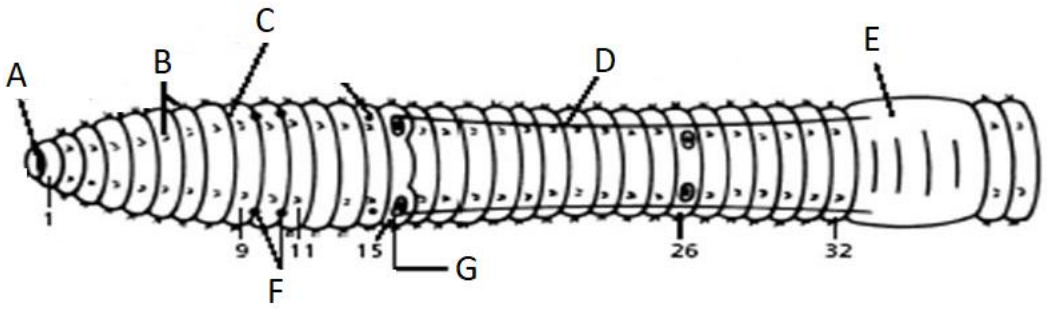
Date: _____ Block: _____

Earthworm Dissection

Focus on the dissection first. Read the procedures and follow them. It will tell you to come back to this sheet at regular intervals. Most of the answers are in the procedures sheet or the video that you were supposed to watch as a prelab activity. Some of them will require you think back to the beginning of the year about body systems. Others can be inferred based on observation.

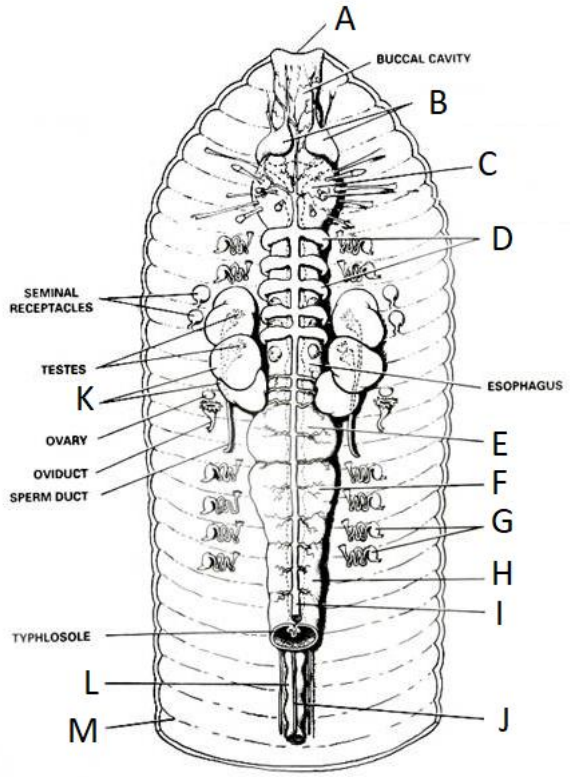
The diagrams have tables under them. Name the structures and add notes about the functions.

Ventral View of External Anatomy



Structure	Notes
A. mouth	beginning of digestive tract. Food enters through here
B. setae	bristles. helps to grip and to keep worm from back sliding
C. septum	separates segments from each other
D. sperm groove (seminal groove)	sperm travels along here to get to the to the correct place to enter the body of the other worm
E. clitellum	secretes the cocoon for eggs and sperm to meet and develop into young worms
F. opening to seminal receptacles	place where sperm enters the body of the worm during copulation. Sperm will also leave here when fertilization is going to happen.
G. male genital pore	where sperm leaves the worm during copulation
female genital pore (there's a line but not letter)	where egg leaves the worm for fertilization

Dorsal View of Internal Anatomy



A. mouth

B. cerebral ganglia ("brain")

C. pharynx

D. aortic arches ("hearts")

E. crop

F. gizzard

G. nephridia

H. intestine

I. dorsal blood vessel

J. ventral blood vessel

K. seminal vesicles

L. ventral nerve cord

M. septum

Digestive System

Structure	**Notes**
A. mouth	food enters through here
C. pharynx	pumping action sucks in food
E. crop	storage space for food
F. gizzard	grinds up food ("chews" with the help of sand)
H. intestine	digests food and place where nutrients are absorbed
Typhlosole	infolding of intestine – increases surface area for more absorption of nutrients

Circulatory System

Structure	Notes
D. aortic arches	acts like the heart and pumps blood around the body
I. dorsal blood vessel	blood flows anteriorly in this vessel
J. ventral blood vessel	blood flows posteriorly in this vessel

Reproduction

Structure	Notes
K. seminal vesicles	holds sperm that was made by the worm
seminal receptacles	receives sperm from a mate. Holds the sperm until fertilization happens
testes	makes sperm
ovary	makes eggs

Nervous System

Structure	Notes
B. cerebral ganglia	the brain of the worm
L. ventral nerve cord	part of the central nervous system

Excretion

Structure	Notes
G. nephridia	the kidneys of the worm. removes nitrogenous waste and works in osmoregulation (making sure the water/salt balance is correct)

Other

Structure	Notes
M. septum	separates the segments of the worm from each other

1. What major features separate earthworms from roundworms and flatworms?
   Earthworms have segmentation, a true coelom, more specialized organs for digestion (crop and gizzard), an actual circulatory system.

2. Considering the contents of the intestine, why are earthworms important to the ecosystem?
   The stuff in the intestine looks like dirt, so maybe they make dirt or recycle nutrients back into the soil.

3. How is the reproductive strategy of earthworms adapted to a terrestrial lifestyle?
   Fertilization is internal so the gametes are protected. The cocoon also is protective.

4. In terms of structures in the digestive tract, which vertebrate group has common structures to the earthworm? Name the common structures and compare their functions in both groups.

   Birds have both a crop and a gizzard with similar functions. Crops hold food and are expandable and softer. Gizzards are harder, more muscular because they grind food using sand (worms) and small rocks (birds)

5. Do you think marine worms and earthworms create the same forms of metabolic wastes? Explain.
   Probably not. We learned early in the year (September or October) that there were three forms of nitrogenous waste: ammonia, urea, and uric acid. Ammonia is the most toxic and needs the most water to dilute and get rid of it. Urea and uric acid were less toxic and could be concentrated in the body, which uses less water. Marine worms probably produce ammonia because they can easily get rid of it into the surrounding water. Earthworms probably produce urea or uric acid because there's less water on land.

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Review Quiz: Worms

Write the terms into the chart. Some terms will be used more than once. Some terms will not be used at all.

1-way	complete	gizzard	pseudocoelomate
2-way	earthworm	hookworm	radial
acoelomate	ectoderm	incomplete	ring
ascarid	endoderm	leech	roundworm
asymmetrical	flame cell	mesoderm	segmented worm
bilateral	flat	oligochaete	tapeworm
cestode	fluke	planarian	thread
coelomate	ganglia	polychaete	ventral nerve cord

	Platyhelminthes	Nematoda	Annelida
Meaning of phylum name			
Example organisms/ groups			
Symmetry			
Germ layers			
Body cavity			
Digestive tract of majority			
Specialized structures/ cells			

Use the chart to summarize how the following worms carry out life functions

	Planarians	Nematodes (in general)	Earthworms
Feeding & Digestion			
Internal transport			
Respiration			
Response			
Locomotion			
Excretion			
Reproduction			

Reflect: How did you do? What do you need to work on? What will you do to study? When will you study?

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Phylum Mollusca Reading Guide

Flip through Section 27-1 of the textbook and complete the table below of the three major mollusc classes.

	Class	Class	Class
meaning of class name			
example animals			

Complete the rest of this worksheet as you read Section 27-1 in your textbook.

What is the significance of a trochophore larva?	
What is the definition of a mollusc?	
Name and define the four basic parts of a mollusc body plan.	
Describe the form and function of the radula.	
Describe some ways that molluscs defend against predators	

Use the chart to summarize how the following classes of molluscs generally carry out life functions

	Gastropoda	Bivalvia	Cephalopoda
Feeding & Digestion			
Internal transport			
Respiration			
Response			
Locomotion			
Excretion			
Reproduction			

Name: _____

Date: _____ Block: _____

Squid Dissection Questions

1. Based on the difference in colouration of the dorsal and ventral surfaces and referring to the concept of countershading, how is the squid likely to be oriented when swimming in the ocean?

2. Why would a squid need three hearts? Name the hearts and their functions.

3. What is the radula, and what is its function?

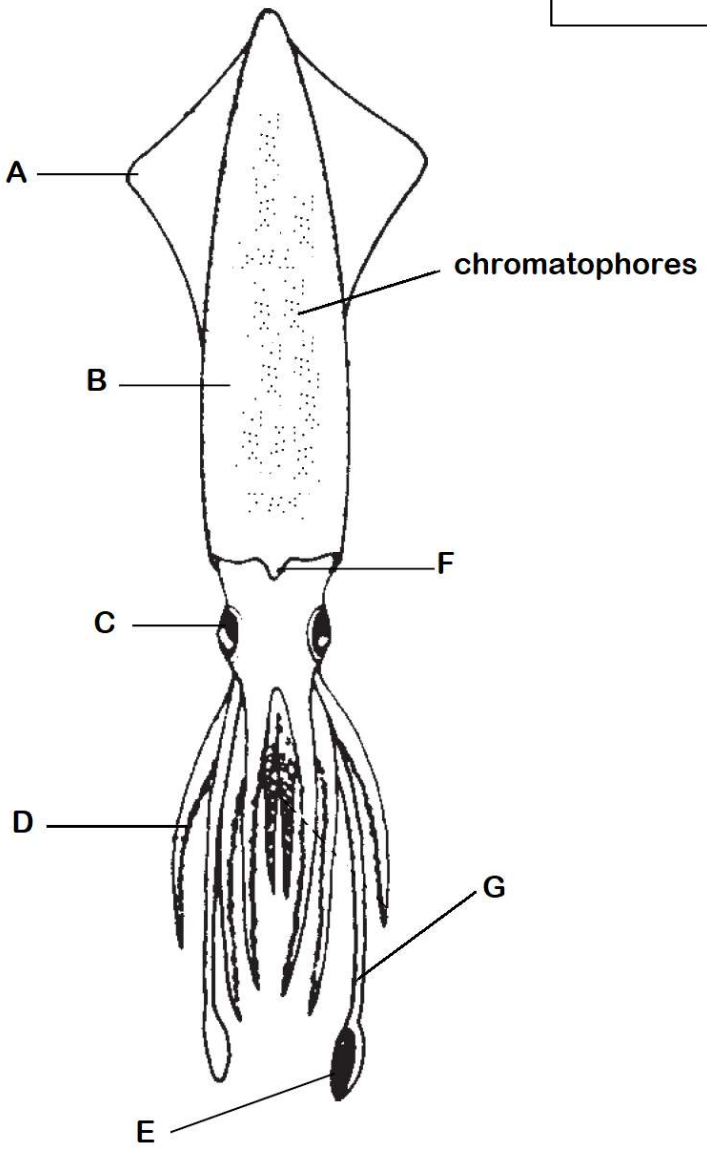
4. If we had eyes of the same proportion as a squid, how big would they be? What inference can you make about the lifestyle of the squid?

5. What do you think is the function of the dark pigment in the eye?

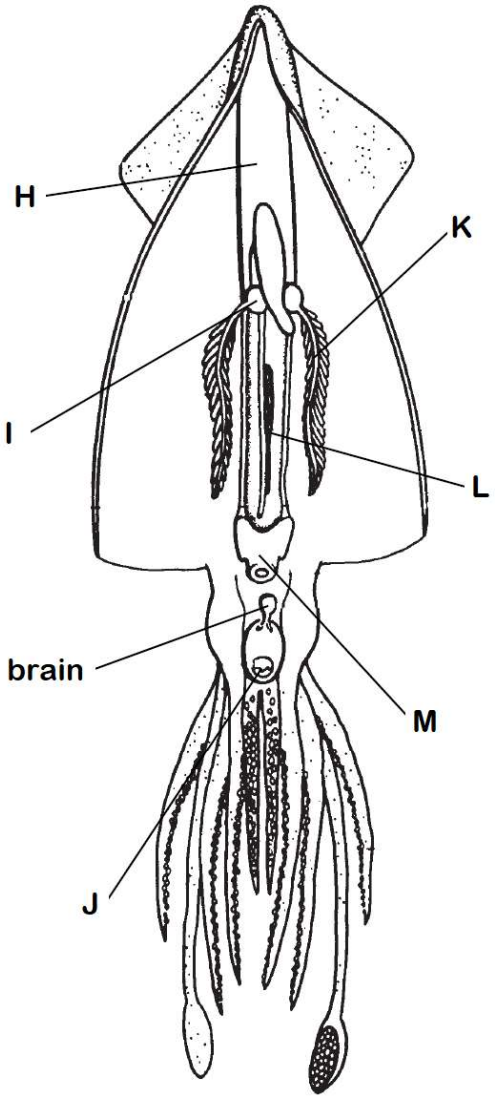
6. Why do you think you can cause a colour change just by rubbing on the skin?

As you follow the procedures, note the bolded structures onto these diagrams. Include information about their function

External Anatomy
Dorsal View



Internal Anatomy
Ventral View



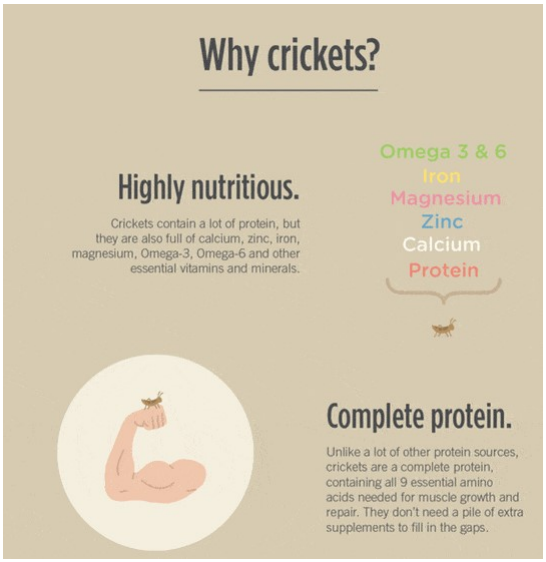
Phylum Arthropoda

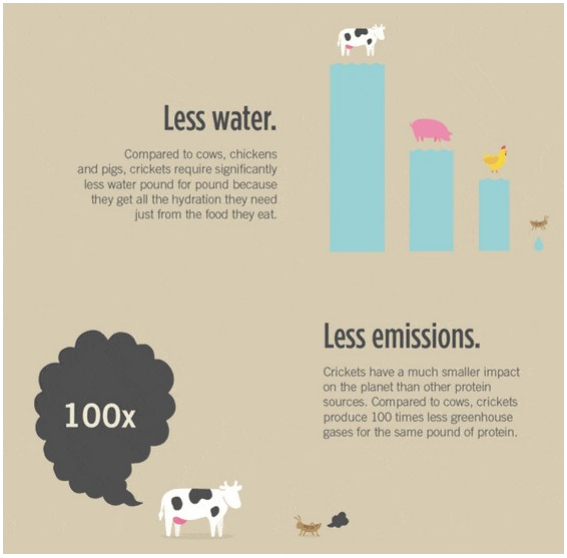
Animals with jointed legs

Miller & Levine: Chapter 28

1

Environmentally friendly protein source?





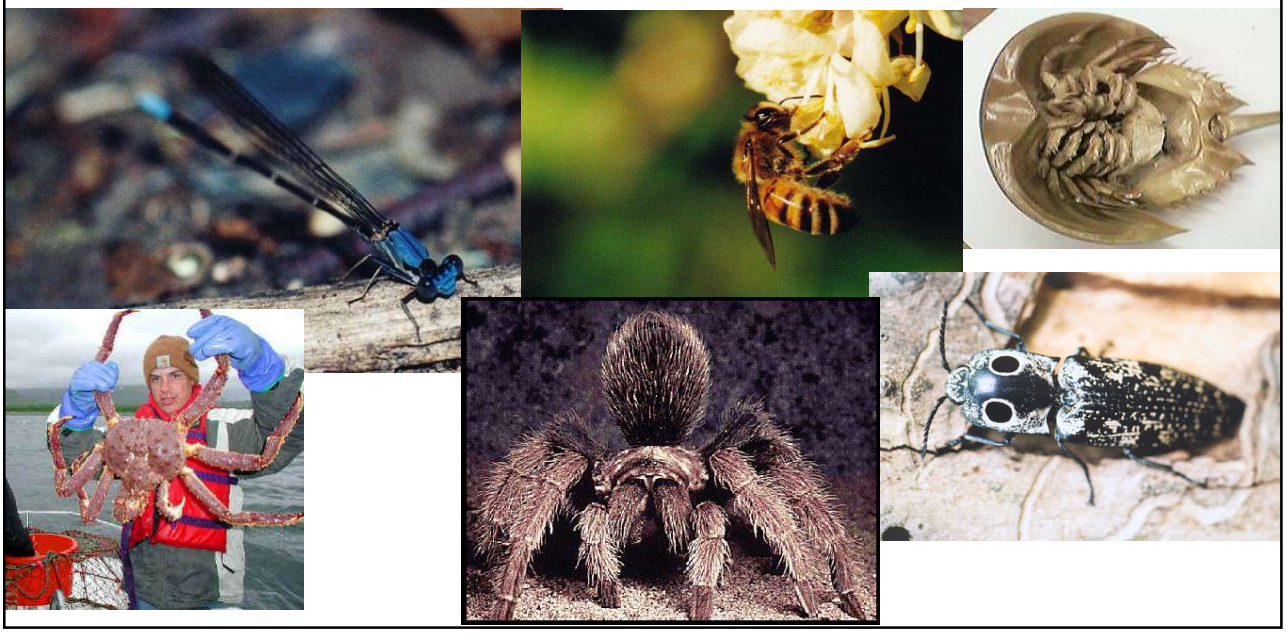
2

NOTE

- This is an incredibly diverse phylum.
- This course will provide only a brief introduction.
- This presentation will highlight only a few key points. You are responsible for knowing the information from this lecture, as well as the material in the textbook and labs

3

Introducing the *real* rulers of Earth



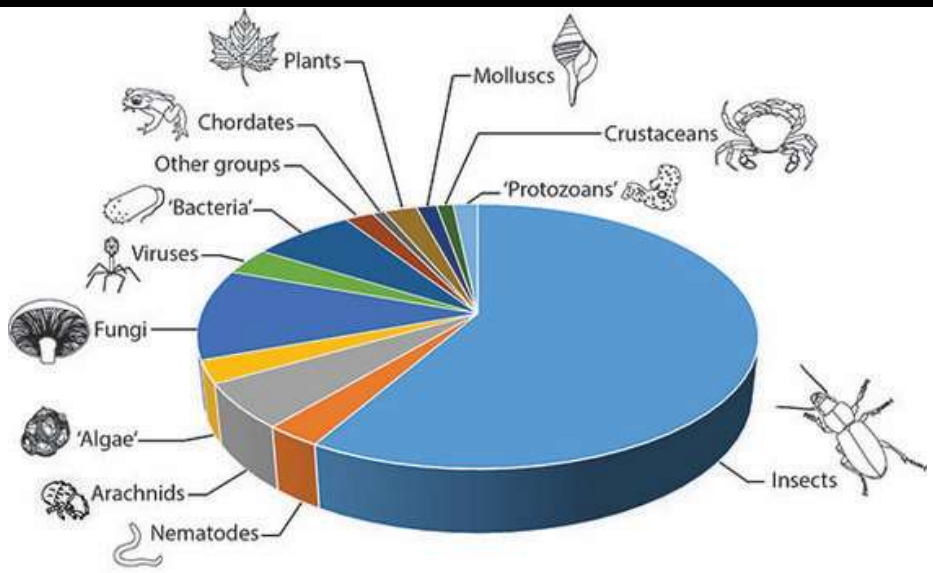
4

video: groups of arthropods

- https://youtu.be/puKoq5fzyAg

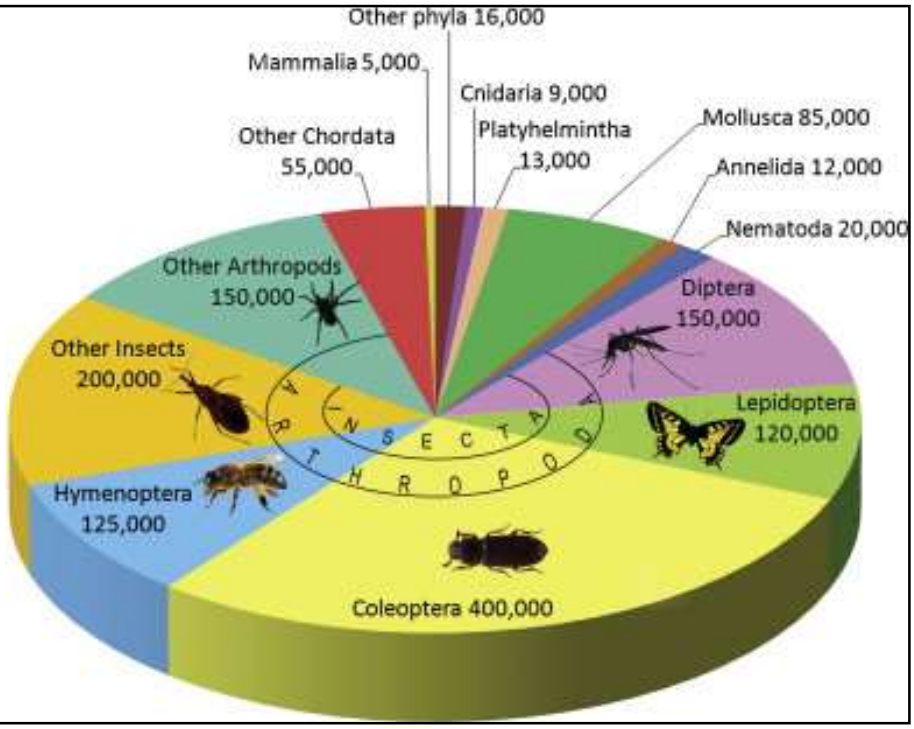
5

Proportion of life, by number of species



6

Animals, by species



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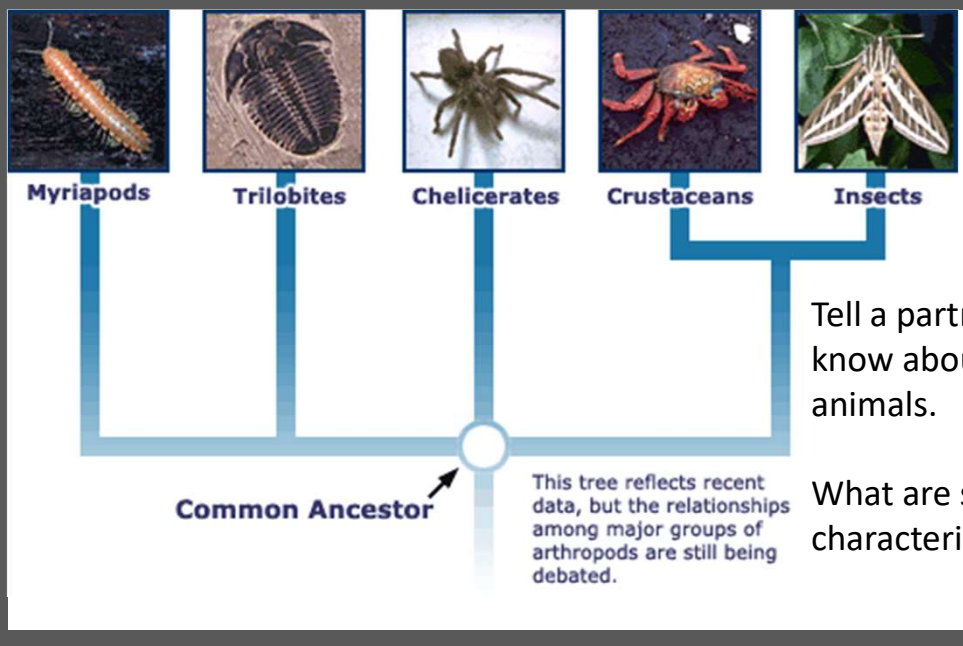


Tell a partner what you know about these animals.

What are some common characteristics?

8

General Characteristics

- "jointed legs" – all arthropods have jointed appendages
- exoskeleton
  - protection & support
  - muscle attachment sites
  - terrestrial species have cuticle to prevent desiccation
  - made of chitin, a fibrous polysaccharide (would be analogous to plant cellulose)
  - must be moulted for animal to grow
  - limits size, especially on land

9

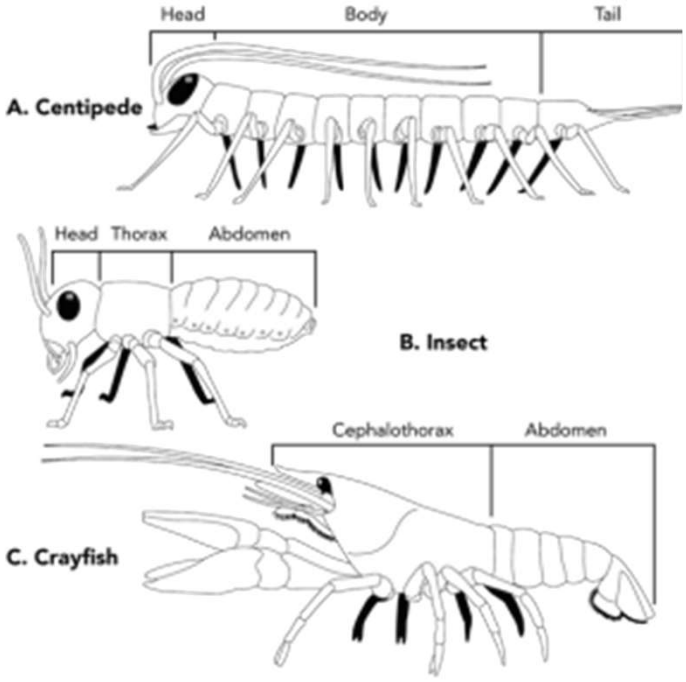
Video: Crab Moulting

- https://www.youtube.com/watch?v=mgffHW8RSXM

10

Body Regions

- most have a segmented body grouped into three regions: head, thorax, abdomen
  - regions may be fused or reduced, depending on the species



11

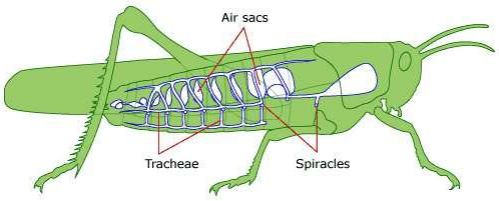
Systems

- open circulatory system
- nervous system:
  - brain
  - sense organs. Ex: compound or simple eyes, chemical receptors, statocysts

12

Systems

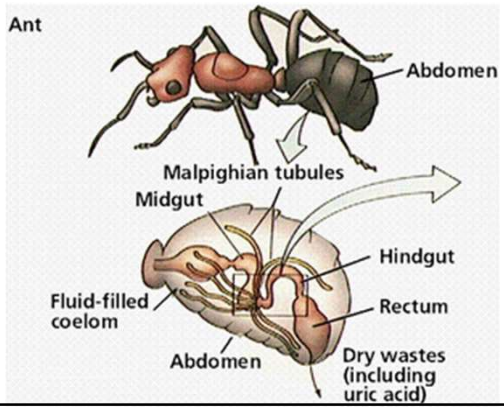
- respiratory system
  - aquatic: gills
  - terrestrial: insects have spiracles (air holes) and tracheae (tubes)
    - https://www.youtube.com/watch?v=o4Du1kSFGYw

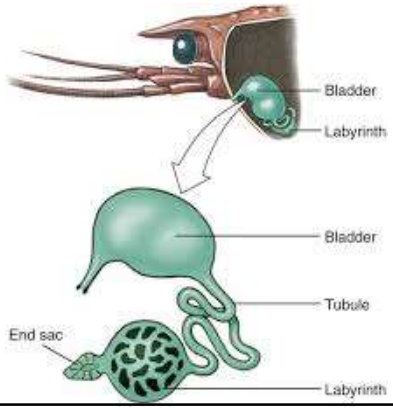


13

Systems

- excretion:
  - several different structures, depending on species
  - terrestrial: Malpighian tubules empty into digestive tube; uric acid exits through anus





14

Systems

- feeding and digestion:
  - can have specialized mouth parts
  - hunting *Portia* https://youtu.be/UDtlvZGmHYk

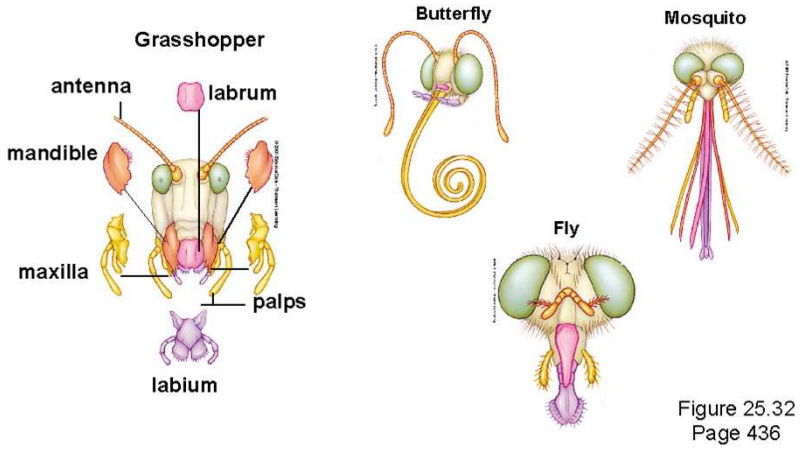


Figure 25.32
Page 436

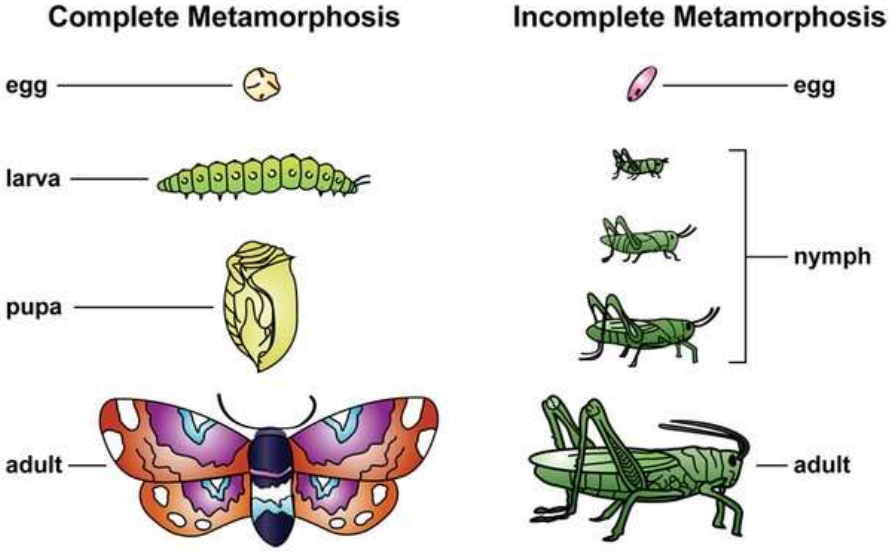
15

Systems

- reproduction:
  - most are dioecious
  - most have short generations → rapid evolution
  - some undergo metamorphosis
    - Hercules beetle: https://youtu.be/AFbu21AGSho

16

What are similarities and differences? Write them into the Venn diagram



17

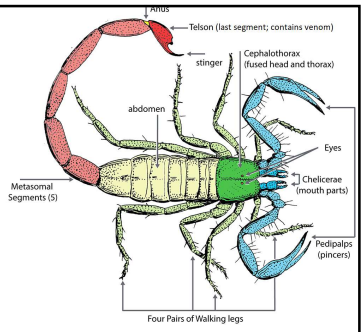
Major Groups of Arthropods:

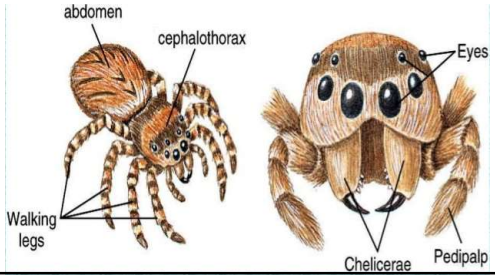
- note: there are different ways to group, depending on the level of taxa, and history
- myriapods
  - "many legs"
  - have many body segments
  - ex:
    - herbivorous millipedes that have 2 pairs of legs per segment
    - flat, carnivorous centipedes that have one pair of legs per segment

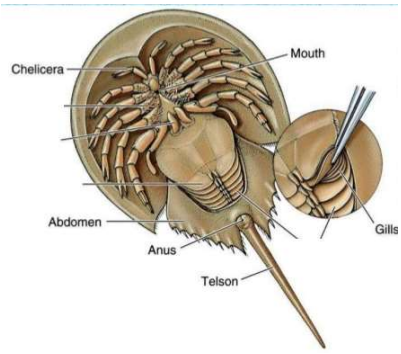
18

Major Groups of Arthropods:

- chelicerates
  - have 2 pairs of appendages near mouth:
    - chelicerae and pedipalps
  - 2 main body parts: cephalothorax and abdomen
  - ex: spiders, scorpions, horseshoe crabs



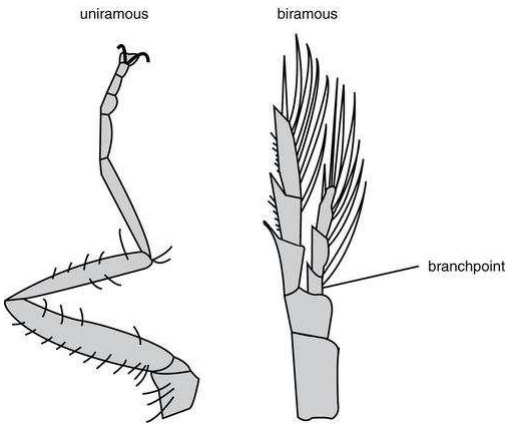




19

Major Groups of Arthropods:

- crustaceans
  - have biramous legs (branch into two)
  - most are aquatic
  - most have a cephalothorax, covered on the dorsal surface by a single piece of exoskeleton called a carapace
  - ex: crab, crayfish, shrimp, pill bugs, barnacles
  - barnacle video: https://youtu.be/ysvtObCmUDU

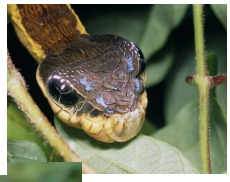


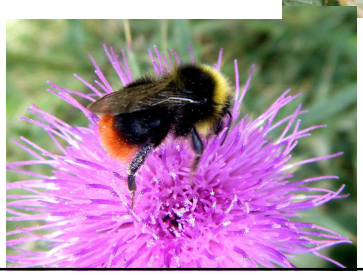
20

Major Groups of Arthropods:

- insects
  - most diverse group of animals
  - also called hexapods
  - 3 body regions:
    - head with mandibles (jaws) & 2 antennae
    - thorax with 6 legs and sometimes wings
    - abdomen with heart, reproductive organs and some digestive organs

Courtesy of the National Pest Management Association / Tom Myers





21

- hawks moth caterpillar https://www.youtube.com/watch?v=ZzpY3gJgXQw

22

Review

- Take turns with partner:
  - What are some characteristics of arthropods?
  - What are the major groups of arthropods, and examples of them?

23

Work

- Read Chapter 28 in the textbook
  - write down unfamiliar terms
  - make notes
  - answer questions on the worksheet. You will need to write the answers on your own paper when instructed to do so; I didn't want to use more paper than necessary.
- Mollusc quiz next class
- Shrimp dissection next class
  - if there are specimens leftover, you are free to eat them. Method of cooking will be boiling. Bring your own condiments

24

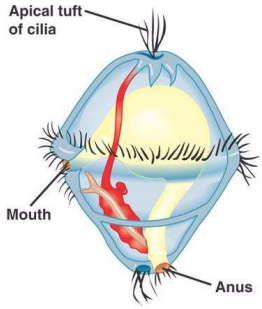
Feb 28

- Squid lab debrief
- Reminder: quiz next class (classes; parts and function; characteristics of molluscs)
- Quizlet is up for molluscs

21

Characteristics of molluscs

- most have trochophore larva – common with marine annelids
- generally have bilateral symmetry
- soft-bodied
- muscular foot (modified in some species)
- mantle:
  - tissue layer that covers the internal organs
  - secretes the shell
- shell:
  - GROWS with the animal (unlike exoskeleton of arthropods)
  - made of calcium carbonate ($CaCO_3$)
  - not in all species
- radula:
  - raspy tongue-like structure unique to phylum
  - bivalves do not have radulas



Structure of trochophore larva

22

Deep Look: Two gastropods

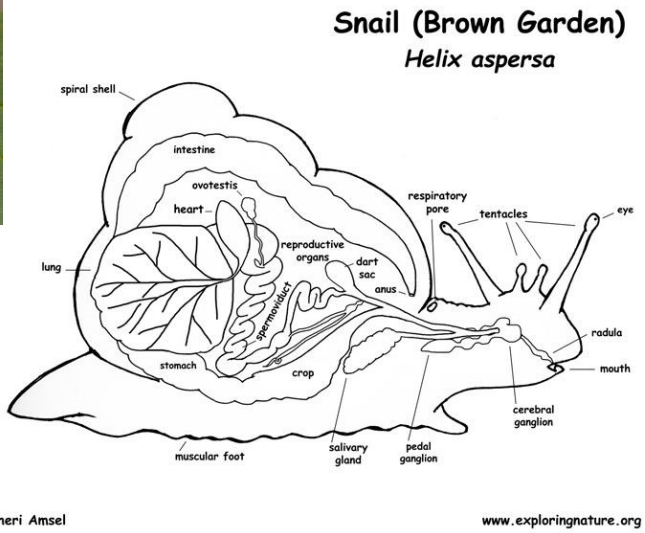
- cone snails https://www.youtube.com/watch?v=jYMjLgPFSso
- nudibranch defence https://www.youtube.com/watch?v=KLVfWKxtfow

23

Class Gastropoda

- 'typical' mollusc: certain gastropods have all of the phylum characteristics:
  - soft body
  - shell
    - snails, abalone, limpets have shells
    - nudibranchs, slugs do not
  - bilateral symmetry, though some species undergo torsion
  - cephalization
  - muscular foot on ventral side of body
    - looks like it's crawling around on its belly – "stomach-foot" class name
  - mantle
  - radula

24



25

two functions of slime (for slugs)

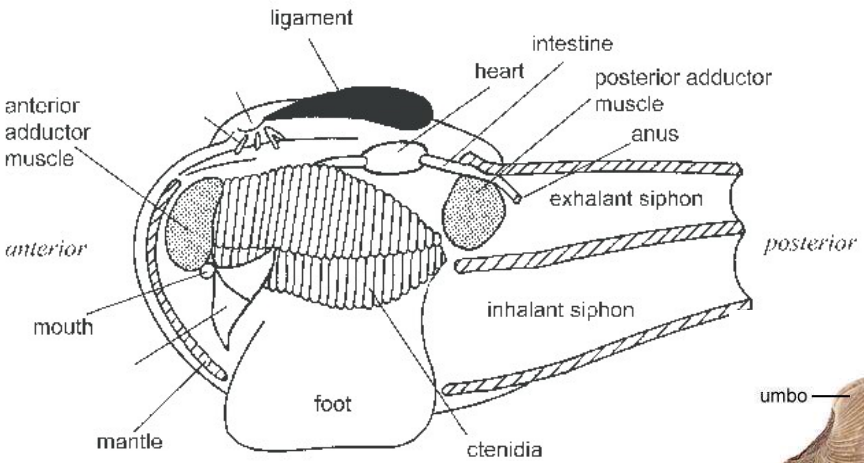
- https://www.youtube.com/watch?v=wG9qpZ89qzc&t=2s (BBC)
- https://www.youtube.com/watch?v=N3MeFpXCXj0

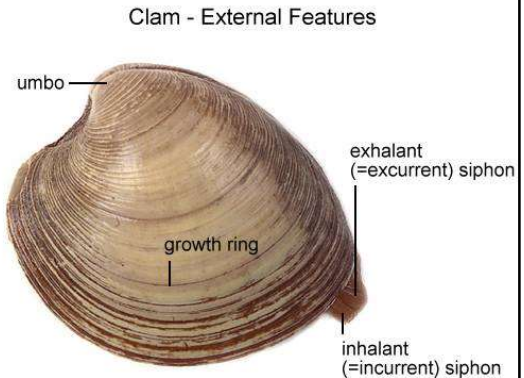
26

Class Bivalvia

- aquatic animals with two shells connected by a hinge
- open circulatory system
- filter feeders
- some secrete nacre, a lustrous substance
  - mollusc shells used to be used as currency
  - pearls were foreign particles that couldn't be removed, so nacre was secreted to protect the soft body from irritation

27





28

Class Cephalopoda

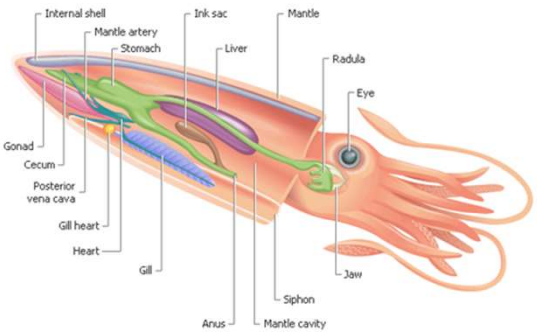
- "head foot": tentacles/arms are modified from the muscular foot
- shells:
  - nautilus: present
  - cuttlefish: cuttlebone inside body
  - squid: flexible chitinous remnant within the body
  - octopus: none
- closed circulatory system: blood is fully contained in vessels
- most intelligent of phylum

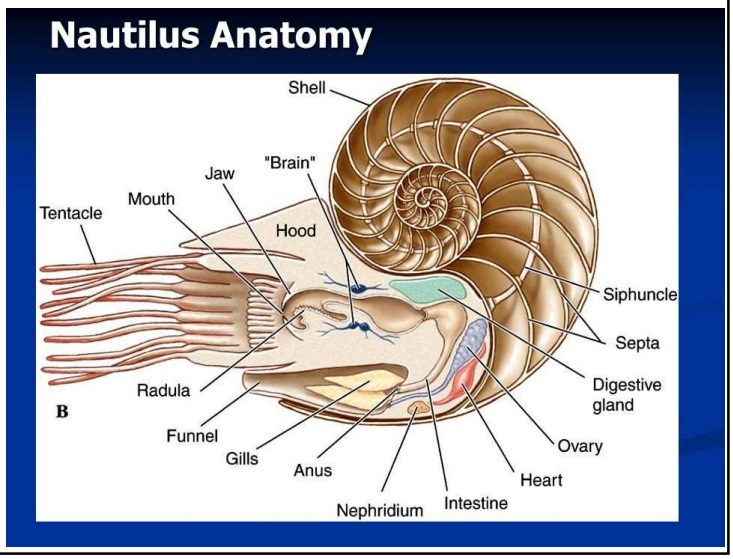






29





30

- chromatophores (deep look) https://www.youtube.com/watch?v=0wtLrlIKvJE
- coconut octopus https://www.youtube.com/watch?v=BFda1MZ54G4
- rolling coconut octopus https://www.youtube.com/watch?v=iSy66K6aQ6g
- octopus & shark (nat geo; play in silence) https://youtu.be/Q36_8s5z6S8?t=90

31

Review

- With a partner:
  - list three classes
    - meaning of class names
    - examples from each class
    - characteristics of each class

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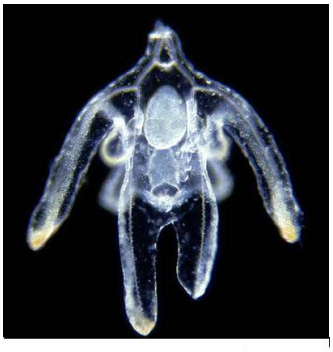
Phylum Echinodermata

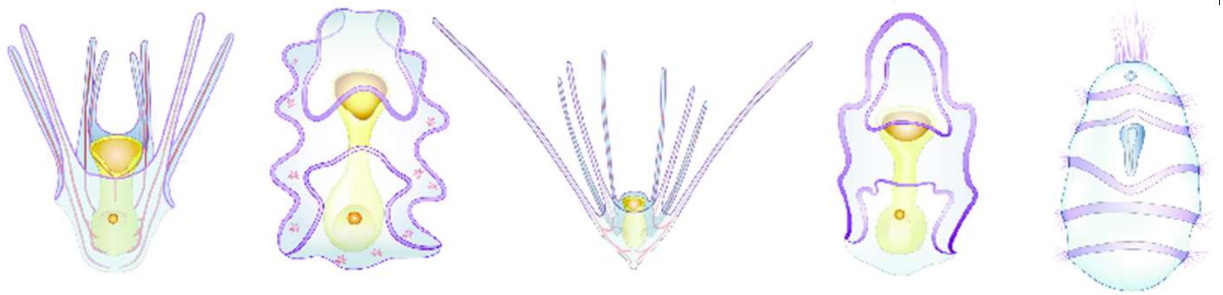
Spiny-Skinned Animals

2

Phylum Characteristics

- most adults: radial symmetry
  - majority: pentaradial symmetry
    - eg: 5 rays from a central body mass
  - secondary trait – larva are bilaterally symmetrical
    - likely evolved as animals became more sedentary
      - meet the environment from all sides

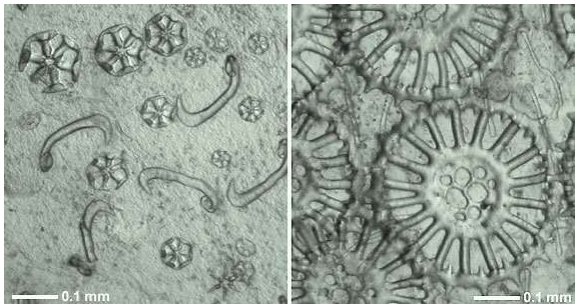




3

Phylum Characteristics

- endoskeleton
  - internal: covered by skin
  - calcareous plates (ossicles)
  - support against water pressure
  - creates protected space for coelom and organs



4

Phylum Characteristics

- generally covered with spines
  - can be moveable (like in sea urchins)
- water vascular system: unique to echinoderms

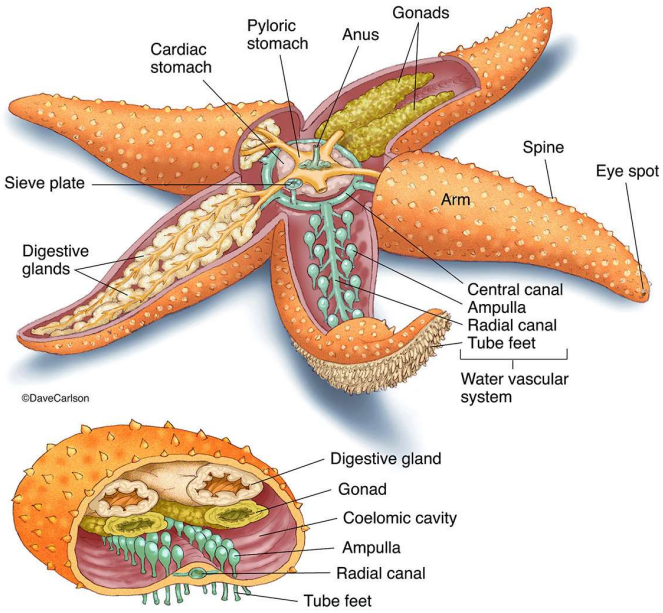
5

Sea Stars

6

Sea Stars – Morphology

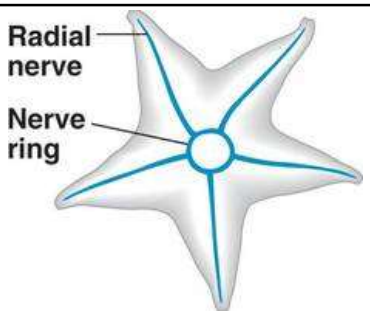
- central disk
  - mouth in the center under side (oral surface)
  - often needed for regeneration of whole animals from fragments
- arms (usually 5 or multiples of 5)
- calcareous plates bound by fibrous connective tissue
  - separate plates → flexibility
- pedicellariae
  - help to protect animal and keep surface clean
- water vascular system: uses hydraulic pressure
  - ring canal and radial canals
  - locomotion, circulation, excretion
- https://www.sciencelearn.org.nz/image_maps/46-sea-star-adaptations-dorsal-view

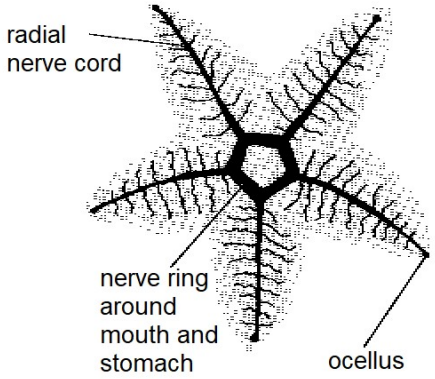


7

Sea Stars – Nervous System

- simple, like all echinoderms
- no brain or ganglia to coordinate
- nerve ring connected to radial nerves
- sensory nerve net on surface of animal
- tip of each arm has sensory tentacles (can be for food, chemicals, and light)
  - latest research: some sea stars can form images – helps them to see large objects (coral reef) and not stray from home

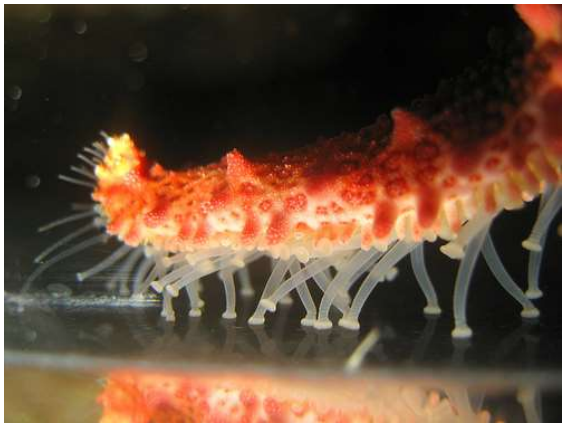




8

Sea Stars

- Locomotion:
  - tube feet have tiny muscles and sucker-like ends
    - hundreds of tube feet give sea star strength to resist being tossed around by waves
  - https://youtu.be/Lbg-tQ6FJgQ



9

Sea Stars – Feeding & Digestion

- primary prey are bivalves
- hundreds of tube feet pull at the shells until prey is exhausted
- thin cardiac stomach is everted and digestive enzymes are secreted
- https://youtu.be/UqbrPfeetmo
- material is taken into the stomach and moved to the paired digestive glands in each arm.
- nutrients then diffuse into coelom
- waste is minimal and expelled through anus on aboral surface

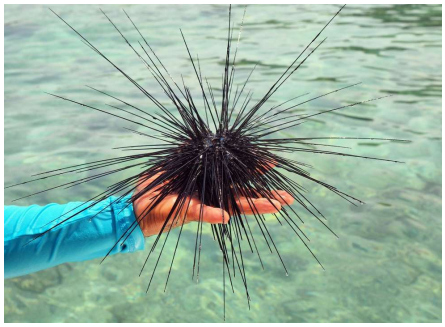
10

Sea Stars

- Internal transport
  - mostly through diffusion into and out of the coelom
- Respiration
  - oxygen and carbon dioxide can pass through the skin using skin gills (small finger-like projections)
- Excretion
  - by diffusion through tube feet and skin gills
- Reproduction
  - separate sexes; each arm has a pair of gonads
  - broadcasters: gametes are released into water

11





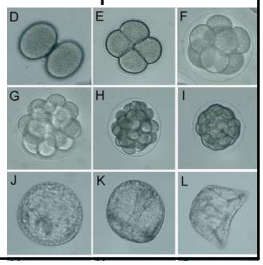
Sea Urchins

12



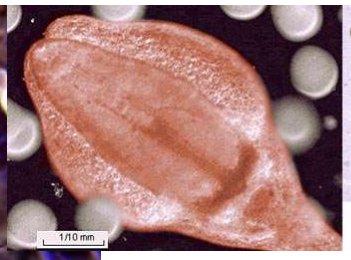

Sea Urchins

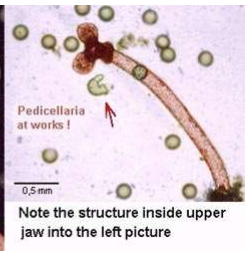
- notable for spines
- imagine a sea star with arms curved up
- rounded skeletal test protect soft parts
- mouth parts (Aristotle's lantern) has 5 teeth
- herbivores will destroy kelp forests in absence of predators
- gonads: delicacy (ex: Japanese *uni*)
- useful for studying embryonic development, as eggs are transparent



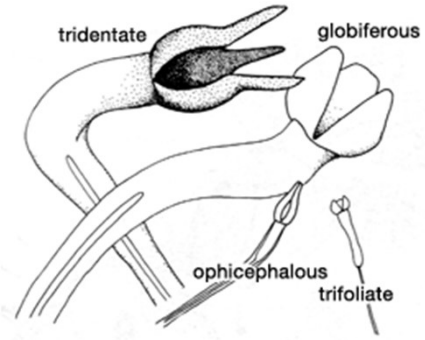
13

Tube feet and Pedicellariae





Note the structure inside upper jaw into the left picture

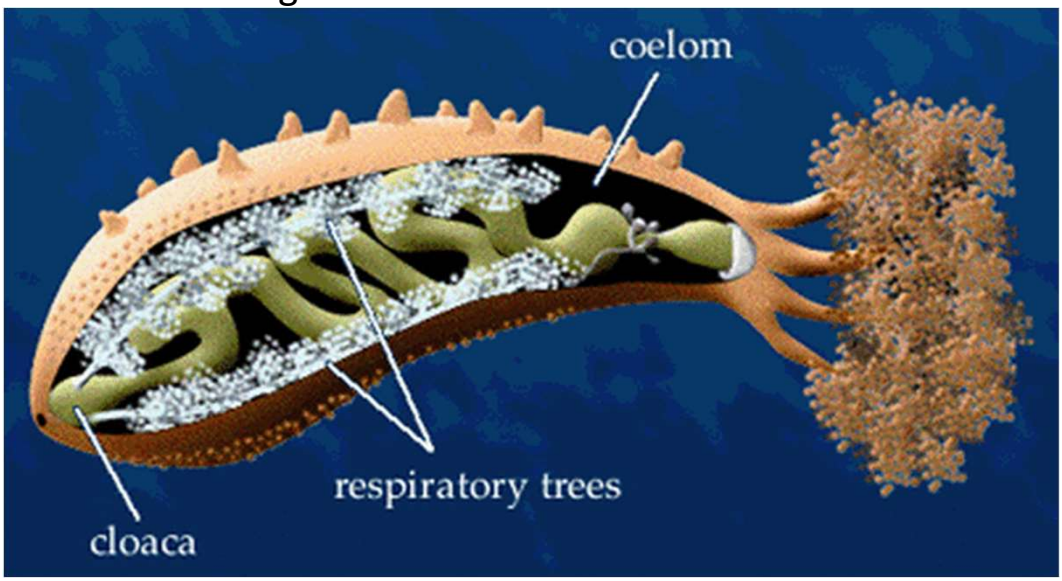


14

Sea Cucumbers

15

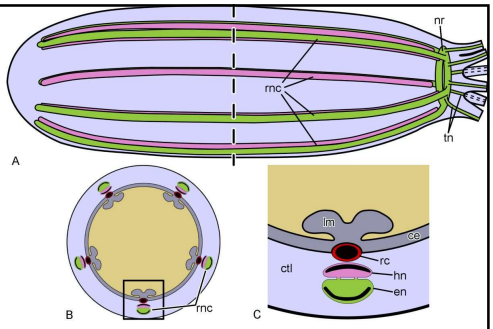
Examine the diagram. How do some sea cucumbers breathe?



16

Sea Cucumbers

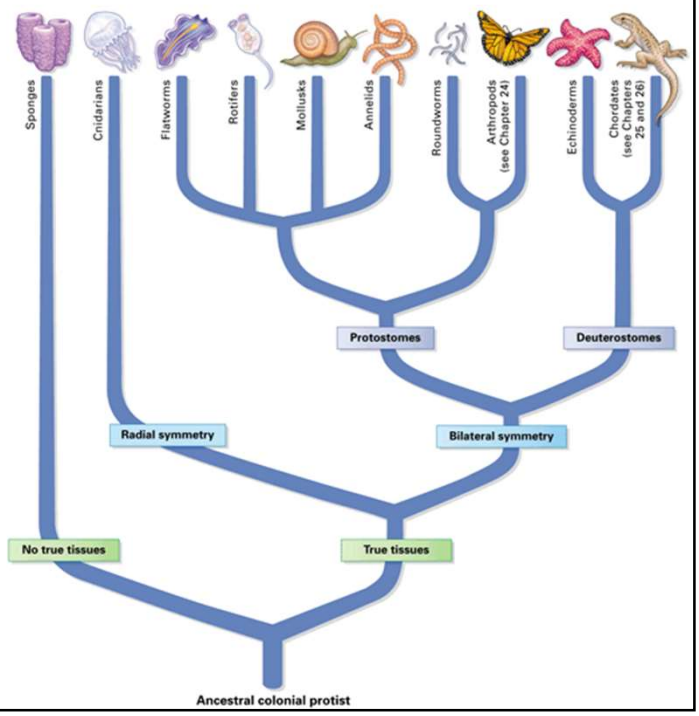
- symmetry more noticeable in x.s.
  - 5 bands of muscles & nerves
  - some have 5 bands of tube feet
- small ossicles in the soft body wall; no spines
- some eviscerate https://www.pbs.org/video/gross-science-sea-cucumber-evisceration/
- feeding and Cuvierian tubules https://www.youtube.com/watch?v=wXf_YodWw40



17

Phylogeny

What information does this diagram contain?



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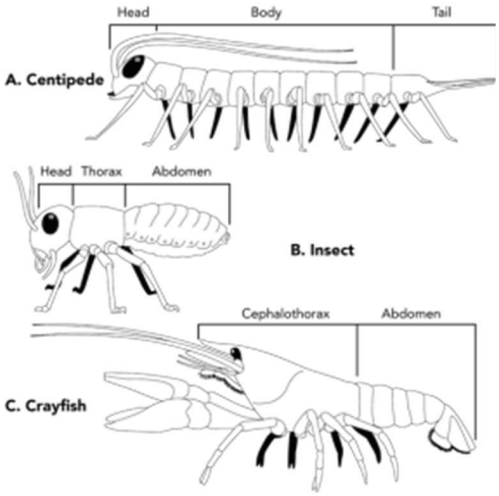
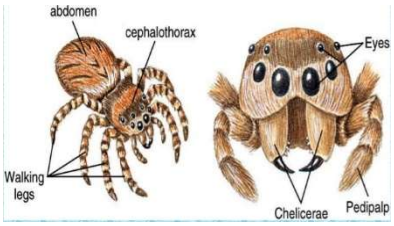
Date: _____ Block: _____

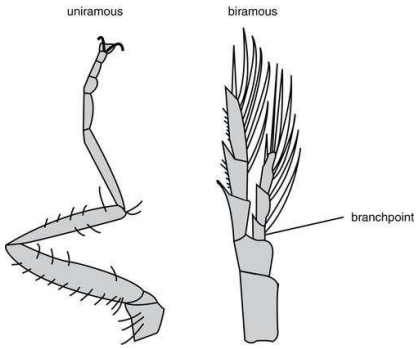
Phylum Arthropoda

Animals with jointed legs

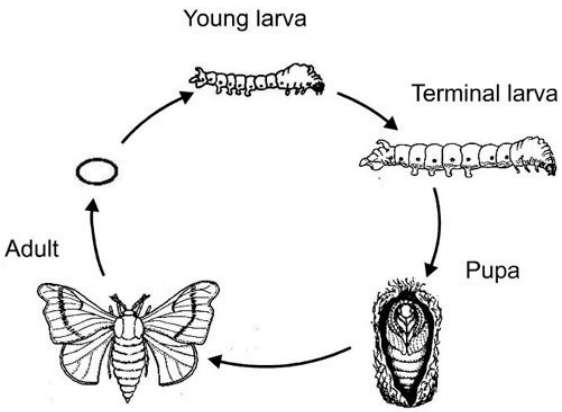
Miller & Levine, Chapter 28

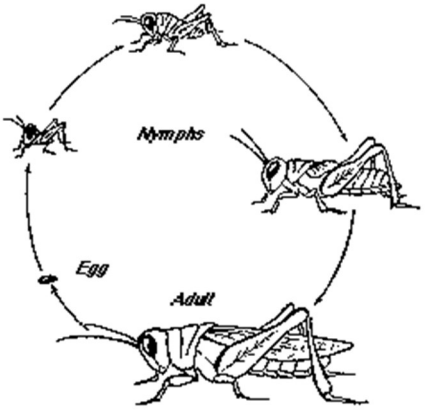






Complete and Incomplete Metamorphosis





Questions

1. What are three defining characteristics of arthropods?

2. Fill in the chart (the textbook uses a particular system; we'll use it for this course. You'll likely see a different classification system if you study arthropods in post secondary.):

Subphylum	Defining Characteristics	Example Animals

3. Describe the different types of organs that are used in arthropod respiration.

Write the answers to the rest of the questions in your notebook.

4. Terrestrial arthropods often have valves that open and close on the spiracles. How are these valves an adaptation to life on land? (Think about what happens every time *you* exhale.)
5. What are chelicerates? Name and give examples of the two main groups of chelicerates.
6. What is silk? How do spiders use silk?
7. How are chelicerae modified for feeding in spiders? In ticks?
8. What is a cephalothorax?
9. Describe the basic body plan of an insect.
10. Explain how the mouthparts of bees, mosquitoes, and butterflies are adapted to different food sources.
11. If all worker bees are females, why is the queen the only egg-layer in the colony?
12. Why are certain insects essential to agriculture?
13. How are arthropods beneficial to other living things? Give specific examples.
14. Name three dangerous or destructive arthropods and explain how they cause problems for humans.

Biology 11
Ms. To

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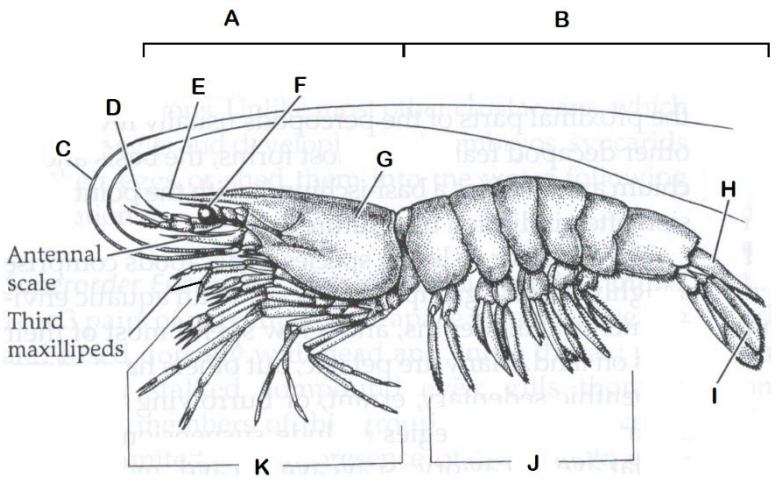
Shrimp Dissection Worksheet

Write down the answers as you come across the underlined sections in the procedures. Background information is often found in the instructions of the lab.

1. Label the diagram as you come across the structures in the lab.



A _____

B _____

C _____

D _____

E _____

F _____

G _____

H _____

I _____

J _____

K _____

2. What do prawns eat?

3. What characteristics do prawns have that define them as being in Phylum Arthropoda?

4. On what basis is the prawn placed into Order Decapoda?

5. Drawing

6. Why would stalked eyes be an advantage?

7. What is the shape of each ommatidium of the compound eye? Estimate the size of each ommatidium.

8. Name at least three tasks performed by the appendages on the cephalothorax. Explain how the morphology of the appendage help you to infer the function.

9. How does the exoskeleton on the joints of the abdomen compare with the unjointed sections?

10. Suppose you wanted to catch a shrimp with a net. Should you try to scoop it up head first or tail first? Explain.

11. What is the function of the carapace?

12. What is the function of the gills? How does the structure of the gills increase its efficiency?

13. Which two human organs would the hepatopancreas be analogous to?

14. What is the purpose of the gastric mill?

15. What is the function of the green glands?

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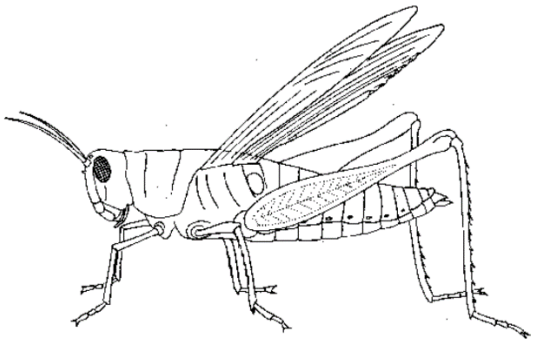
Grasshopper Dissection

1. What are the defining characteristics of insects?

2. How does the exoskeleton at the joints differ from the exoskeleton of the rest of the leg? What is the purpose of this difference?

3. On the diagram below, label the head, thorax, abdomen, dorsal, ventral, anterior and posterior. Is the diagram of the righ or left side of the body?



4. Examine the legs.
    a. What is the function of hindlegs? How do you know?

    b. Explain why the hindlegs are barbed along one section. (Why would it be useful for an insect jumping along the grass?)

5. Compare the structure of the forewing and hindwing and describe how their forms relate to their functions.

6. Label the tympanum on the diagram. What is the function of the tympanum, and how does it work?

7. Label the spiracles on the diagram.
    a. Which organ system do spiracles and tracheal tubes belong to?

    b. Write down the equation for cellular respiration. Circle the two main gases and indicate which enters the body, and which exits.

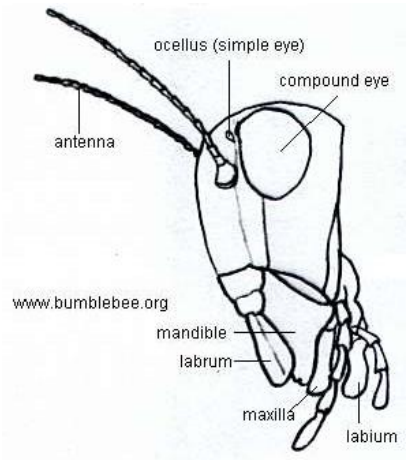
    c. Can you drown a grasshopper by holding its head under water? Explain.

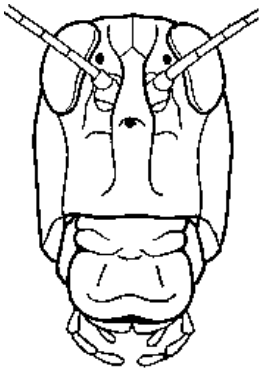
8. What is sexual dimorphism?

    a. Draw and label the posterior ends of males and females.

    b. What are some advantages of burying eggs?

9. The head.
    a. Label the diagram on the right. There are three ocelli.





    b. Describe or draw the mandibles.

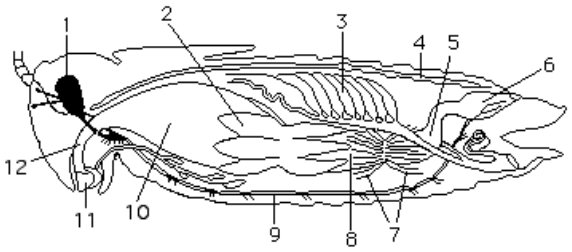
    c. Summarize the functions of the mouthparts that can be found on a grasshopper's head. Consider the structure of the maxilla and infer another function for them.

    d. What sense organs are found on the head of the grasshopper?

    e. What term refers to the development of a head with sensory organs and a central nervous system? What advantage does this confer?

10. What is the shape of each ommatidium?

11. Use the descriptions from the procedures to complete the table below.
(Terms: crop, gastric caeca, intestine, Malpighian tubules, ovaries, rectum, stomach)



Structure	Function
2.	
3.	
5.	
6.	
7.	
8.	
10.	

12. Identify the analogous structure to Malpighian tubules in each of the following animals:
    a. human:
    b. shrimp:
    c. mollusc:
    d. earthworm:
    e. flatworm:

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Shrimp Dissection Worksheet

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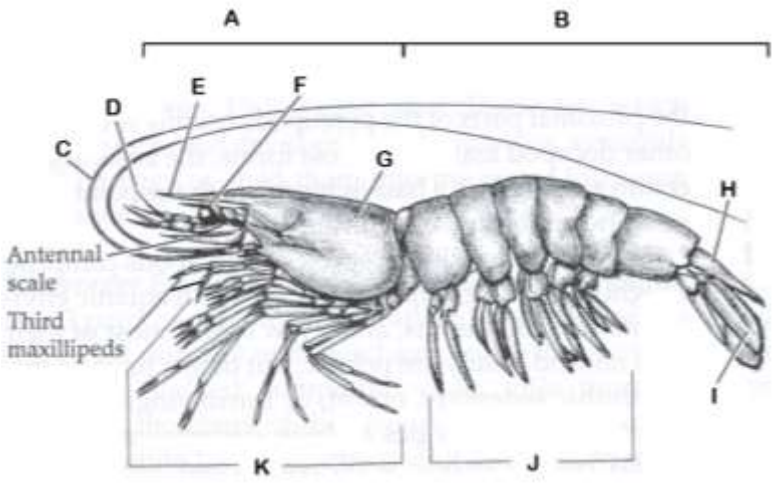

A <u>cephalothorax</u>

<u>B abdomen</u>

<u>C antenna</u>

D antennule

E <u>rostrum</u>

F <u>eye</u>

<u>G carapace</u>

H telson

I uropod

J <u>swimming legs/swimmerets</u>

<u>K walking</u> legs

2. What do prawns eat?

3. What characteristics do prawns have that define them as being in Phylum Arthropoda?
   jointed legs, exoskeleton, bilateral, segmented bodies

4. On what basis is the prawn placed into Order Decapoda?
   10 WALKING legs (other decapods have different numbers of other legs)

5. Drawing
6. Why would stalked eyes be an advantage?
   wider field of view (see more of the surroundings)
7. What is the shape of each ommatidium of the compound eye? Estimate the size of each ommatidium.

8. Name at least three tasks performed by the appendages on the cephalothorax. Explain how the <u>morphology</u> of the appendage help you to infer the function.
   how does the structure help you guess what the function is
   walking, grabbing, tearing, sensing

9. How does the exoskeleton on the joints of the abdomen compare with the unjointed sections?
   at joints, it is softer, thinner for more flexibility and movement. Unjointed: stiffer for better protection & structure

10. Suppose you wanted to catch a shrimp with a net. Should you try to scoop it up head first or tail first? Explain. from back, because it can't see, and the escape response is to move backwards

11. What is the function of the carapace?
    protection of internal organs

12. What is the function of the gills? How does the structure of the gills increase its efficiency?
    feathery structure increases surface area for more gas exchange

13. Which two human organs would the hepatopancreas be analogous to?
    hepatitis – disease of liver. liver and pancreas – produce and secrete digestive enzymes

14. What is the purpose of the gastric mill?
    teeth in stomach – to grind food

15. What is the function of the green glands?
    kidneys – remove metabolic waste (ammonia) – in conjunction with gills; osmoregulation (balancing the salt and water in the body)

Names:

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Plants Photo Journal

Purpose:

- To document the changes of plants over a season
- To learn how to identify plant species
- To hone observation skills
- To appreciate the diversity of plants

Mind where you step, and be gentle with the plants.
Be mindful of others and keep a lane clear on the sidewalks.

Take pictures of **at least 7 different plants**. Keep a list of plants on the back of this paper so you don't have duplicates. If you don't know the name, write a brief description.

For **each** plant:

- Take a picture that reminds you of the **location** of the plant – you'll be coming back several times to take more pictures of this plant
- Take a picture of the **entire plant**
- Take a picture of **one branch** (if it's a tree/shrub). You want to see how the flowers or leaves are arranged.
- Take **close-ups** of the flowers or cones, and leaves. Topside and underside. **Check** that veins and small details are visible. At least one of these pictures should have an **object for scale** – a coin, a ruler, a paper clip. Use the same object throughout.

Look for moss that has "sprouts" and try to take detailed pictures of them.

Names:

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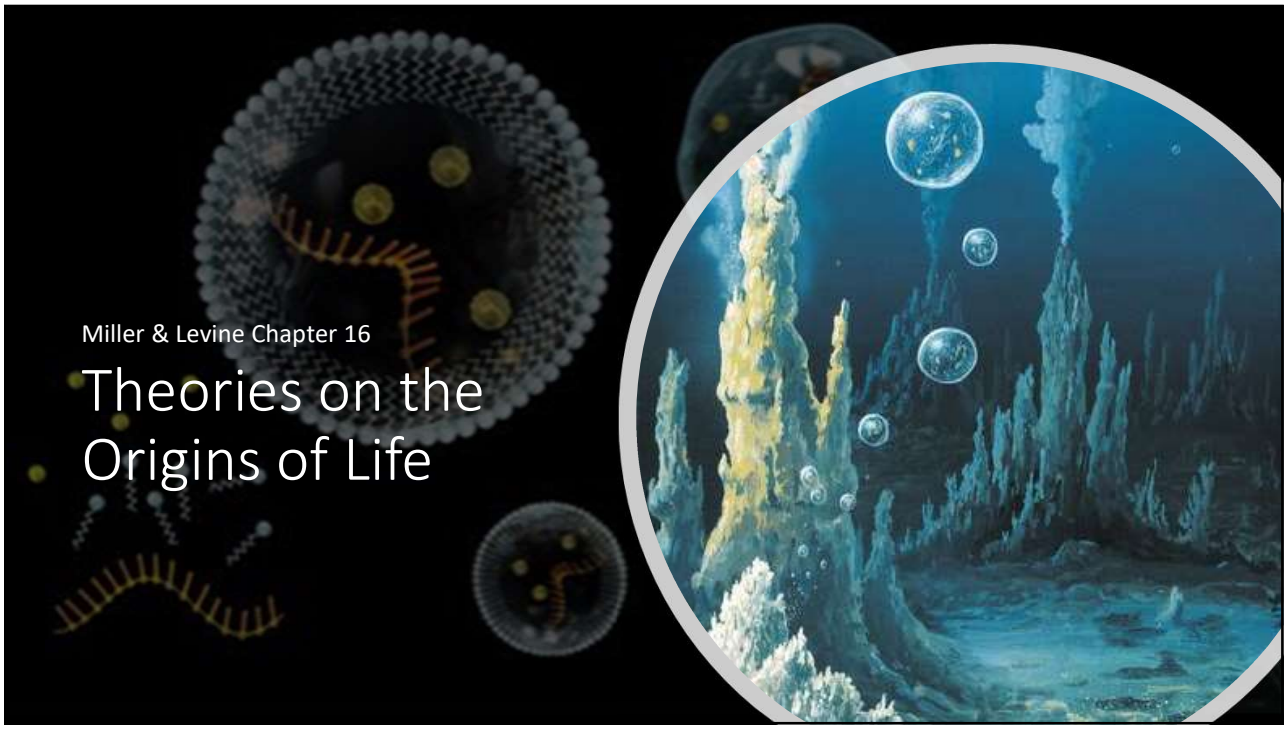


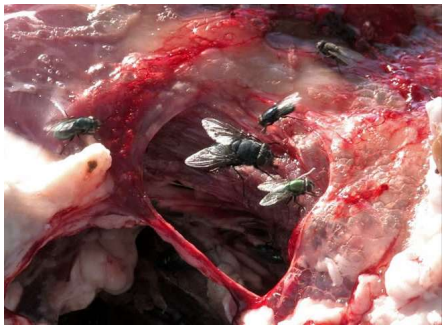
Miller & Levine Chapter 16

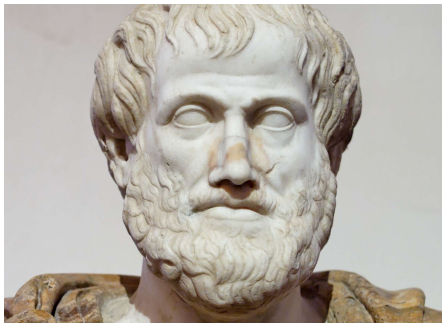
Theories on the Origins of Life

2

Early Logic

3



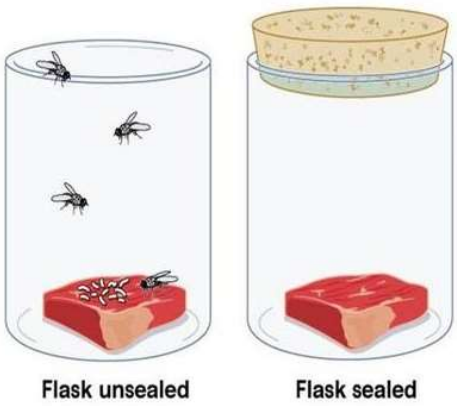


Abiogenesis, AKA: Spontaneous Generation

4

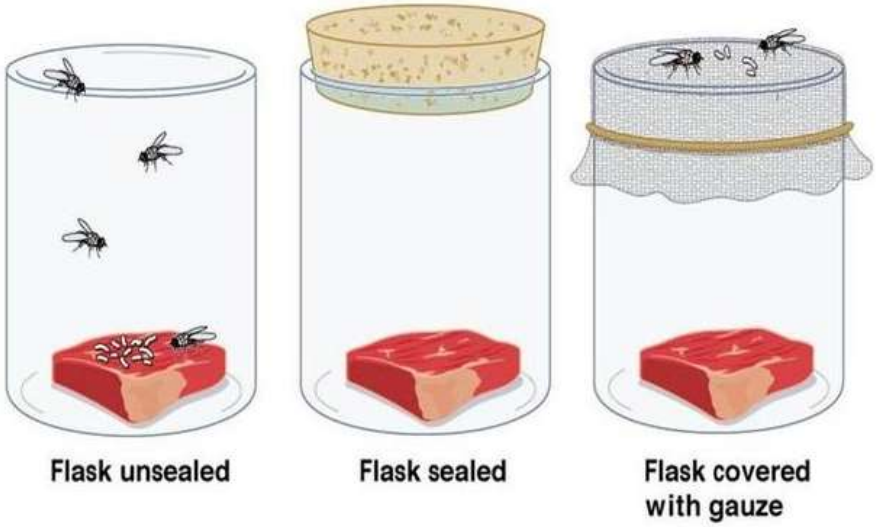
5

Francesco Redi, 1688



But wait!
Air is the active ingredient!

6



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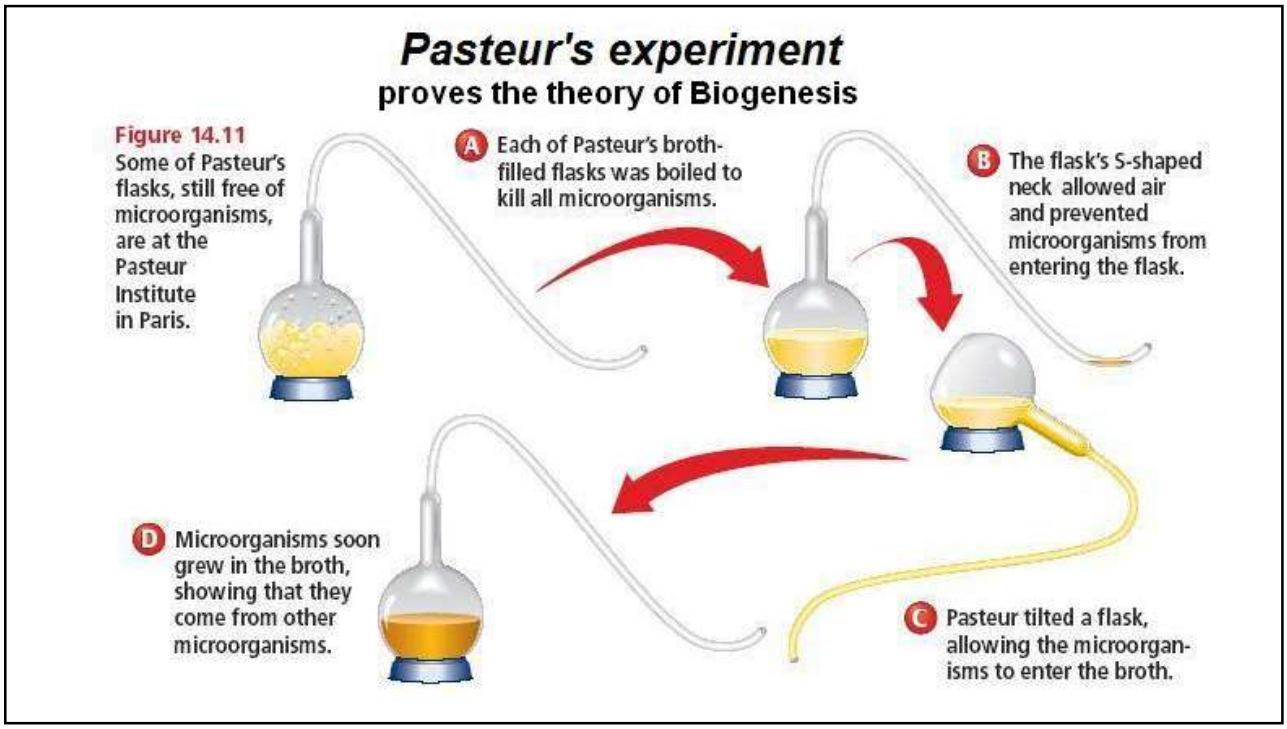

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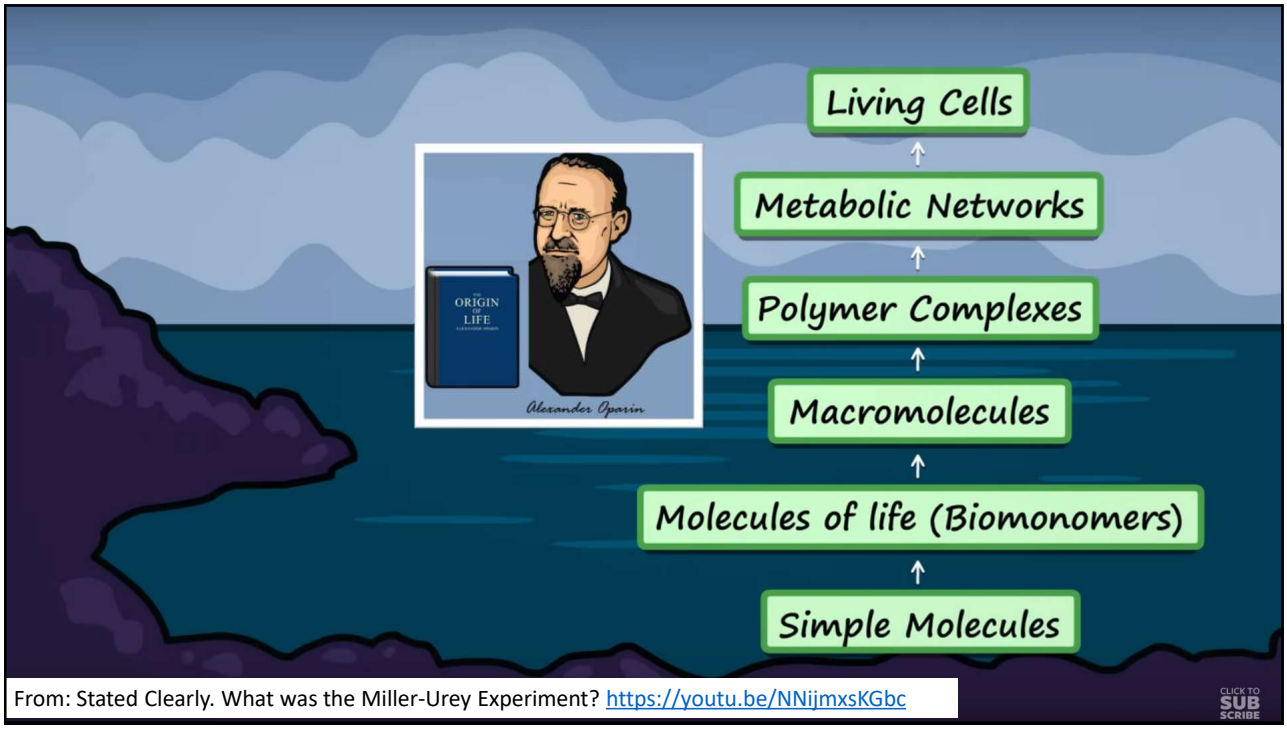
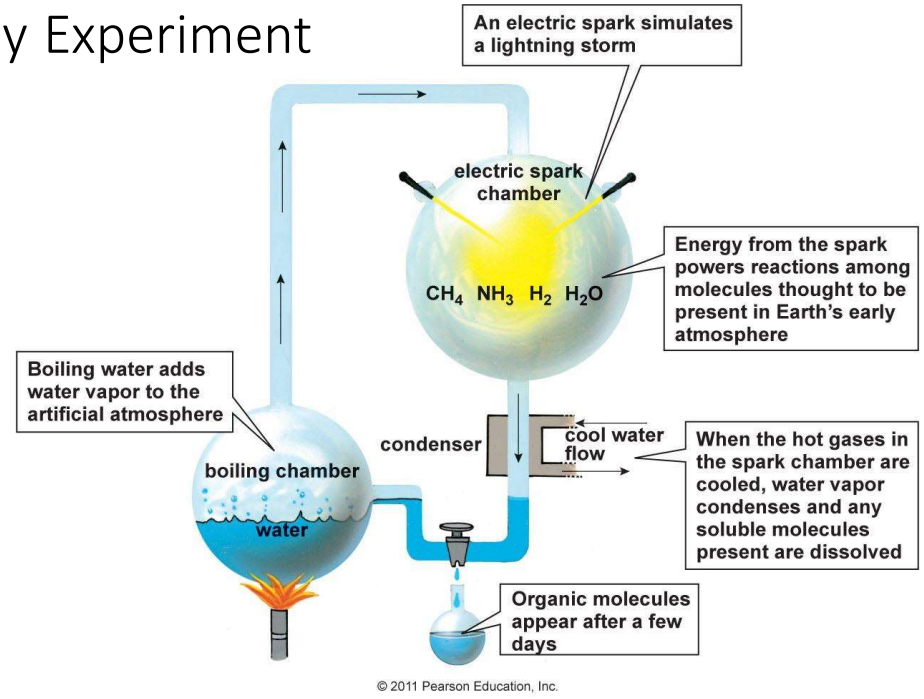


From: Stated Clearly. What was the Miller-Urey Experiment? https://youtu.be/NNijmxsKGbc

9

Miller-Urey Experiment



10

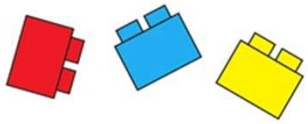
Organic Compounds

- All have covalently bonded carbon
- Most also have hydrogen and oxygen
- Inorganic carbon compounds include:
  - Carbides (Metal-C)
  - Carbonates (Metal-CO_3)
  - Carbon oxides (Carbon-O_x)
  - Simple cyanide compounds (Metal-CN)
- Combustion/Oxidation:
  - Organic compound + oxygen → carbon dioxide + water
  - Cellular respiration: $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

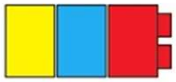
11

Monomers and Polymers

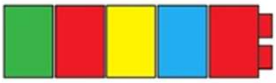
- Polymers: molecules made of smaller units
- Monomer: smallest unit of a type of molecule



Monomers



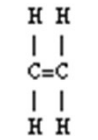
Polymer of three monomers



Polymer of five monomers

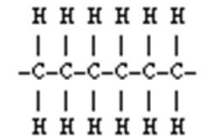
MONOMER

$CH_2=CH_2$



POLYMER

$-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-$



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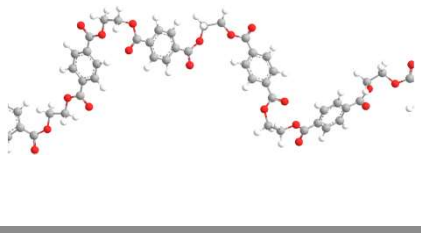

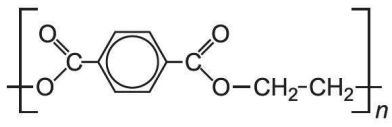

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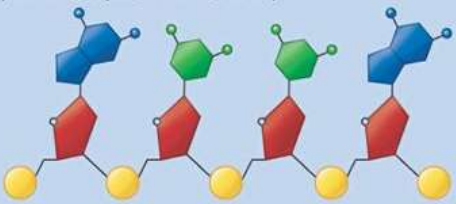
If the monomer is...	The polymer is...
A **monosaccharide** (for example, glucose, fructose) 	A **polysaccharide** (for example, starch, glycogen, cellulose) 
An **amino acid** (for example, arginine, leucine) 	A **polypeptide** or **protein** (A- and B-chains of insulin are polypeptides and insulin is a protein) 
A **nucleotide** (sugar, phosphate, base in combination) 	A **nucleic acid** (for example, DNA, RNA) 

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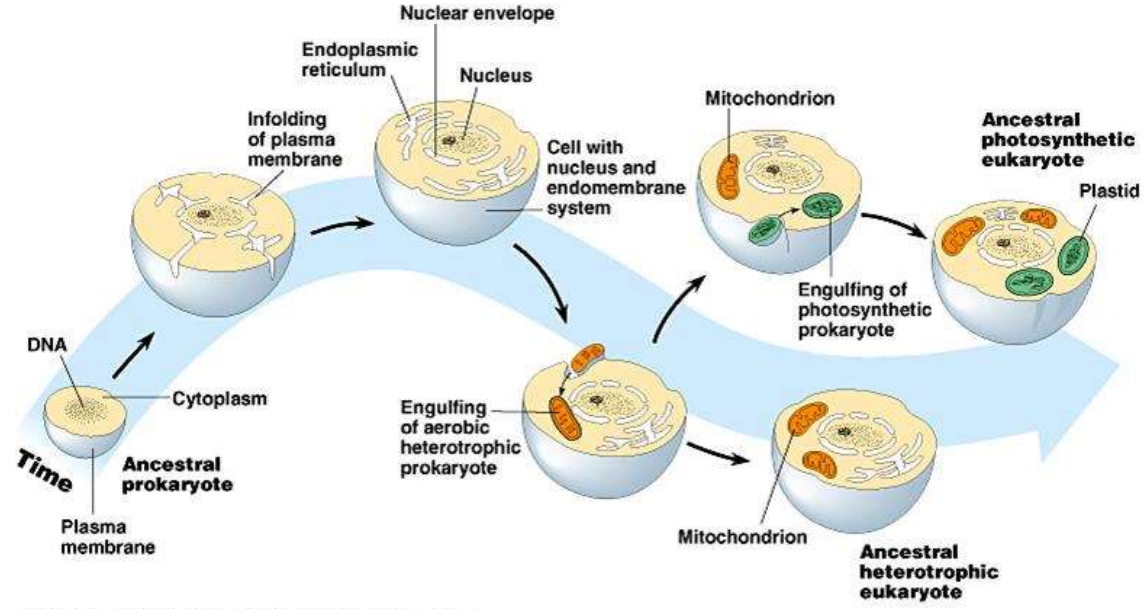
Endosymbiotic Theory



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Work

- Read Chapter 16
  - define terms
  - make brief notes on sections 16-2 & 16-3
    - main ideas only, this chapter provides context
- Study for echinoderm quiz

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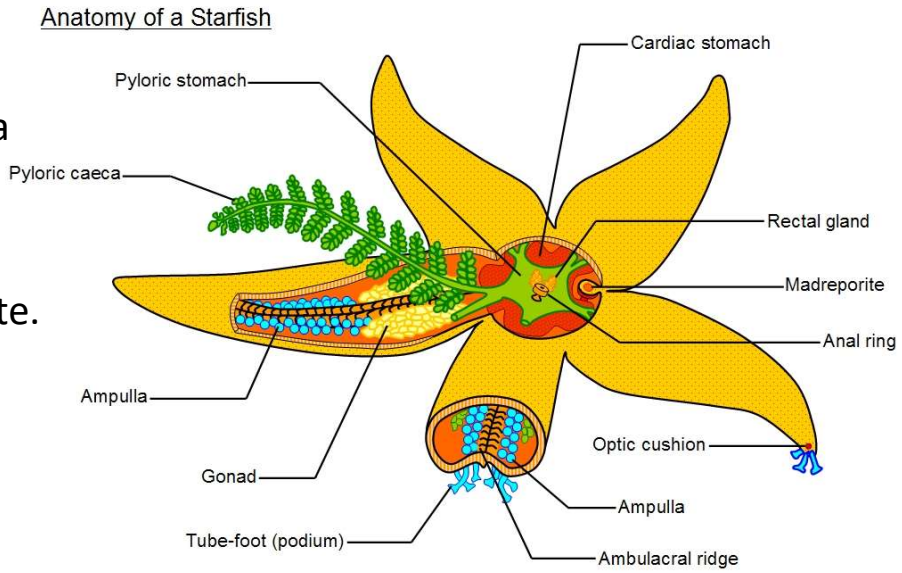
Echinoderm Review

- What are defining characteristics of echinoderms?
- Describe how a sea star feeds on a bivalve. Include digestion and elimination of waste.



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Prokaryotes

Miller & Levine Sections 17-2 & 17-3

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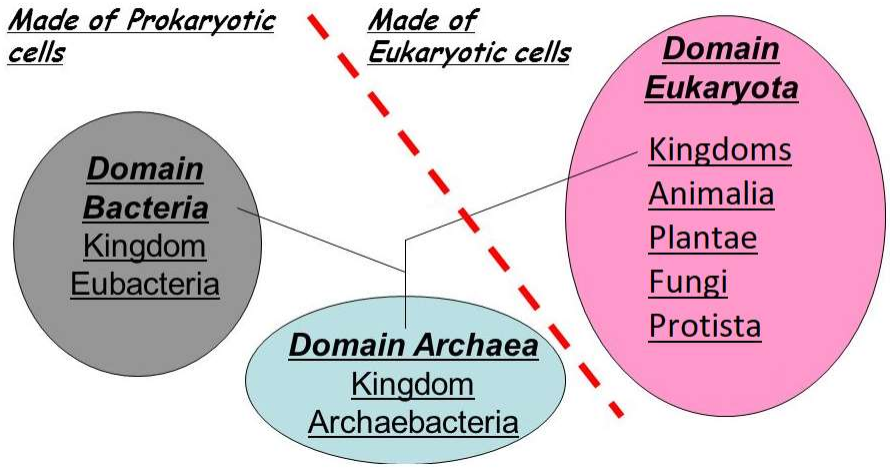
Prokaryotes

- "before nucleus" – no nucleus or membrane-bound organelles
- unicellular
- used to all be classified into kingdom Monera



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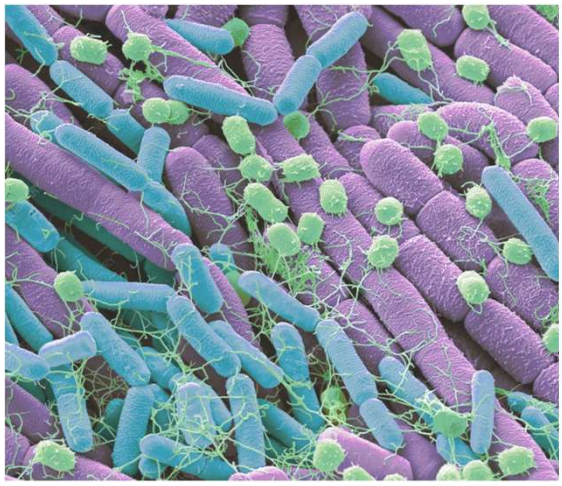
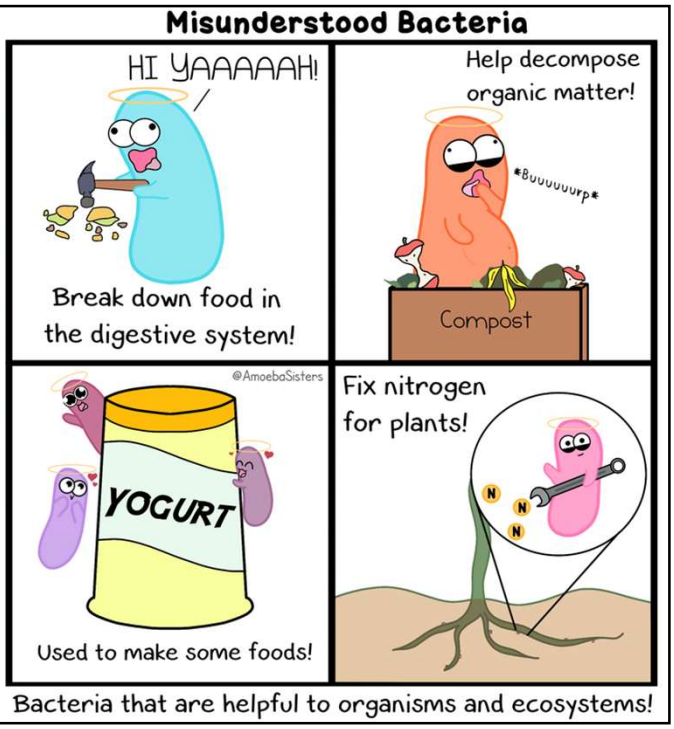


Bacteria



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Identifying Bacteria

- shape
- chemical nature of cell wall
- movement
- method of obtaining energy

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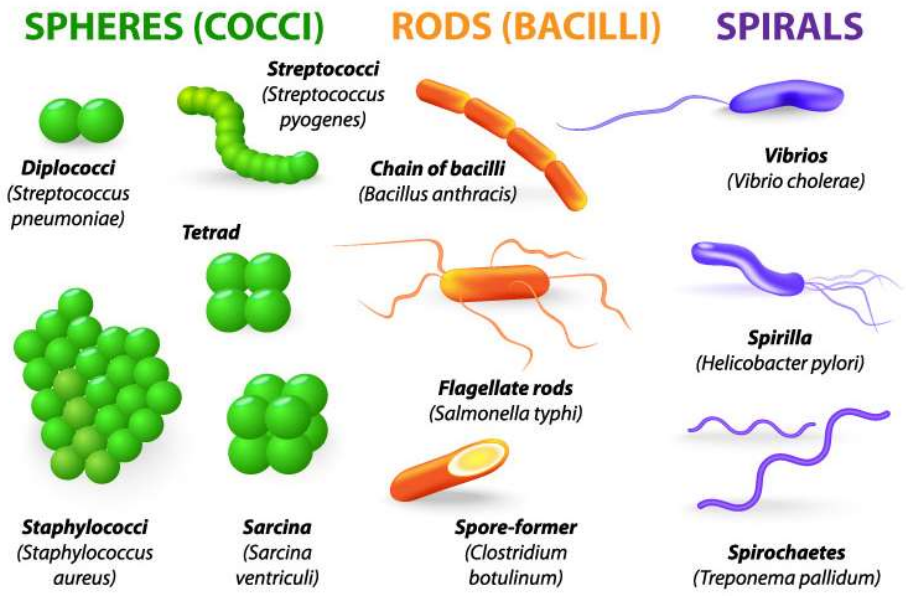
Major Bacteria Shapes & Arrangements



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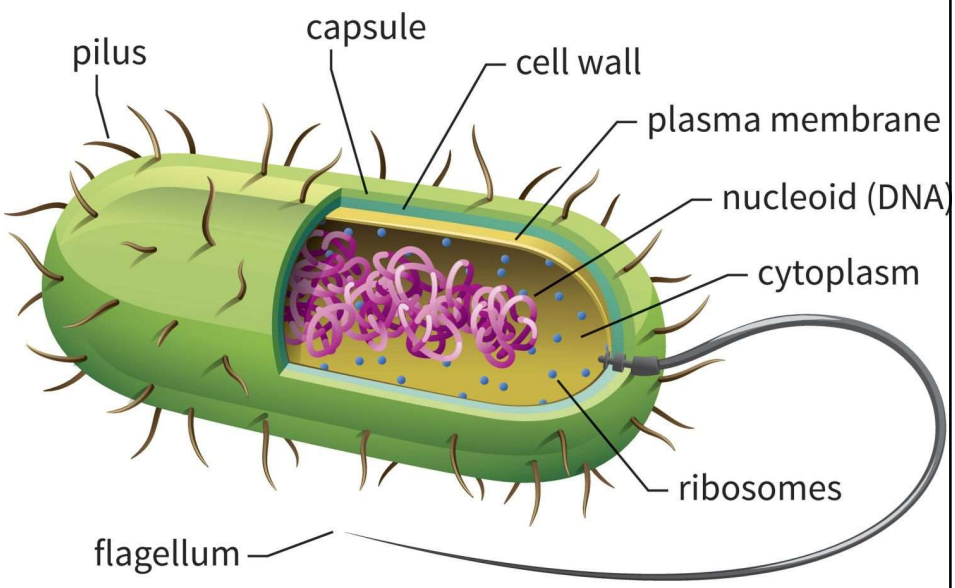
Bacteria

- live almost everywhere
- usually surrounded by cell wall
  - cell wall: peptidoglycan
- some have second membrane outside cell wall



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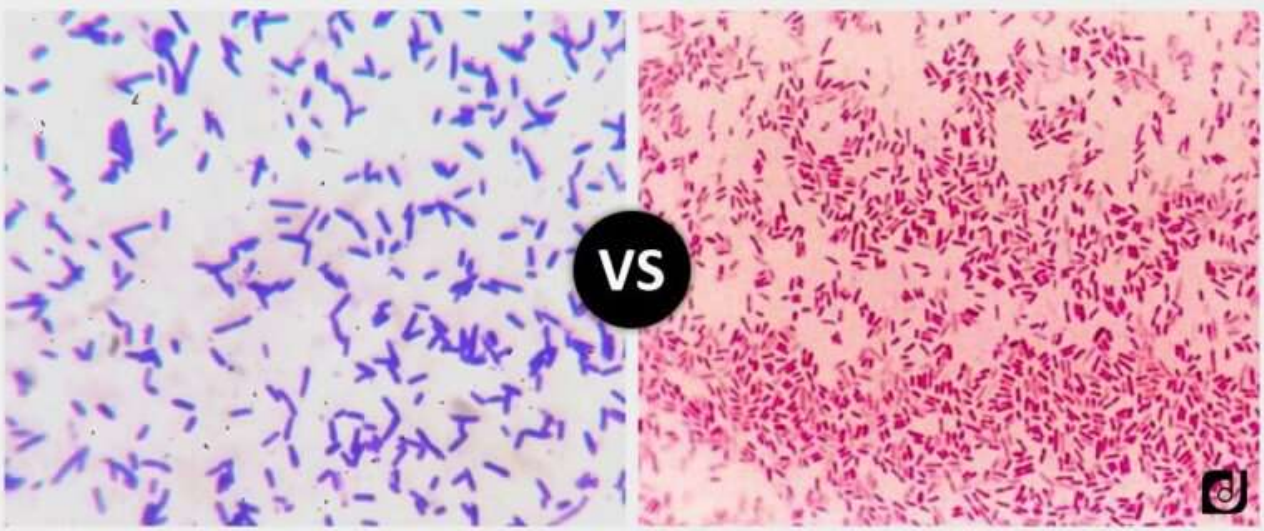
Gram Staining



Gram Positive Bacteria vs. Gram Negative Bacteria

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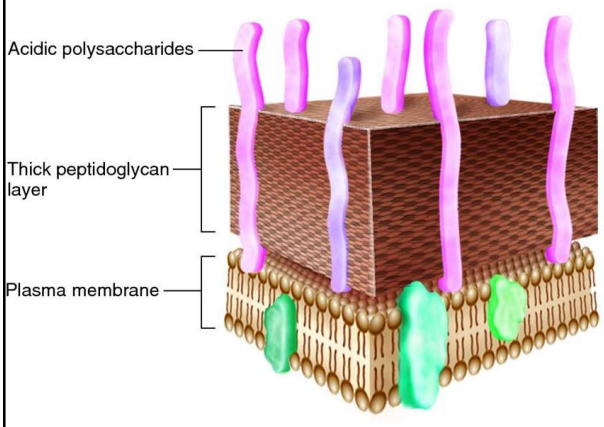
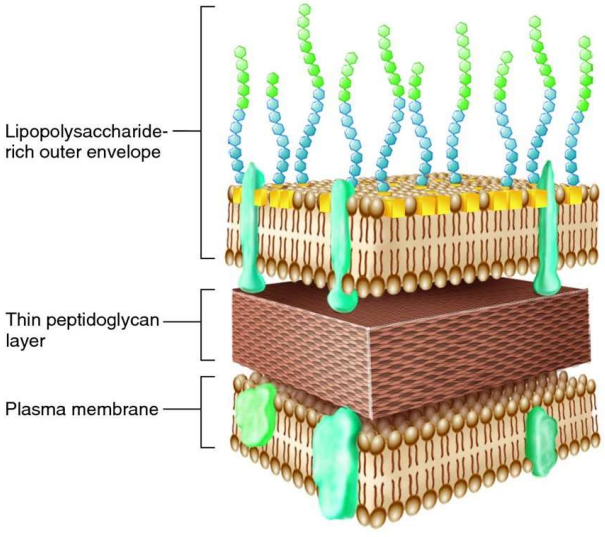
Cell Wall & Gram Staining



(a) Gram-positive: thick cell wall, no outer envelope



(b) Gram-negative: thinner cell wall, with outer envelope

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Draw: Gram-positive vs Gram-negative

- nucleoid, cell membrane, cell wall, outer membrane

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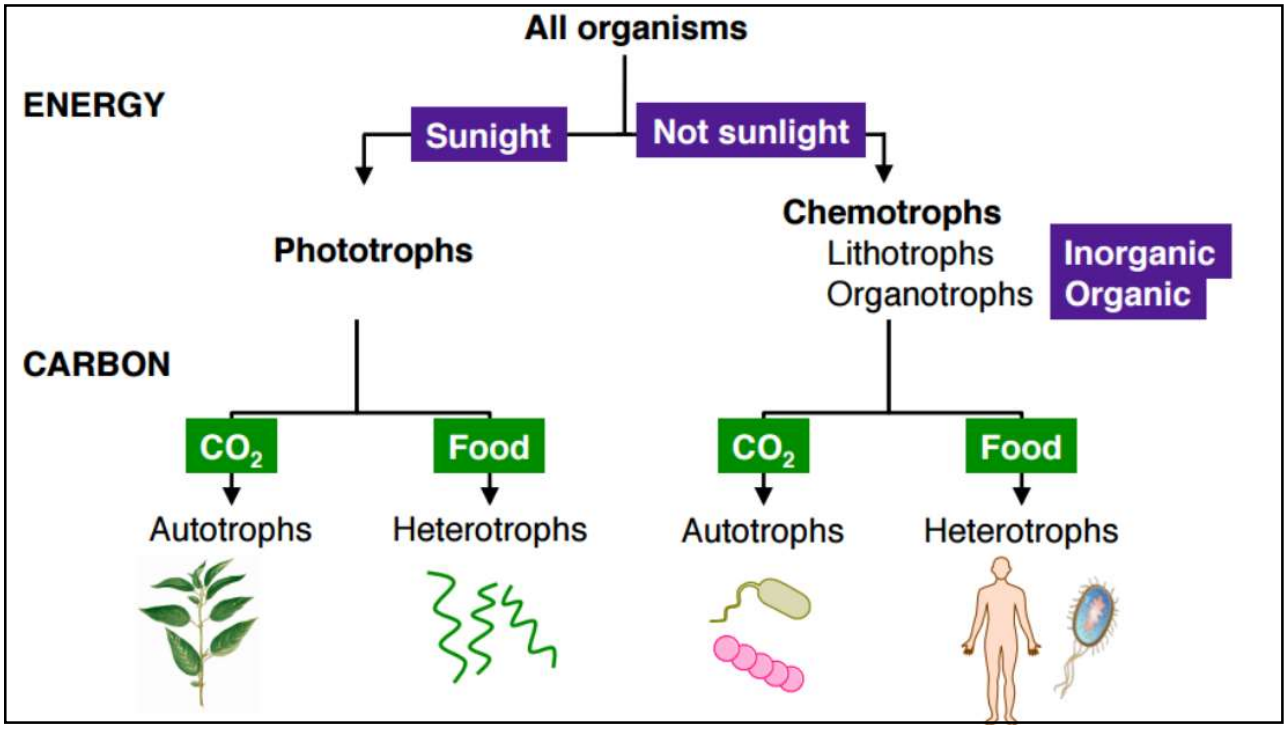

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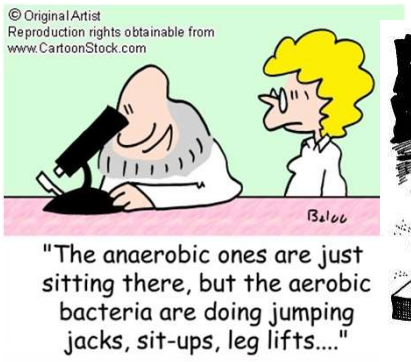
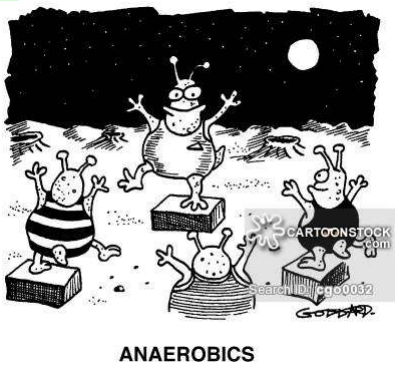
Metabolic Diversity: Aerobes and Anaerobes

- obligate aerobes
  - need oxygen
- obligate anaerobes
  - die with oxygen
- facultative anaerobes
  - survive with or without oxygen





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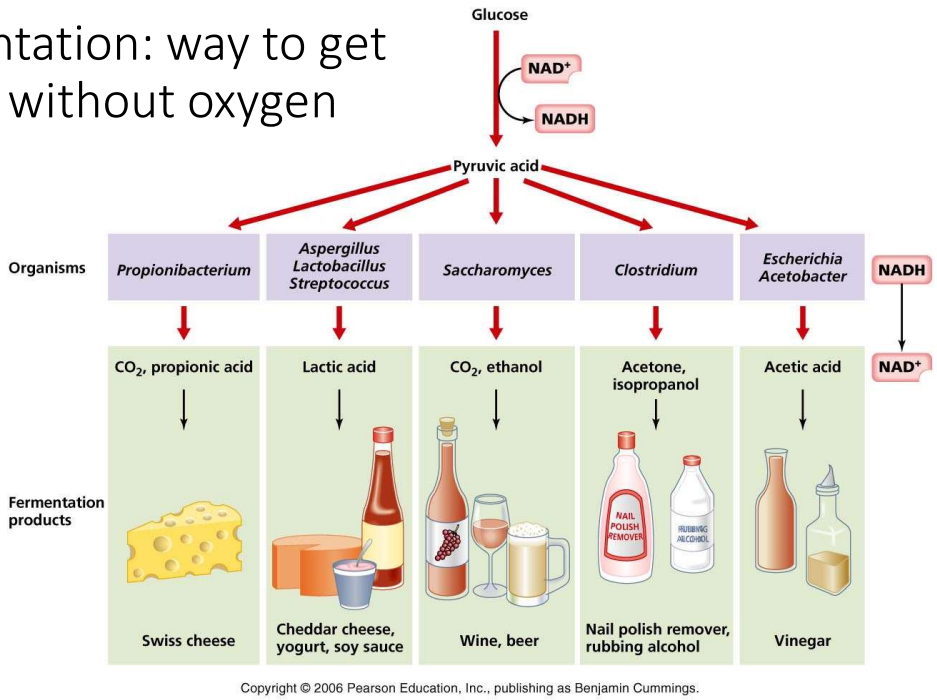
Fermentation: way to get energy without oxygen



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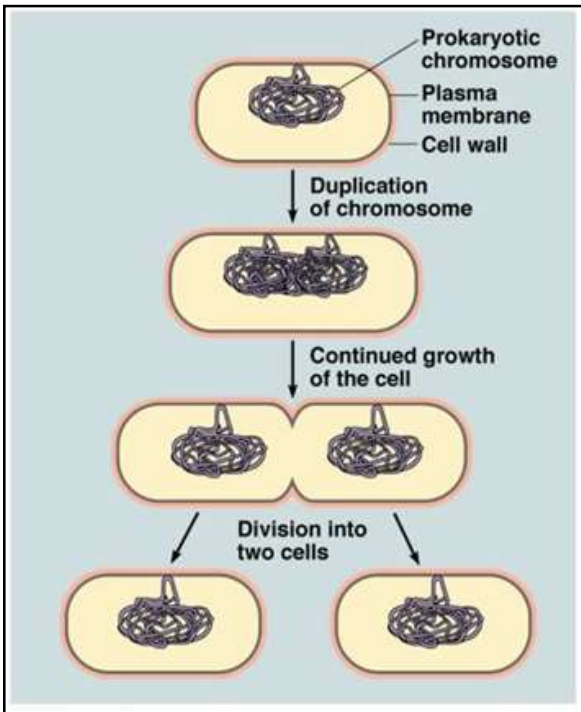
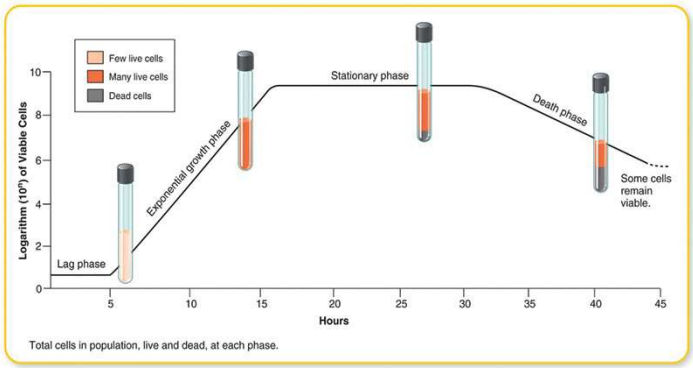


Binary Fission

- can occur quickly under optimal conditions



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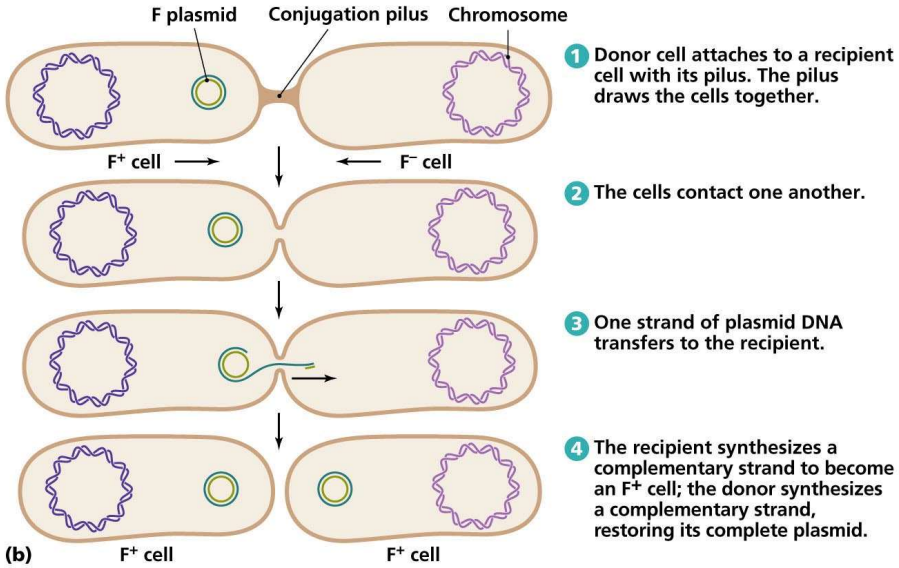
Conjugation: transferring a small piece of DNA



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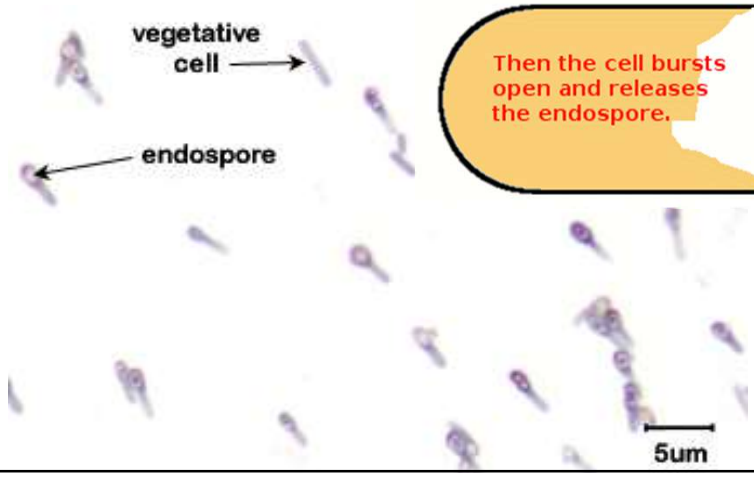
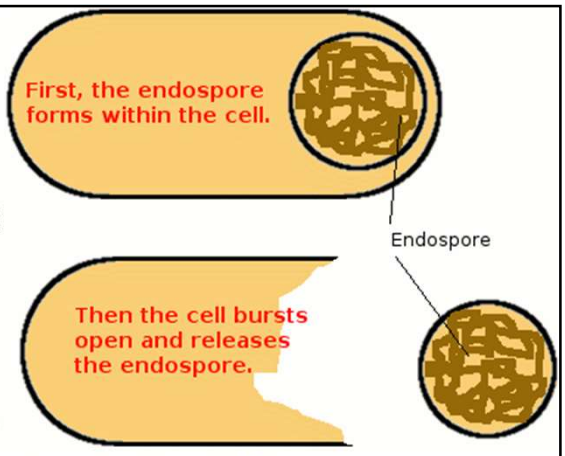
Endospores

- encloses chromosome in a tough coating
  - excludes plasmids
- can survive adverse conditions, depending on species
  - heat
  - desiccation
  - radiation
  - vacuum





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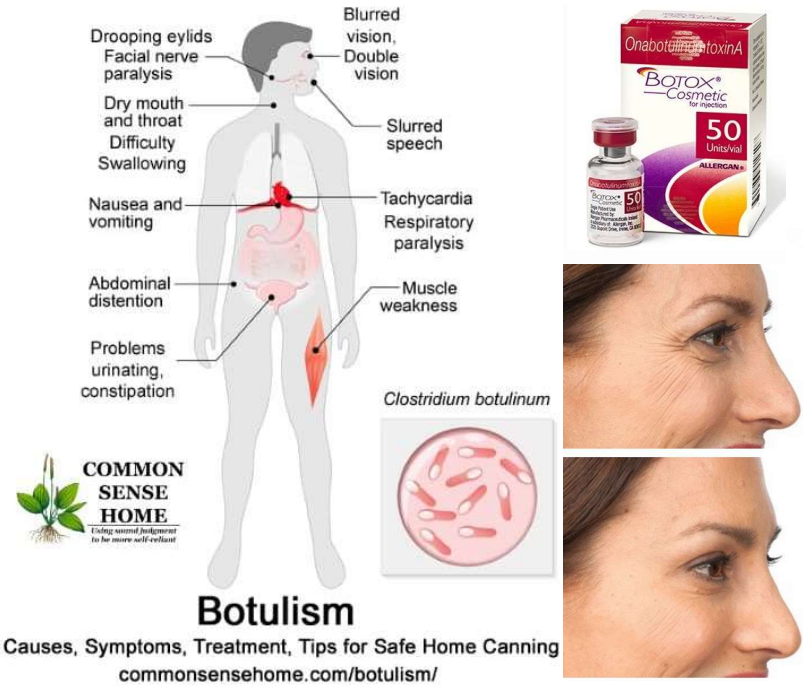
Pathogenic Effects of Bacteria

- direct:
  - use cells for food (destroys cells)
- indirect:
  - release toxins that interfere with normal activity
    - Botox (from *Clostridium botulinum*)



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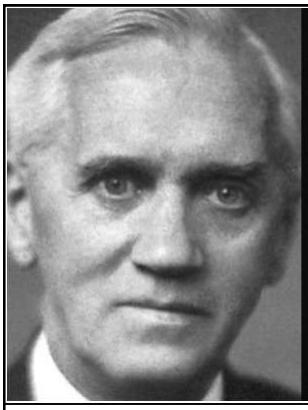
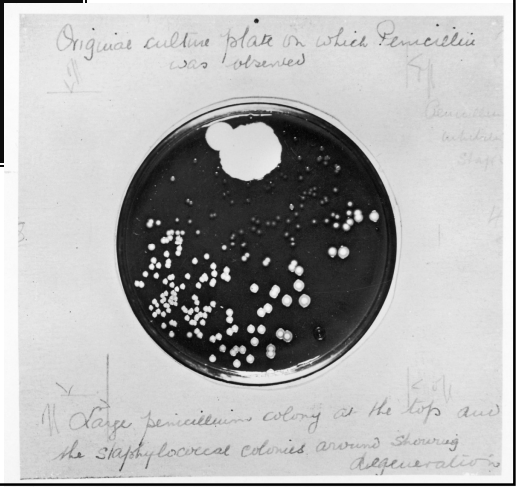


One sometimes finds what one is not looking for. When I woke up just after dawn on Sept. 28, 1928, I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I guess that was exactly what I did.

— Alexander Fleming —

AZ QUOTES



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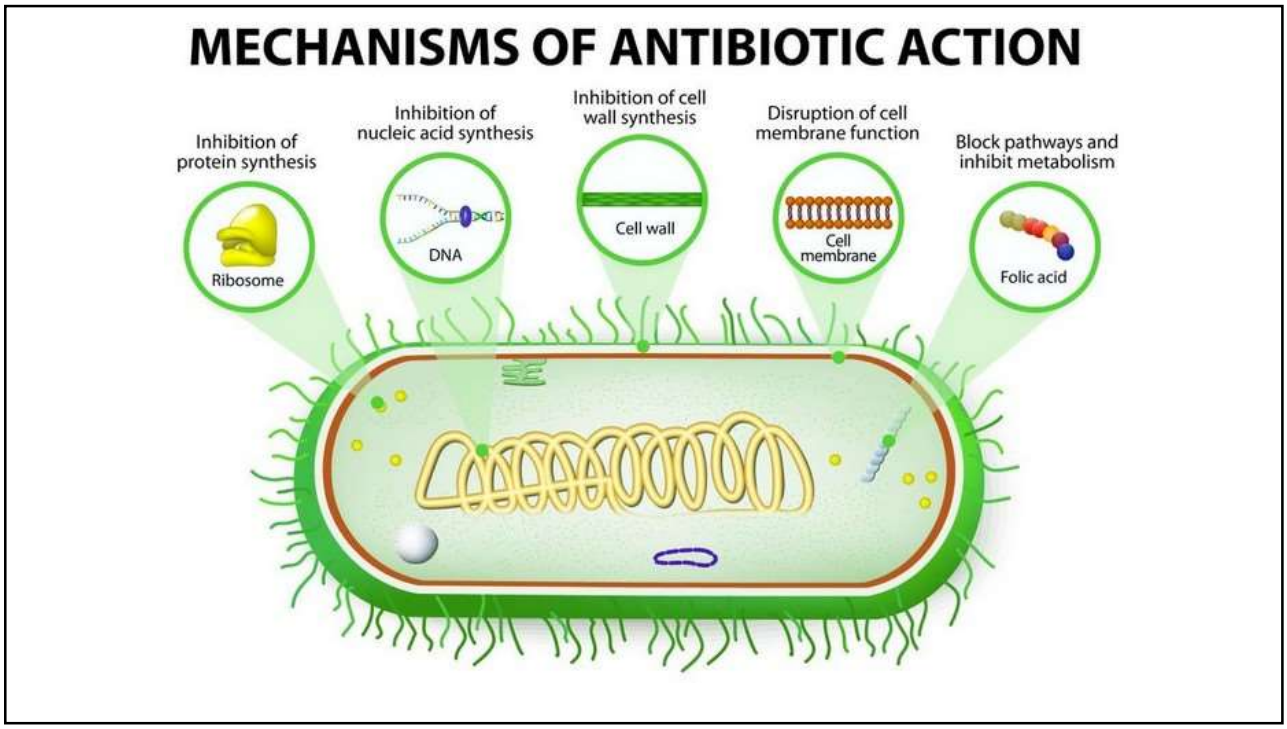

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Antibiotic Resistance

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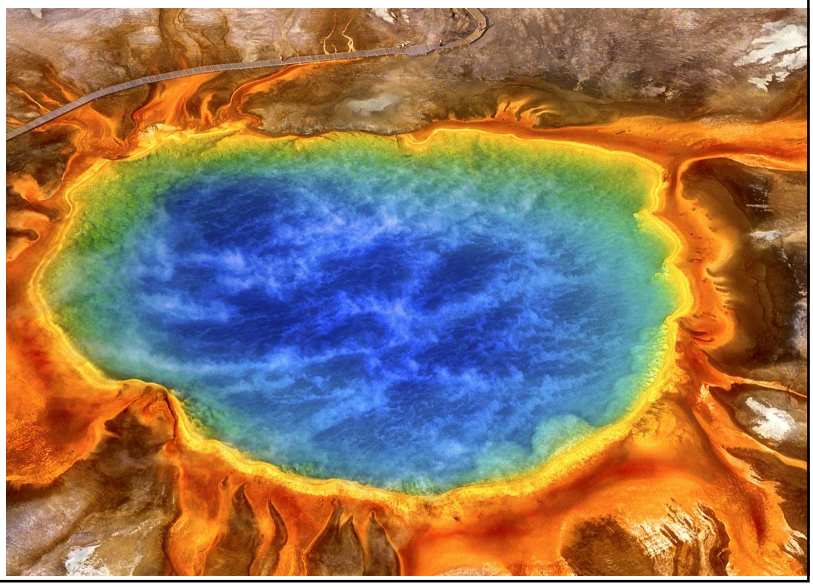
Bacteria vs. Archaea

- We do not focus on domain Archaea, only need to know that:
  - no peptidoglycan in cell wall
  - generally live in extreme environments
    - hot (thermophiles)
    - salty (halophiles)
    - acidic (acidophiles)
  - more closely related to eukaryotes than bacteria are



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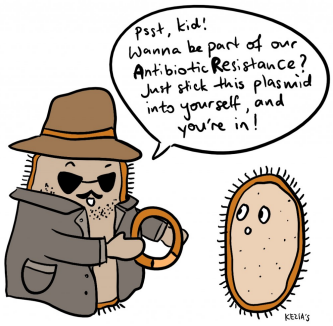
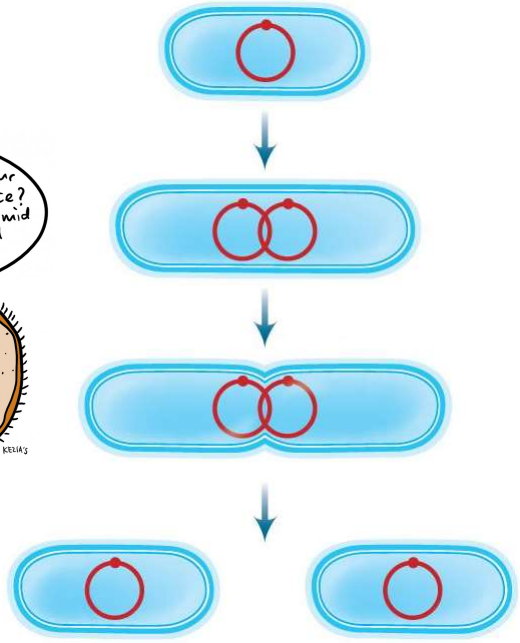
Review

What does it mean to be a

- chemoheterotroph
- photoheterotroph
- photoautotroph
- chemoautotroph

- What are plants? Animals?
- Name and describe processes in diagrams





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Vancouver International Universities Fair Information Sessions, May 5th, 2019

1- What Students Should Know When Applying To US Universities

Dr. Douglas L. Christiansen, Vanderbilt University

Applying to colleges and universities in the United States may seem daunting. While the Common Application has simplified the process, there are still critical components that need extra attention. Grades and test scores are important and speak for themselves. Even more important in the holistic admissions process are the essays, recommendation letters, and extracurricular activities. This workshop will help students with the application process by clarifying what US institutions are looking for.

2- How to Write A Winning Essay

Simon Nascimento, University of Chicago

A college essay can be a stressful task, and students often feel that choosing a topic is next to impossible.
The reality is that the "what" of an essay is much less important than the "how." The approach of the writer takes communicates much more about themselves than the general topic itself. This session will include brainstorming for meaningful essay topics, best practices for effective essay writing, and case studies using real essay examples.

3- Financing Your Education

Paul DeGrace, Simon Fraser University

Chris Dembiske, Simon Fraser University

This session will look at typical costs and tips on budgeting as well as discussing the general types of funding available to students considering a post-secondary education. From institutional funding such as scholarships and awards to external opportunities, including government student loans, the goal is to provide an overview of the types of funding available. We will also explore options to subsidize your education costs by doing co-op and at the same time gain valuable work experience before you graduate.

4- *What it Takes to Become a Medical Doctor in Canada*

Dr. Mir Sohail Fazeli MD, PhD

Dr. Janet Ip, MD CCFP FCFP

Dr. Edward Mills, PhD, FRCP Edin.,

Becoming a physician requires a certain personality and a long list of abilities by which a successful doctor can effectively meet the health care needs of the people they serve. These characteristics are often wisely and indirectly probed during admission interviews to medical programs across the world. This session will focus on the personal and professional universal characteristics of a physician and the panel will shed more light on some of these characteristics by sharing from their personal experiences.

5- What is Engineering

Ryan Pyear, University of Waterloo

Monique Sullivan, University of Calgary

Join Ryan and Monique for an interactive discussion about what it means to be an engineer. Learn about the differences between Engineering and Science, what engineers do, and how they shape the world around us. Learn about the types of engineering, engineering specializations, and the difference between engineering schools across Canada. Discover how engineering can also lead to a career in medicine, law and business.

6- Many of The Top Ranked Universities Are in the UK; Shouldn't You Know More About Studying There?

Amy Roberson, University of Cambridge, England

Ashley Sevadjian, University of Glasgow, Scotland

Jo Turner, UCL, England

Studying in the UK offers students an opportunity to travel abroad and attend some of the world best universities at the same time. Whatever degree you are interested in studying the UK has something for everyone. In this workshop, we will provide applicants with a robust toolkit to successfully navigate the UCAS application form. Students will learn what makes a good personal statement and some of the pitfalls to avoid as well as what universities (especially the good ones) are looking for in applicants.

7- Who Gets In? The Truths and Myths of How Canadian Universities Make Admission Decisions

Paola Baca, University of British Columbia

Shennella Blake, University of Alberta

Alyson Murray, Dalhousie University

Grade 11 and 12 grades, self-reporting, personal statements, short answer questions, extra-curricular activities, and applicant interviews; there is a great deal of information that can go into admission decisions. This begs a question: how do Canadian universities use all this information to determine who gets in? This presentation will provide an overview of the rationales and decision-making process Canadian universities often use to make admission decisions. We will also dispel the myths and rumours that often surround the admission process; expect an interactive and lively discussion!

8- Fit Matters: Choosing a Business School

Dr. Simon Ford, Simon Fraser University

Carissa Kocsis, University of Victoria

There are so many factors to consider when choosing a business school: curriculum delivery, location, career aspirations, reputation, student community, work and international experience opportunities to name just a few. How do you compare program structures and decide which one is best for you? In this session we'll discuss the important factors you should consider when making that choice, including maximizing your experience, achieving your career goals, avoiding common pitfalls and finding the right fit.

Workshop Presenters

Paola Baca, University of British Columbia

Paola has more than 18 years of leadership experience in higher education including undergraduate admissions, strategic enrolment management, research & data analysis, student academic services, and international student recruitment. She is currently the co-Director (interim) of UBC's Undergraduate Admissions Office. She has also held leadership roles at the Sauder School of Business and the UBC International Student Initiative. Paola holds a M.Ed. in Higher Education and a BA (Hons.) in Political Science and International Relations from UBC. She is a Program Advisor for UBC's leadership development program, Managing@UBC, and a UBC Internal Coach.

Shennella Blake, University of Alberta

Shennella began her career in admissions but soon transitioned to student recruitment, working with both Canadian and international markets for the University of Alberta. She has extensive experience in higher education, specifically in areas of admission, recruitment, student communications and strategy, and is currently the Assistant Registrar, Recruitment and Student Engagement.

Dr. Douglas L. Christiansen, Vanderbilt University

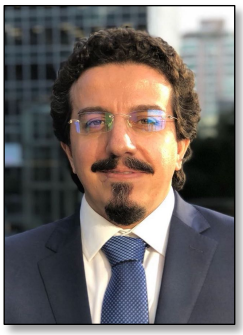
Douglas L. Christiansen holds a Ph.D. in higher education administration and is Vanderbilt University's vice provost for university enrollment affairs, and dean of admissions and financial aid. Dr. Christiansen is also an associate professor of public policy and higher education in the Department of Leadership, Policy and Organizations at Vanderbilt's Peabody College. Currently, he is serving as Chair for the Board of Trustees of the College Board. In his role as vice provost, Dr. Christiansen serves as the university's chief enrollment strategist. He has been in higher education and admissions for almost thirty years.

Paul DeGrace, Simon Fraser University

Paul is the Co-op Education Coordinator for the Faculty of Environment at Simon Fraser University. In this role he manages graduate and undergraduate Co-op programs in Geography, Environmental Science, Archeology, Resource Management, GIS, Earth Sciences and Sustainability. He has 20 years of experience teaching, counselling, and providing support and guidance to university students looking to maximize their career potential and gain valuable related employment experience prior to graduating.

Chris Dembiske, Simon Fraser University

Chris is a Student Aid Officer with Simon Fraser University's Financial Aid and Awards Office. She has had over seven years' experience assisting students to fund their educations at both private and public post-secondary institutions throughout the Metro Vancouver. She has delivered workshops on behalf of the Financial Consumer Agency of Canada and has sat on the Executive Committee for the Association of Awards Personnel of BC. She currently works, lives and plays on the unceded and traditional territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh Úxwumixw (Squamish), səl̓ilw̓ətaʔɬ (Tsleil-Waututh) and kʷikʷəƛ̓əm (Kwikwetlem) Nation.



Dr. Mir Sohail Fazeli MD, PhD

Dr. Fazeli is a physician epidemiologist. His research expertise includes designing and conducting clinical trials and systematic literature reviews of health interventions. He has been an instructor to undergraduate and graduate students for many years as well as an adviser, and a mentor to a number of students many of which are now working as physicians, nurses, and mid-wives within healthcare systems.

Dr Simon Ford, Simon Fraser University

Simon Ford is an innovation and entrepreneurship lecturer and Academic Director at the Beedie School of Business, Simon Fraser University, where he is responsible for overseeing the Business Minor. He is an advocate of co-curricular experiential learning and supports SFU student organizations such as CaseIT, Enactus, JDC West and SFU Aerospace. He previously studied and worked at the University of Cambridge, and his latest research explores the use of 3D printing to improve sustainability and its application in the education system.

Dr. Janet Ip, MD CCFP FCFP

Dr. Janet Ip is a Family Physician, Clinical Instructor with the UBC Department of Family Practice, and Medical Director of Cambie Village Family Practice. Originally from Winnipeg, she studied three years of Biopsychology at UBC before completing her MD degree at UBC and her CCFP degree following her Family Practice residency at UBC. She has been an interviewer for UBC Family Practice Residency Admissions as well as an examiner for the CCFP licensing exam for graduating residents nationwide. She practices family medicine with a special interest in dermatology and currently teaches family medicine residents in the field of dermatology, both as a lecturer and clinician.

Carissa Kocsis, University of Victoria

Carissa completed her Bachelor of Commerce (BCom) through the Gustavson School of Business with a specialization in Service Management. She transitioned into her current role as a Recruitment, Admissions, Advising Officer after obtaining domestic and international student recruitment, programming and communications work experience. Carissa has held positions with a social enterprise in Thailand, the Gustavson School of Business' International Summer Institute for Business Management (ISIBM) and the University of Victoria's Orientation team. Carissa is an active member of NACADA: The Global Community for Academic Advising and plays a key role in helping students navigate the BCom admission process and structure their undergraduate degree.

Dr. Edward Mills PhD, FRCP Edin.,

Dr. Mills is a medical researcher involved with clinical trials in low and middle income (LMIC) settings. He leads adaptive clinical trials and mega-cohorts for The Bill & Melinda Gates Foundation and is a Professor at McMaster University and the University of Rwanda.

Alyson Murray, Dalhousie University

Alyson has worked in enrolment services for seven years and currently serves as Associate Registrar and Director of Recruitment & Admissions at Dalhousie. Her work in higher education has spanned marketing and communications, recruitment, and admissions. Alyson completed a Bachelor of Science at Dalhousie, an Advanced Diploma in Public Relations at NSCC and an Executive Master's in Corporate Communication at IE University. She has been recognized as one of the top 50 emerging leaders under 40 in Atlantic Canada.

Simon Nascimento, University of Chicago

Born in Catalao, a small town a few hours south of Brazil's capital city, Simon attended the University of Chicago and earned a bachelor's degree with honors with a concentration in International Studies. He joined UChicago's Office of College Admissions in 2010, and is now the director of international admissions, and is in charge of reading applications and recruiting students from Africa, Canada, and Latin America.

Ryan Pyear, University of Waterloo

Ryan is a Marketing and Undergraduate Recruitment Specialist for the Faculty of Engineering at the University of Waterloo. He joined the university in 2015, and among other things helps students gain an understanding of the differences between engineering programs offered to help find their fit in a direct entry engineering environment. Ryan has been involved in university student recruitment for 13 years at two different institutions.

Amy Roberson, Cambridge University, England

Amy is a Deputy Student Recruitment Manager at the University of Cambridge in the UK. Amy studied at the University of Birmingham in the UK and spent a year at the University of Iowa in the US. After graduating and travelling for six months Amy worked in UK Student Recruitment at Cambridge before moving to the International team.

Ashley Sevadjian , University of Glasgow, Scotland

Ashley is the Senior International Officer for Western USA at the University of Glasgow. After working in UK Recruitment almost three years, she is now based in California, where she helps interested students from North America take steps towards studying in Scotland. Ashley is a North American who has worked, lived, and studied in Scotland over the last twelve years, and has first-hand experience with the UK application process.

Monique Sullivan, University of Calgary

Monique Sullivan is a two-time Olympian and mechanical engineering graduate, currently in graduate school studying engineering education. Her research focuses on designing conditions to optimize motivation and performance for engineering students.

Jo Turner, UCL, England

Jo Turner has a background in Linguistics and a master's degree in Education. Her experience in international education spans more than 20 years and includes teaching English in Germany and Austria; developing UCL's Study Abroad programme and for the past six years recruiting students from the Americas. Jo travels regularly to Canada to visit schools and universities and attend recruitment events. UCL is currently home to the largest number of international students in the UK.

Session Schedule

All information sessions will be held on level one of the Vancouver Convention Centre (West Building). The presentations are scheduled for approximately 45 minutes. Sessions are popular so please arrive early to avoid disappointment.

Time	Room 110	Room 111/112	Room 116/117
1:30 PM	#7, Canadian Admission	#5, Engineering	#3, Financing Education
2:30 PM	#1, Applying to the US	#8, Business	#4, Medical School
3:30 PM	#2, Essay Writing	#6, UK Schools	#7, Canadian Admission

Biology 11

Name _____

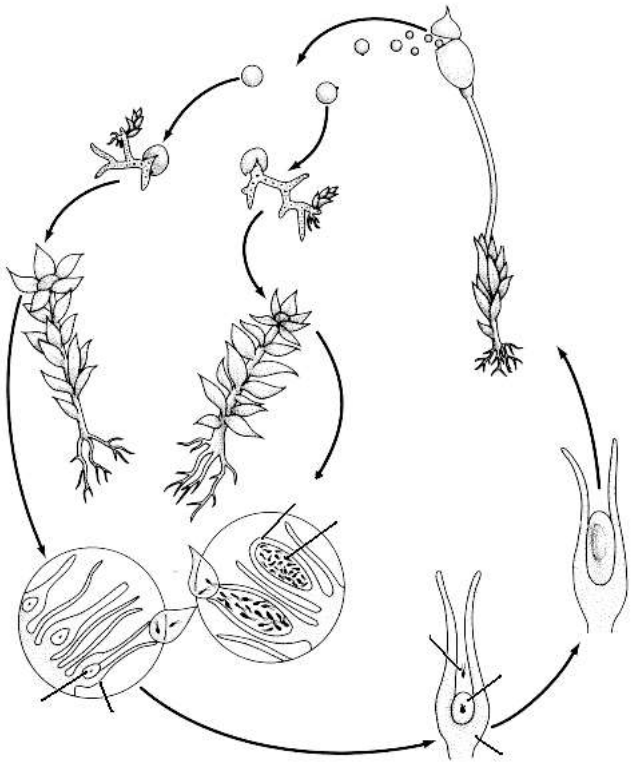
Date _____ Block _____

Mosses & Ferns: Seedless Plants

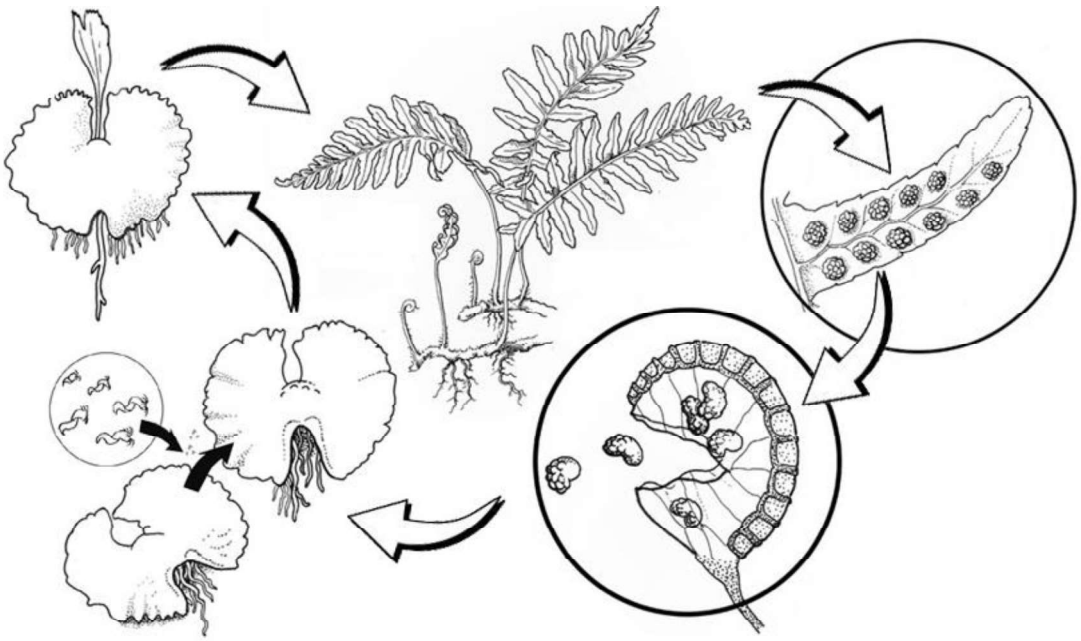
You are responsible for the material in Chapter 21, especially about mosses and ferns. You do not need to go into detail about hornworts and liverworts; know only that they are non-vascular terrestrial plants. Answer the questions on a separate piece of paper.

Questions

1. Name the phyla to which mosses and ferns belong.
2. Describe the requirements for life on land.
3. How are bryophytes similar to algae?
4. Describe the physical characteristics of bryophytes.
5. Draw and label the parts of a typical moss.
6. A small plant is found growing in the desert. Explain why this plant is probably not a moss.
7. What is vascular tissue? Name two types and briefly state their functions.
8. What are tracheophytes named after?
9. How are ferns adapted to life on land?
10. Often, the gametophytes of ferns are hermaphroditic, meaning they contain both female and male sex organs. However, they rarely self-fertilize. Explain.
11. Even though ferns survive under many of the same environmental conditions as mosses, ferns are able to grow much larger than mosses. Why is this so?
12. What characteristics of mosses make them useful?
13. What are two ways in which ferns are used by people?
14. Label the diagram of the life cycle a moss. Then write the main points of the cycle, starting with the spore.



15. Label the diagram of a fern life cycle.



Biology 11
Ms. To

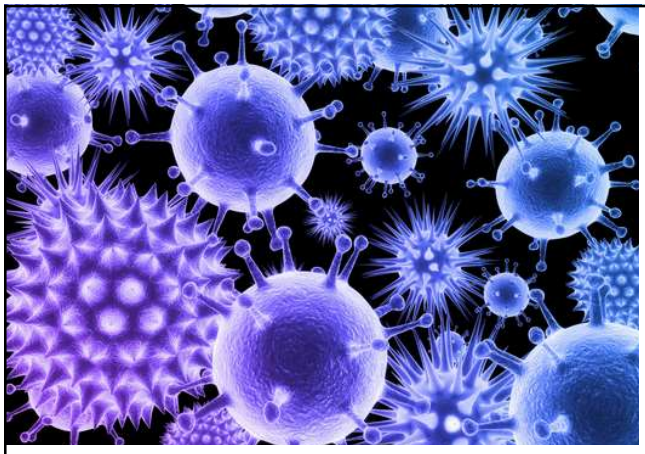
Name: _____

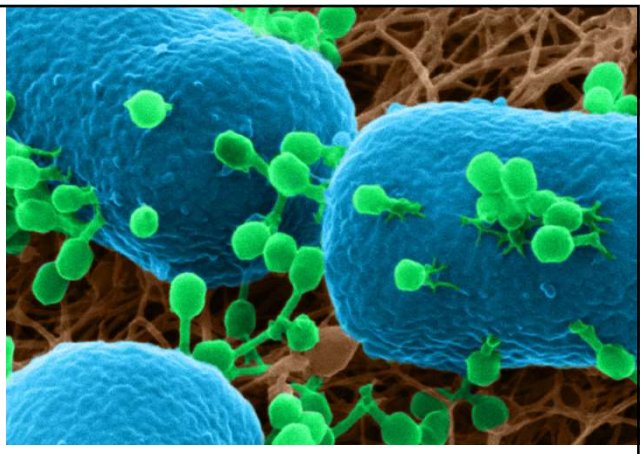
Date: _____ Block: _____

Non-Vascular Plants Vocabulary Practice

1. Photosynthesis happens in the ___ of cells.	
2. Cellular respiration happens in the ___ of cells.	
3. ___ is the process of getting usable energy from glucose.	
4. ___ is described by this equation: **sunlight + CO_2 + H_2O ➔ $C_6H_{12}O_6$ + O_2**	
5. **$C_6H_{12}O_6$** is the chemical formula for ___.	
6. ___ is the green pigment that helps absorb light energy.	
7. Plants are ___, meaning they are made of many cells.	
8. ___ is a term that refers to organisms that can make their food from inorganic sources.	
9. Cells that have nuclei are ___.	
10. ___ refers to organisms that make food by using light energy and carbon dioxide.	
11. The ___ is a structure surrounding the cell membrane that provide support and protection.	
12. Plant cell walls are made of ___.	
13. Green algae are part of the group called ___.	
14. Algae are all ___; they live in the water.	
15. Mosses are part of the group called ___.	
16. Plants have complicated life cycles called ___.	
17. ___ is the term for sex cells.	
18. The generation that makes sex cells is the ___.	
19. The generation that makes cells for asexual reproduction is the ___.	

20. A ___ forms when 2 gametes fuse.	
21. The terms for the process of fusing gametes are ___ and ___.	
22. The gametophyte and sporophyte of *Ulva* are ___; they look the same.	
23. When sex cells look the same, we say that they are ___.	
24. Haploid or diploid? a. Sporophyte b. Gametophyte c. Egg d. Sperm e. Zygote f. Spore	a. _____ b. _____ c. _____ d. _____ e. _____ f. _____
25. The ___ of mosses cannot live alone.	
26. The dominant stage of mosses is the ___.	
27. ___ produces cells with half the number of chromosomes as the parent cell.	
28. ___ results in two genetically identical nuclei.	
29. ___ is the movement of particles from high concentration to low concentration.	
30. ___ is the movement of water across a membrane to equalize solute concentrations.	





Viruses

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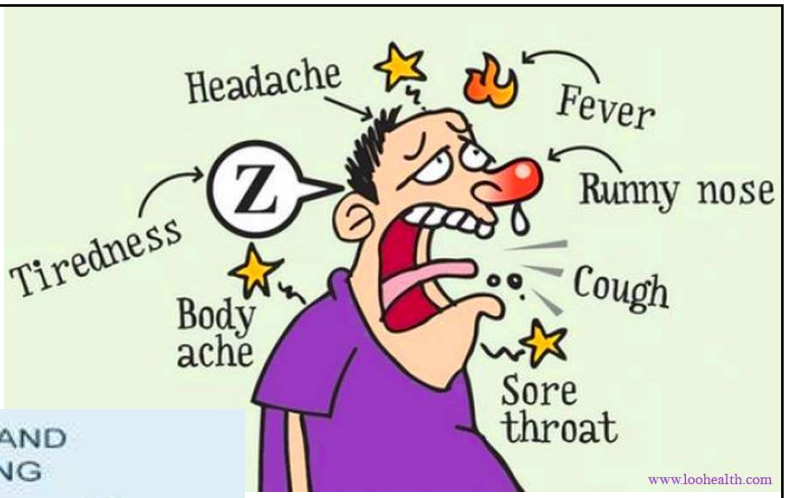
Primer

Tell each other about your most unpleasant experience with viruses. The infected could have been you, or someone you know



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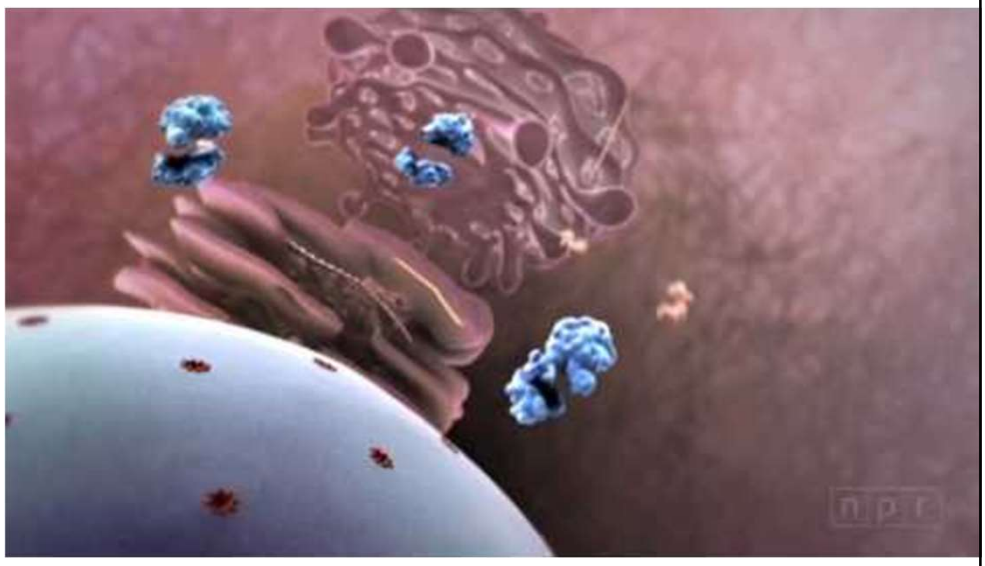
Retell the main points of the video using these terms

DNA
RNA
ribosomes
envelope
protein markers
receptors
DNA replication
endocytosis
polymerase
budding
white blood cell
macrophage
phagocytosis



https://www.youtube.com/watch?v=Rpj0emEGShQ

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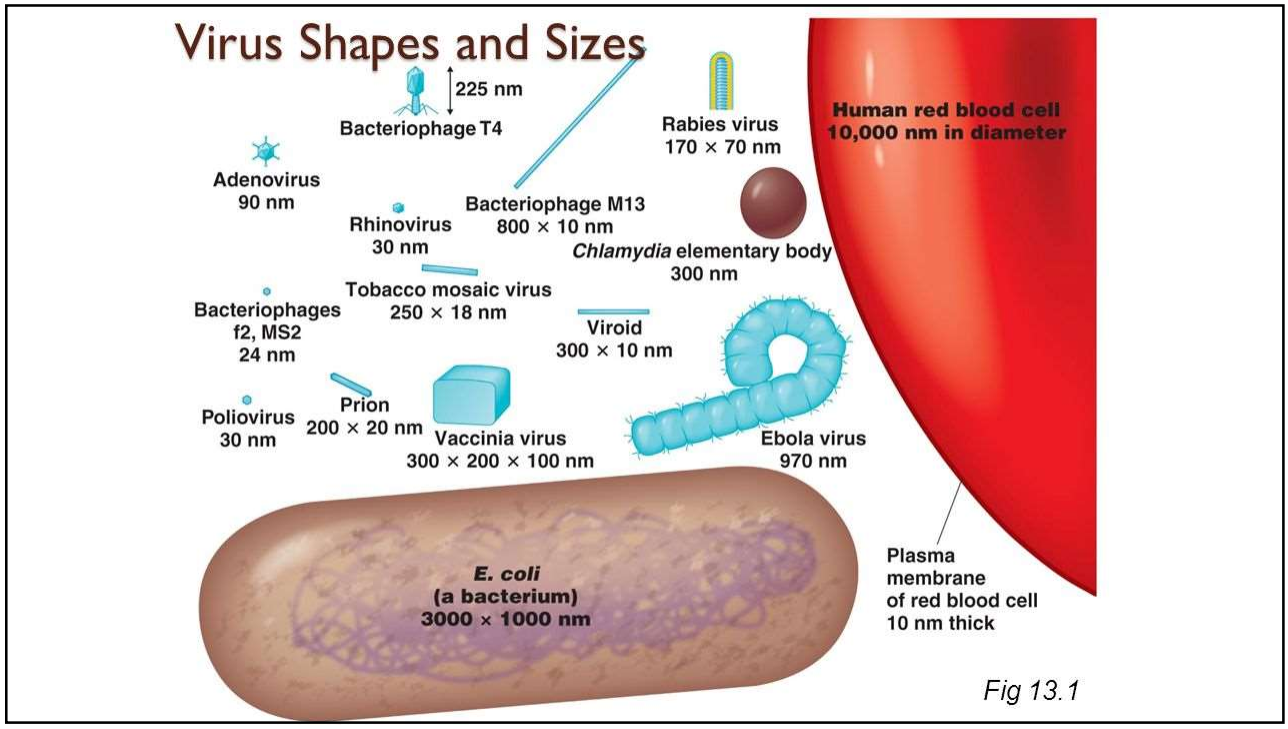

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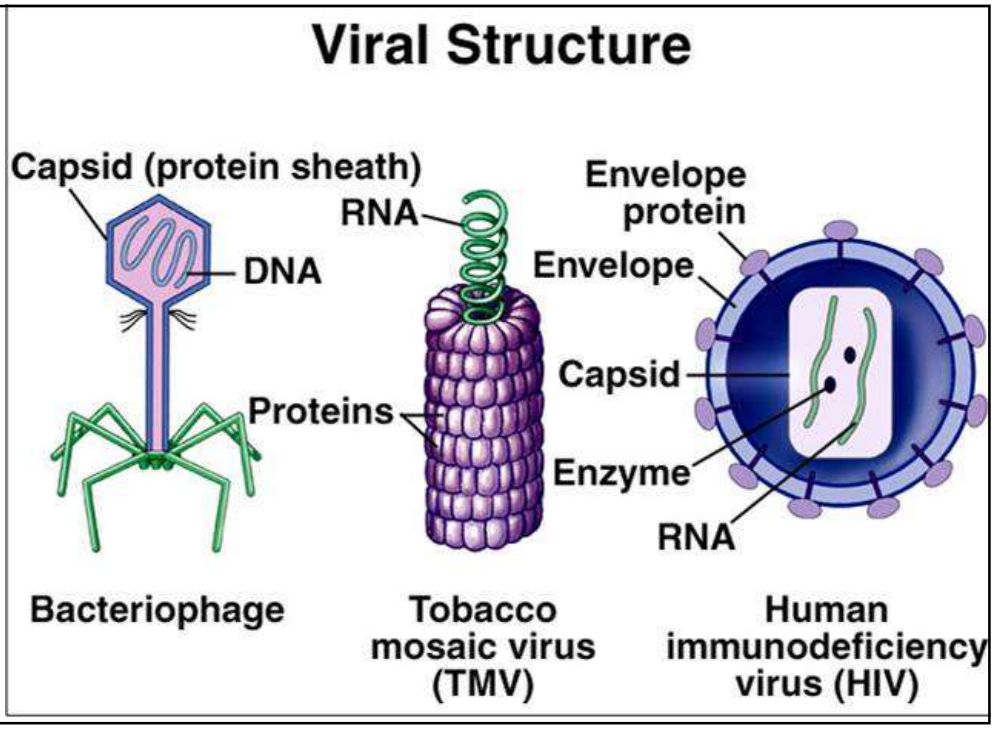
What are the common components of viruses?



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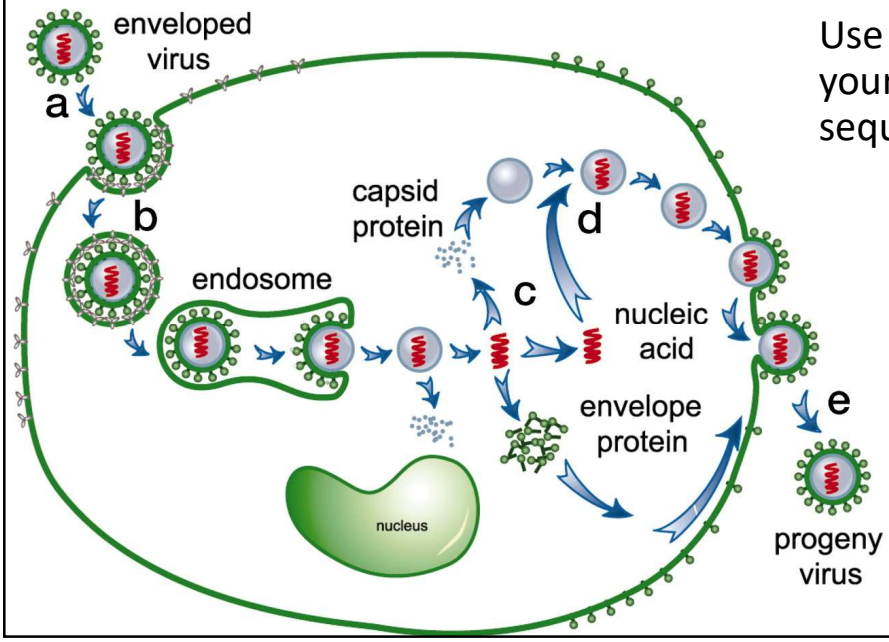
Viruses with envelopes



Use the diagram and tell your partner the sequence of events **a** to **e**

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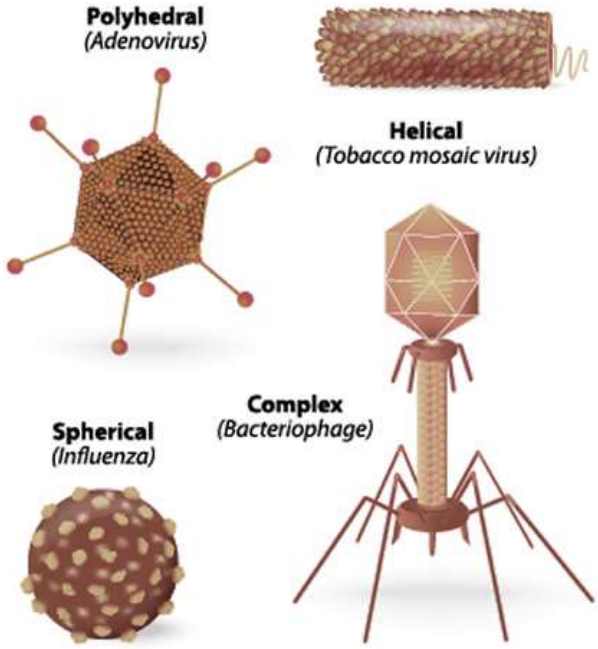
Virus Shapes



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In what way is a sunflower seed an appropriate analogy for a virus?

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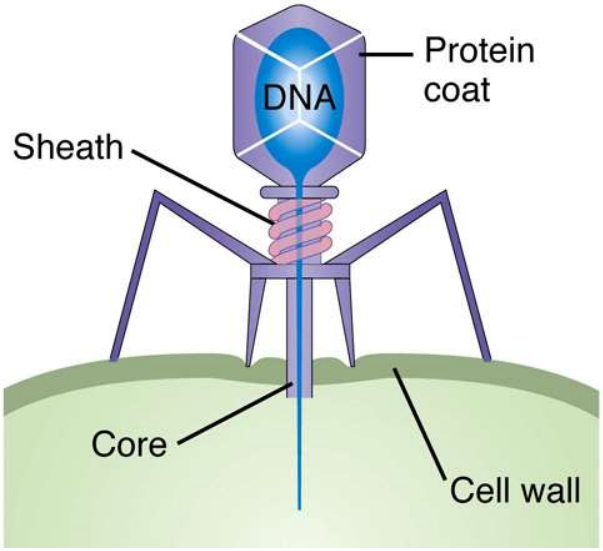
Bacteriophage

"bacteria eater"



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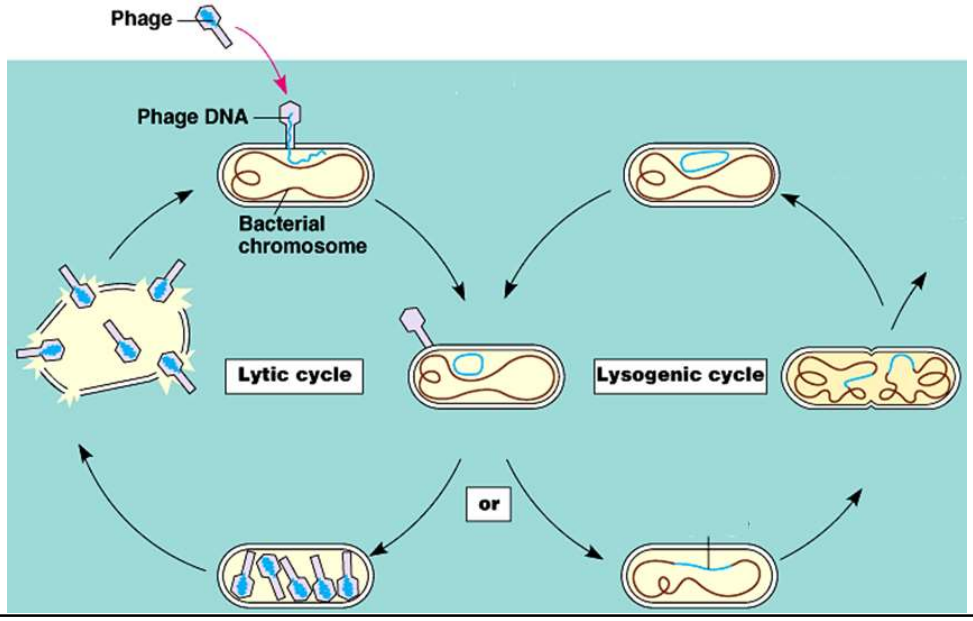
Describe what is happening in the two cycles



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Review

- What are the characteristics of viruses?
- What types of nucleic acids do viruses contain?
- Describe the structure of a virus
- Are viruses living organisms? Explain
- Describe the two life cycles of viruses

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Review

- What does ‘virulent’ mean?
  - Why is it appropriate for a lytic virus?
- What does ‘temperate’ mean?
  - Why is it appropriate for a lysogenic virus?
- Some people experience recurring viral infections such as cold sores when they are under stress or spend too much time in the sun. How can you explain this?
- How might lysogenic viruses be useful?

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Human Immune System Overview

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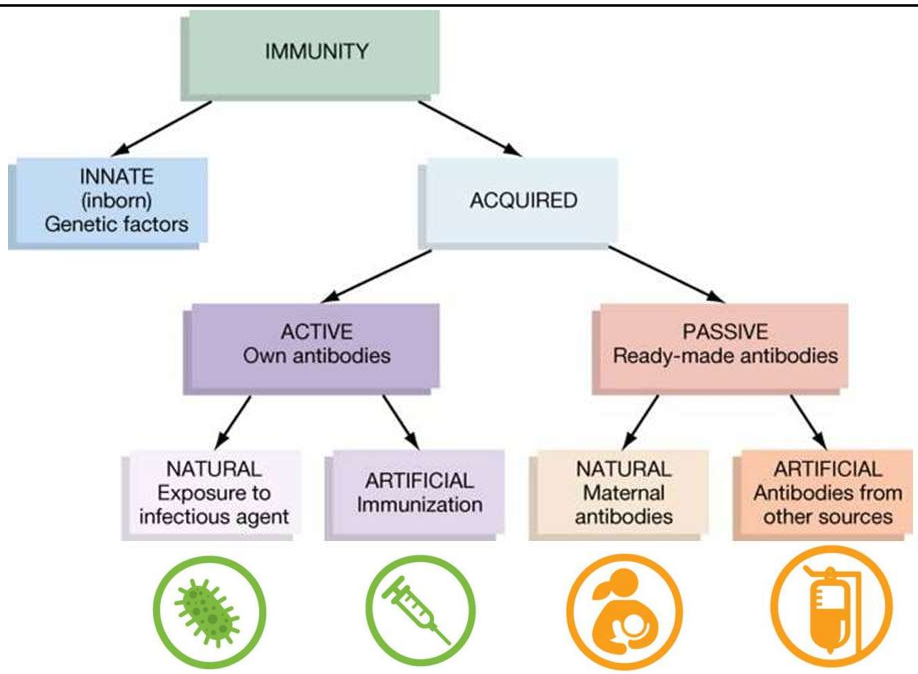

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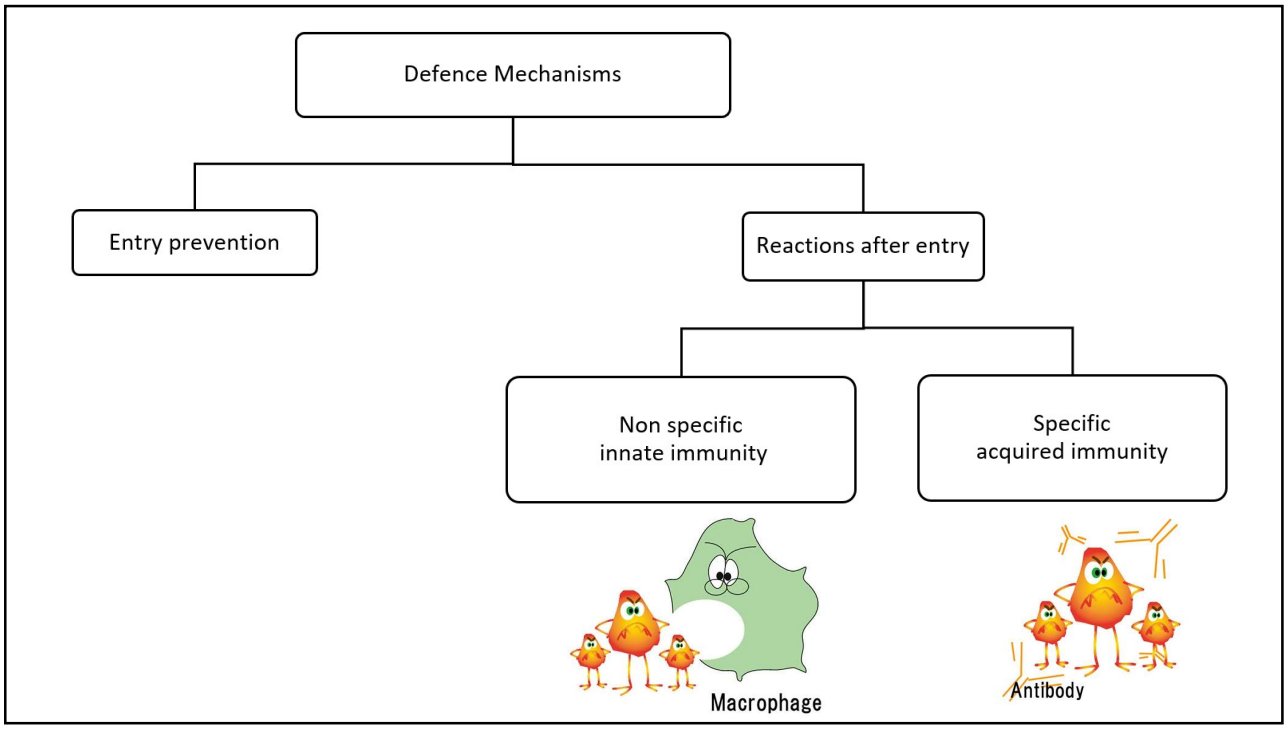

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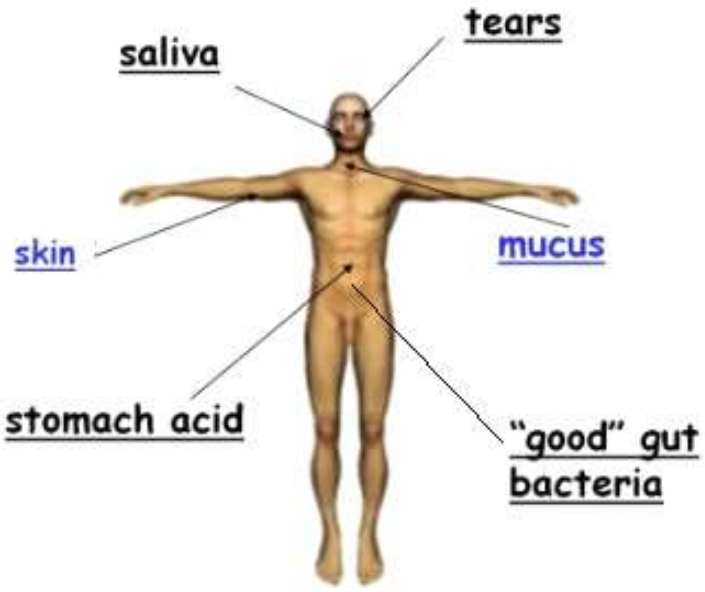
Entry Prevention: First line of defence

- Barriers
- Expulsion



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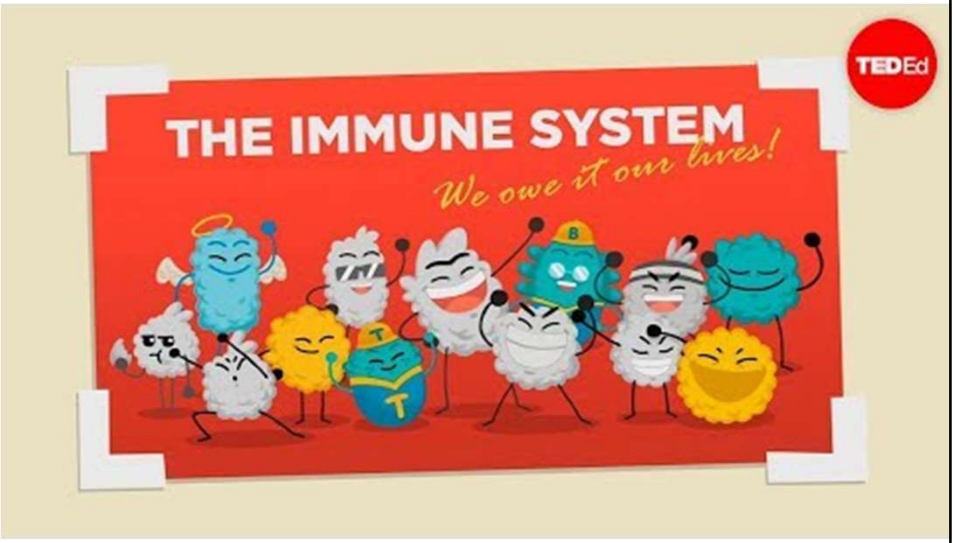
Immune Response Intro

note what these do:

- leukocytes
- antigens
- phagocytes
- macrophages
- killer T-cells
- helper T-cells
- B-cells
- memory B-cells
- antibodies
- fever
- inflammation
- immune system



https://www.youtube.com/watch?v=PSRJfaAYkW4

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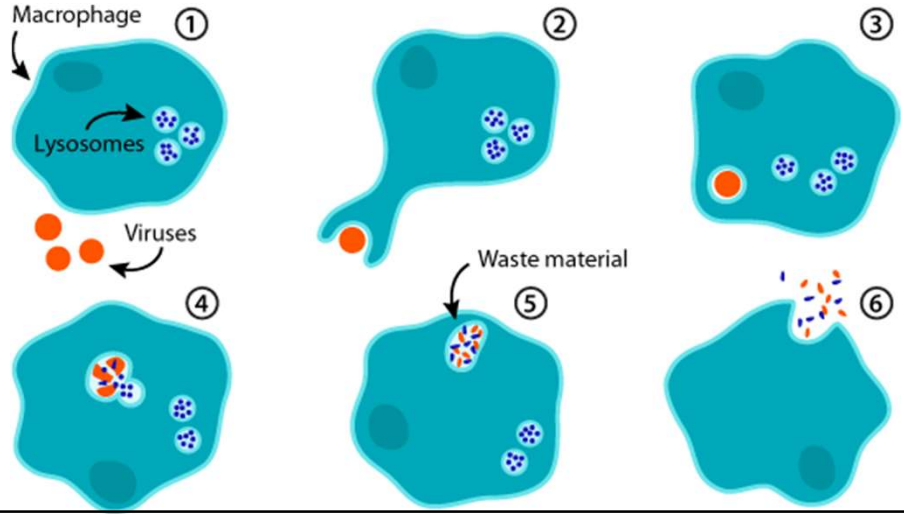
Non-specific (innate) immunity

- general inflammatory response
- macrophages (type of phagocyte)



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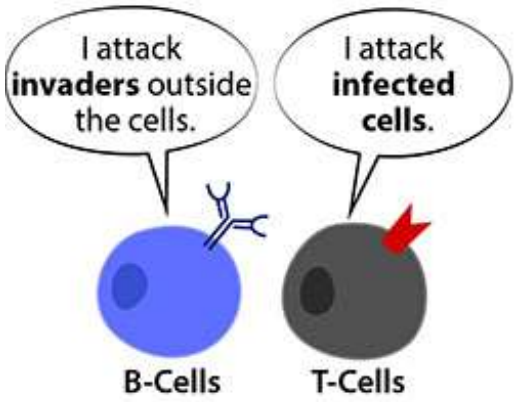
Acquired Response Video

- https://www.youtube.com/watch?v=31zZiL45740
- Key terms:
  - phagocyte
  - macrophage
  - antigens
  - antibody
  - T cells (originate in bone marrow and mature in **thymus**)
  - B cells (matures in bone marrow of humans; named for where they were discovered in birds)



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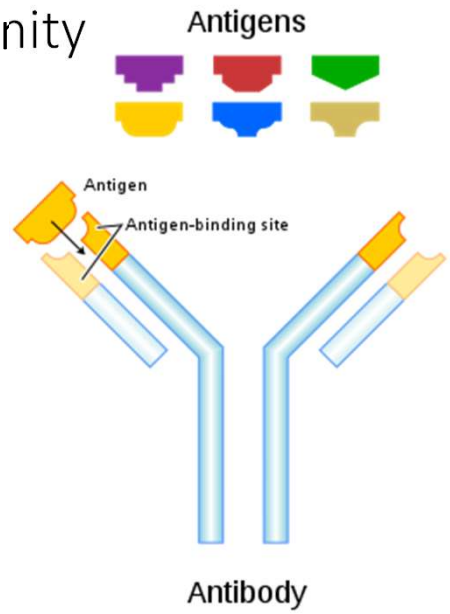
Specific (adaptive/acquired) immunity

- antibodies
  - tag specific pathogens/infected cells for WBCs to destroy
  - deactivates viruses
  - created by B cells (plasma cells)
  - triggered by antigens ("**anti**body **gen**erator")



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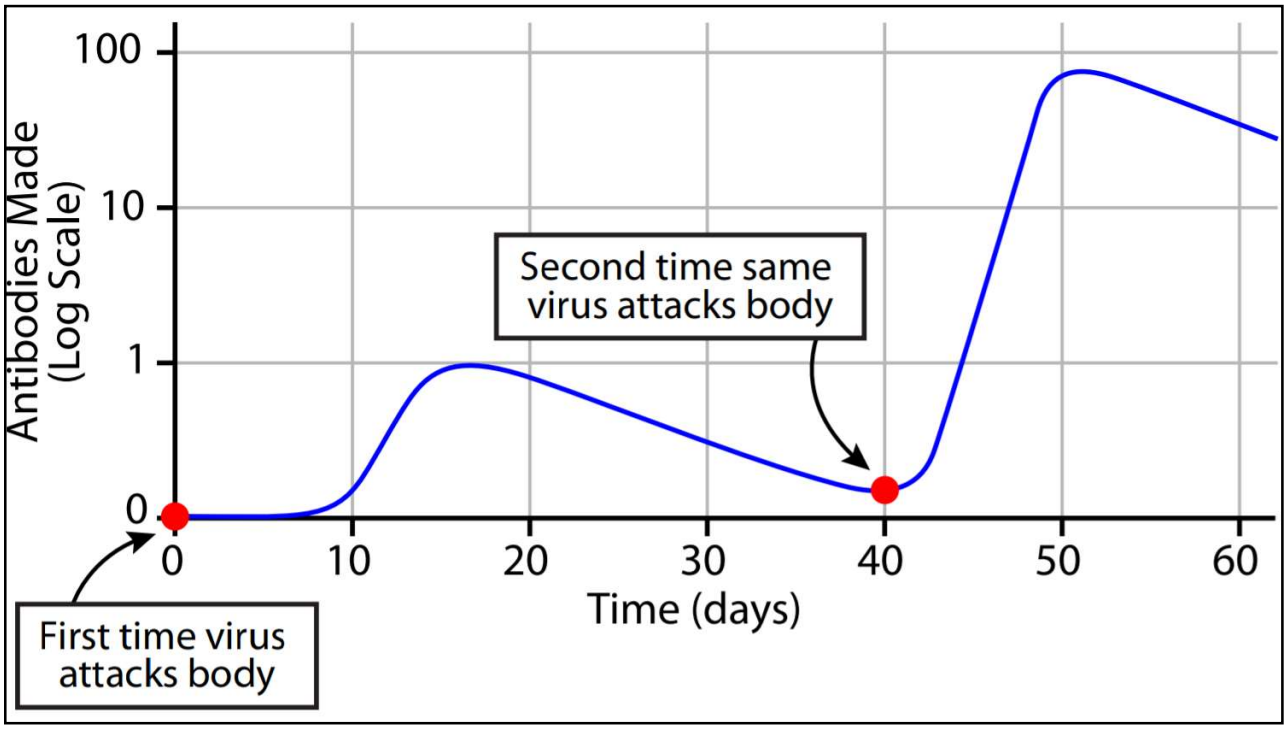

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Concept map

Get a white board and link these terms into a concept map: (terms in circles; arrows from one circle to another with verbs to create sentences)

- pathogen
- macrophage
- infected cell
- helper T cell
- killer T cell (cytotoxic T cell)
- B cell
- plasma cell
- memory B cell
- antigen
- antibody

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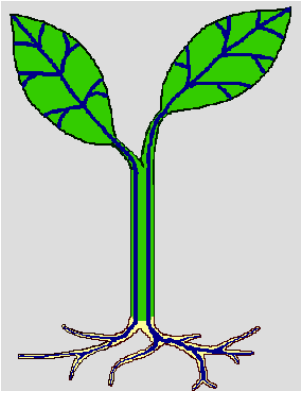
Vascular Plants

In humans, the cardiovascular system is made of the heart (*cardio*) and blood vessels (*vascular*). Its function is to move nutrients and waste inside the body, so it's called the **internal transport system**. Vascular plants also have an internal transport system made of specialized **vascular tissues**. You can see these as **veins** in the leaves of plants.

The large vein in the middle is called the midrib, and as veins branch off, they get smaller and smaller. Veins give structural support to leaves as well. Imagine how floppy they would be without veins!

The development of vascular tissues was in response to the challenges of living on land. Plants that grew taller had an advantage when it came to getting sunlight. Those that had strong supporting structures were able to grow taller. **Tracheid cells** have thick, strong cell walls that strengthen stems and help plants stand up against gravity. Vascular plants belong to the phylum **Tracheophyta**, which is named for the tracheid cells. It may help to remember that your windpipe is scientifically called the trachea, and that it is a hard tube.

However, growing taller meant that getting enough nutrients to all cells became a problem. Plants that had an internal transport system were better able to survive. They had a way of moving nutrients and water from the roots up to the leaves. Food made in the leaves by photosynthesis could also move down to the cells in the stem and roots. The diagram below shows vascular tissue in blue and shows how they are connected from the leaves through the stem and then into the roots. The darker spots on the celery are vascular bundles that run along the length of the stalk.



There are two types of vascular tissue: **xylem** and **phloem**. Xylem tissue helps move water from the roots up to all parts of the plant. Phloem moves nutrients up the plant, and food down the plant.

The three groups of tracheophytes that we will study in this course are ferns, gymnosperms, and angiosperms.

Ferns

Ferns are a familiar sight. They grow readily in the temperate rainforest, and they are often used as ornamental plants in landscaping.

Ferns are well adapted to living on land. They have vascular tissues, strong roots, underground stems called **rhizomes**, and large leaves called **fronds**. The fronds have a waxy coating called a **cuticle** that helps prevent water loss.

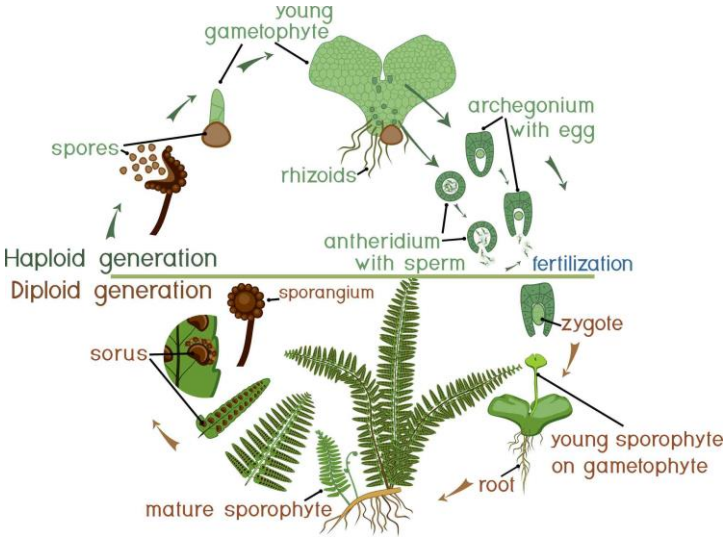
Like all other plants, ferns undergo **alternation of generations**. What we recognize as ferns is the **diploid sporophyte**. Unlike mosses, the dominant generation in ferns is the sporophyte. Fern sporophytes often live for many years. In some species, the fronds die in the fall, but the rhizomes live through winter and sprout again the following spring.

Fern sporophytes produce haploid spores on the underside of their fronds. Spores are produced in tiny containers

called **sporangia**. The sporangia are grouped into large clusters called **sori** (singular: sorus).

When spores are ripe, they care carried by wind and water over long distances. If environmental conditions are right for a spore to germinate, it develops into a **haploid** heart-shaped **gametophyte** called a **prothallium**. The prothallium is quite small and often overlooked. **Antheridia** and **archegonia** are found on the underside of the prothallium. When the antheridia mature, **sperm** are released. There must be water so that the sperm can swim to the **eggs** in the archegonia. When a sperm **fertilizes** an egg, a diploid **zygote** is produced. The zygote then grows into a new sporophyte plant. Similar to mosses, the sporophyte grows out of the gametophyte, because the egg was fertilized in the archegonium on the gametophyte. Unlike mosses, fern sporophytes do not rely on the gametophyte for food. They make their own by **photosynthesis**. The fern gametophyte lives for only a short time and lacks vascular tissue.

Below is a diagram of the fern life cycle. Try to explain the steps, starting with the release of spores.



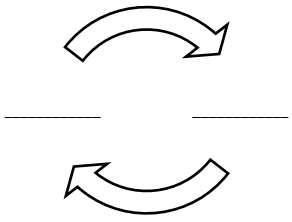
From the diagram, it may seem like the sperm is fertilizing eggs from the same plant, but this usually is not the case. **Self-fertilizatio**n creates less genetic diversity than **cross-fertilization**. One way to prevent self-fertilization is to have eggs mature after sperm. The archegonium remains closed for a while after sperm are released. In that time, the sperm will swim to a different plant.

Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

Introduction to Vascular Plants and Ferns

1. What is the function of an internal transport system?	
2. What are two functions of vascular tissues?	
3. What advantage do taller plants have over shorter plants?	
4. Why are vascular plants called tracheophytes?	
5. What are the two types of vascular tissues, and what are their functions?	
6. What characteristics make ferns suited to terrestrial life?	
7. Draw a fern sporophyte with sori. Label the frond.	
8. To alternate is to go back and forth between two states. What are the two states of *alternation of generation* in plants?	 _____ _____

9. Draw a diagram of the fern life cycle. Label the spores, prothallium, archegonium, antheridium, sperm, egg, zygote, young sporophyte, and mature sporophyte. **Indicate where meiosis occurs**.	
10. Use words to describe the life cycle of ferns. Use short phrases and a flow chart format. Include the phrase "meiosis occurs to produce ____." This is a cycle, so connect back to the first step.	Spores released from sporangium →

11. What is needed for sexual reproduction to occur in ferns?	
12. What is the difference between self-fertilization and cross-fertilization?	
13. How is self-fertilization prevented in ferns?	
14. How are ferns similar to mosses?	
15. How are fern life cycles different from moss life cycles?	
16. Why are ferns able to grow large, but not mosses?	

Fern Vocabulary Practice

(some terms reviewed from non-vascular plants)

1. Ferns use ___ tissue for internal transport.	
2. In terrestrial plants, water moves from ___ to ___.	
3. ___ happens in the leaves of plants to produce food.	
4. Leaves produce ___, which can be used by cells for food.	
5. The carbon in food comes from ___ in the atmosphere.	
6. The tissue that moves water is ___.	

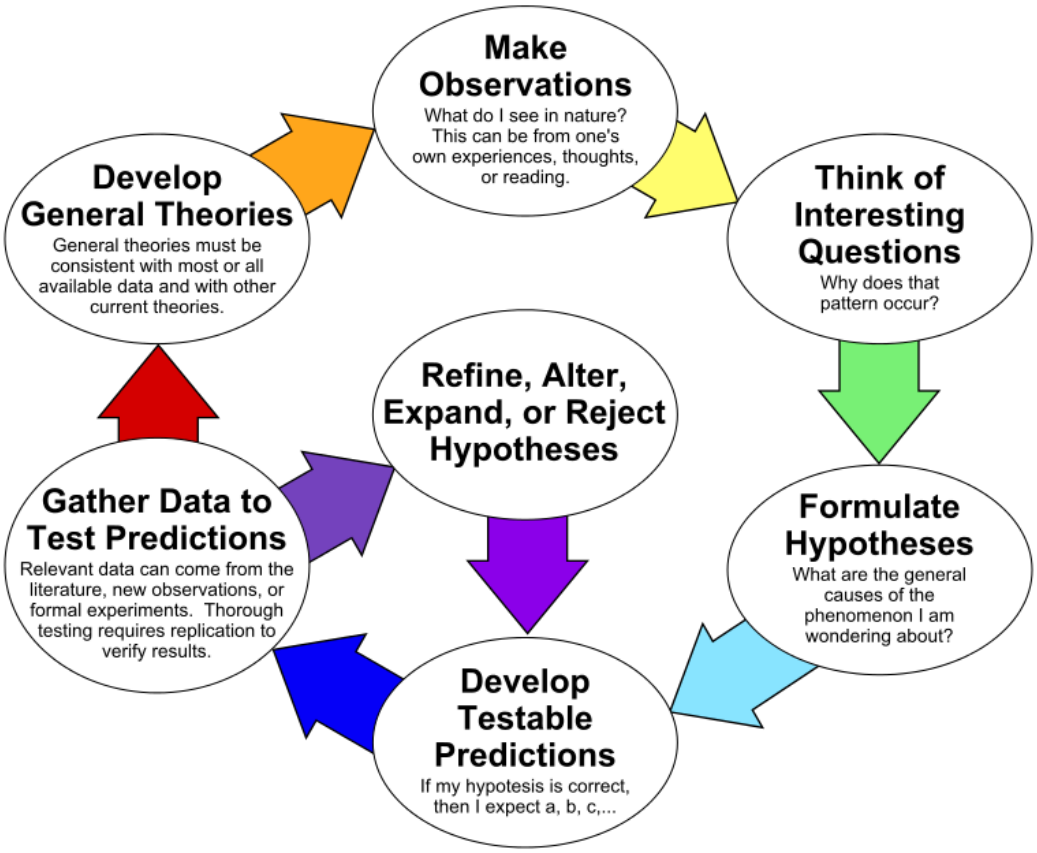
7. The tissue that moves nutrients and the products of photosynthesis is ___.	
8. The haploid generation of plants is the ___.	
9. The diploid generation of plants is the ___.	
10. ___ is abbreviated as (n).	
11. The ___ is the dominant generation in ferns.	
12. The leaves of ferns are called ___.	
13. The leaves are covered by a ___ to minimize water loss.	
14. The underside of fern fronds contains ___, clusters of sporangia.	
15. Underground stems, called ___, help ferns to remain alive over winter.	
16. In ferns, meiosis occurs to produce haploid ___.	
17. Eggs and sperm are female and male ___.	
18. Sperm are made in ___.	
19. Eggs are made in ___.	
20. The ___ is formed by fertilization.	
21. The fern gametophyte is known as a ___.	
22. The process of ___ is when eggs and sperm from the same plant meet and fuse.	
23. Ferns require ___ for sexual reproduction.	

Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

The Scientific Method as an Ongoing Process



1. Define:
   a. Hypothesis

   b. Experimental group

   c. Control group

   d. Independent/manipulated variable

   e. Dependent/responding variable

Smithers thinks that a special juice will increase the productivity of workers. He creates two groups of 50 workers each and assigns each group the same task (in this case, they're supposed to staple a set of papers). Group A is given the special juice to drink while they work. Group B is not given the special juice. After an hour, Smithers counts how many stacks of papers each group has made. Group A made 1,587 stacks, Group B made 2,113 stacks.

2. Identify the:
   a. Hypothesis

   b. Control Group

   c. Experimental Group

   d. Independent Variable

   e. Dependent Variable

3. What should Smithers' conclusion be?

4. How could this experiment be improved?

Homer notices that his shower is covered in a strange green slime. His friend Barney tells him that coconut juice will get rid of the green slime. Homer decides to check this this out by spraying half of the shower with coconut juice. He sprays the other half of the shower with water. After 3 days of "treatment" there is no change in the appearance of the green slime on either side of the shower.

5. What was the initial observation?

6. Identify the:
   a. Hypothesis

   b. Control Group

   c. Experimental Group

   d. Independent Variable

   e. Dependent Variable

7. What should Homer's conclusion be?

Bart believes that mice exposed to radiowaves will become extra strong (maybe he's been reading too much Radioactive Man). He decides to perform this experiment by placing 10 mice near a radio for 5 hours. He compared these 10 mice to another 10 mice that had not been exposed. His test consisted of a heavy block of wood that blocked the mouse food. he found that 8 out of 10 of the radiowaved mice were able to push the block away. 7 out of 10 of the other mice were able to do the same.

Identify the:

8. Control Group

9. Independent Variable

10. Dependent Variable

11. What should Bart's conclusion be?

12. How could Bart's experiment be improved?

Write a hypothesis for each of the claims. Then identify the given factors if a study were done to investigate the claim.

13. Cigarette smoking increases the risk of lung cancer.

    Hypothesis: If _____,

    then _____

    Independent variable: _____ Control group: _____

    Dependent variable: _____ Experimental group: _____

14. Eating breakfast increases performance in school.

    Hypothesis: If _____,

    then _____

    Independent variable: _____ Control group: _____

    Dependent variable: _____ Experimental group: _____

15. The deer population decreases in the winter due to lack of food.

    Hypothesis: If _____,

    then _____

    Independent variable: _____ Control group: _____

    Dependent variable: _____ Experimental group: _____

16. Hummingbirds are attracted to the colour red.

    Hypothesis: If _____,

    then _____

    Independent variable: _____ Control group: _____

    Dependent variable: _____ Experimental group: _____

17. Choose one of the claims above and design an experiment to investigate that claim.

Biology 11
Ms. To

Name: _____

Date: _____ Block: _____

Algae

You are responsible for the material in the following sections of Chapter 20:

- Characteristics of Algae (whole section)
- Groups of Algae
  - Intro
  - Chlorophyta—The Green Algae
- Reproduction in Algae
  - Intro
  - Reproduction in *Ulva*
- Where Algae Fit into Our World

Questions

1. What are the defining characteristics of plants?
2. How does mitosis differ from meiosis?
3. What are gametes?
4. What is the difference between sexual and asexual reproduction?
5. What are two characteristics of algae?
6. Into which two kingdoms does the textbook classify algae?
7. List the three phyla of multicellular algae and their common names.
8. Algae do not have specialized transport tissues, and so they do not have true stems, leaves and leaves. Draw a diagram of multicellular algae and label the blade, stipe and holdfast.
9. What advantages are there of living in the water?
10. Why are algae only a few cells thick?
11. What major disadvantage is there about being a photosynthetic organism in the water? How do algae get around that?
12. Define isogamy, syngamy, heterogamy, sporophyte and gametophyte.
13. How is alternation of generations an effective way of ensuring the survival of a species?
14. How would life on earth be different if all algae suddenly became extinct?
15. All life comes from life. A pond has dried up and appears to lack life. Later, this pond fills with water again. Algae begin to grow. How could you explain the growth of algae in this pond?
16. Label the diagram. Be sure to note if each stage is haploid or diploid.

Life Cycle of Ulva: Alternation of Generations