Organizing Biodiversity

Miss Yorke

Bio 40S

Learning checklist – Organizing Biodiversity

Learning increases when you have a goal to work towards. Use this checklist as guide to track how well you are grasping the material. In the center column, rate your understand of the topic from 1-5 with 1 being the lowest and 5 being the highest. Be sure to write down any questions you have about the topic in the last column so that you know what you have yet to learn.

Outcomes	Understanding	Questions
Define the concept of biodiversity in terms of ecosystem, species and genetic diversity		
Discuss the difficulty in determining a definition of species. Examples: hybrids such as mules, phenotypic variations in a species, non-interbreeding sub-populations…		
Describe the dynamic nature of classification. Include: different systems, current debates.		
Describe types of evidence used to classify organisms and determine evolutionary relationships. Examples: fossil record, DNA analysis, biochemistry, embryology, morphology…		
Compare the characteristics of the domains. Include: Archaea (Archaebacteria), Bacteria (Eubacteria), Eukarya.		
Compare the characteristics of the kingdoms in the Eukarya domain. Include: cell structure, major mode of nutrition, cell number, motility.		
Investigate an evolutionary trend in a group of organisms. Examples: hominid evolution, vascularization in plants, animal adaptations for life on land…		

For The First Time, Genetically Engineered Mosquitoes Are Released Into The Wild

The transgenic animals are designed to help stamp out dengue fever in the Cayman Islands
By Lizzie Schiffman Posted 11.12.2010 at 1:29 pm

An Oxford-based research firm has announced the results of a release of genetically modified male mosquitoes in the Cayman Islands, the first experiment with GM mosquitoes to take place in the wild.

From May to October of this year, Oxitec released male mosquitoes three times a week in a 40-acre area. The mosquitoes had been genetically modified to be sterile, so that when they mated with the indigenous female mosquitoes there would be no offspring, and the population would shrink.

Mosquito numbers in the region had dropped 80 percent by August, which the researchers expect would result in fewer dengue cases.

Since it's only females who bite humans and transmit diseases like the untreatable dengue fever this study examined, British biologists suspected that introducing males sterilized by a genetic mutation into the gene pool could dramatically decrease their numbers over time.

While many scientists and environmentalists object to killing off mosquitoes entirely for fear it would harm dependent species, Oxitec asserts that, since the sterilizing gene could not be passed on to subsequent generations, this method will have no permanent ecological impact.

Rather, GM males function like an insecticide, temporarily reducing numbers without the negative effects of using chemical toxins. They can also be more effective against insects that had developed resistance to certain commonly-used pesticides. In regions where booming mosquito populations are have caused epidemic outbreaks of dengue fever, yellow fever and malaria, dramatically reducing the population temporarily could reduce the death toll, and provide valuable lead time to vaccinate and treat hard-hit populations.

As the death toll caused by disease-carrying mosquitoes rises (over 2 million of the 700 million people infected by mosquitoes die annually), science has proposed a wide range of possible solutions to lessen the damage, from lasers to chemicals. But the release of transgenic animals into the wild is a very bold new step.

[AP]

Biodiversity

**Post-it note activity*

Biodiversity is defined as the _____ in an area. Biodiversity increases the stability of an ecosystem and contributes to the health of the biosphere. There are three types of biodiversity to consider: _____ diversity, _____ diversity, and _____ diversity.

i) **_____ diversity –** the variety of _____ _____ that are present in a population. This increases the chances that one type of species will excel if conditions change (such as an outbreak or disease).

Example:

ii) **_____ diversity –** the number of _____ _____ and the relative abundance of each species in a biological community.

Example:

iii) **_____ diversity –** the variety of ecosystems that are present in the biosphere. (An ecosystem is made up of interacting populations and the abiotic factors that support them).

Example: Our biosphere contains many ecosystems with diverse abiotic factors that support a variety of organisms

**** Guess the species activity ****

Definition of Species

*A **species** is a* _____

_____. If the individuals of a species do not reproduce, then when the last individual of that species dies, the species becomes _____.

- This species concept does not apply to extinct animals or those that reproduce asexually.

Question: Many different colours of lady beetles is an example of which type of biodiversity? What do you know about biodiversity?

Appendix 1a: Case Study - As the Worm Turns: Speciation and the Apple Maggot Fly

Introduction

Hawthorn trees grow throughout North America and produce a small fruit, which is eaten by a small fly larva. In 1864, apple growers in New York State discovered an unknown maggot had stared feeding on apples. Through the years, hawthorn and apple maggot flies have become progressively more distinct.

Information taken from the original scientific literature is presented below. Consider and evaluate the evidence in order to answer the following two questions:

1. Do hawthorn maggot flies and apple maggot flies belong to the same species?
2. If not, and if apple maggot flies belong to their own species, what would be a biologically reasonable scenario for how speciation occurred?

Facts about Hawthorn and Apple Maggot Flies

- The apple maggot fly and the hawthorn maggot fly are both assigned to the same species (*Rhagoletis pomonella*) (Bush, 1969).
  - Hawthorn maggot flies and apple maggot flies are physically indistinguishable.
  - There is no geographic isolation or physical separation between adult maggot flies.
- *R pomonella* is native to eastern North America and it originally bred in the fruit of hawthorn trees (Reissig, 1991).
- *R. pomonella* belongs to a set of four closely related fly species that cannot be physically distinguished. (Berlocher and Bush, 1982).

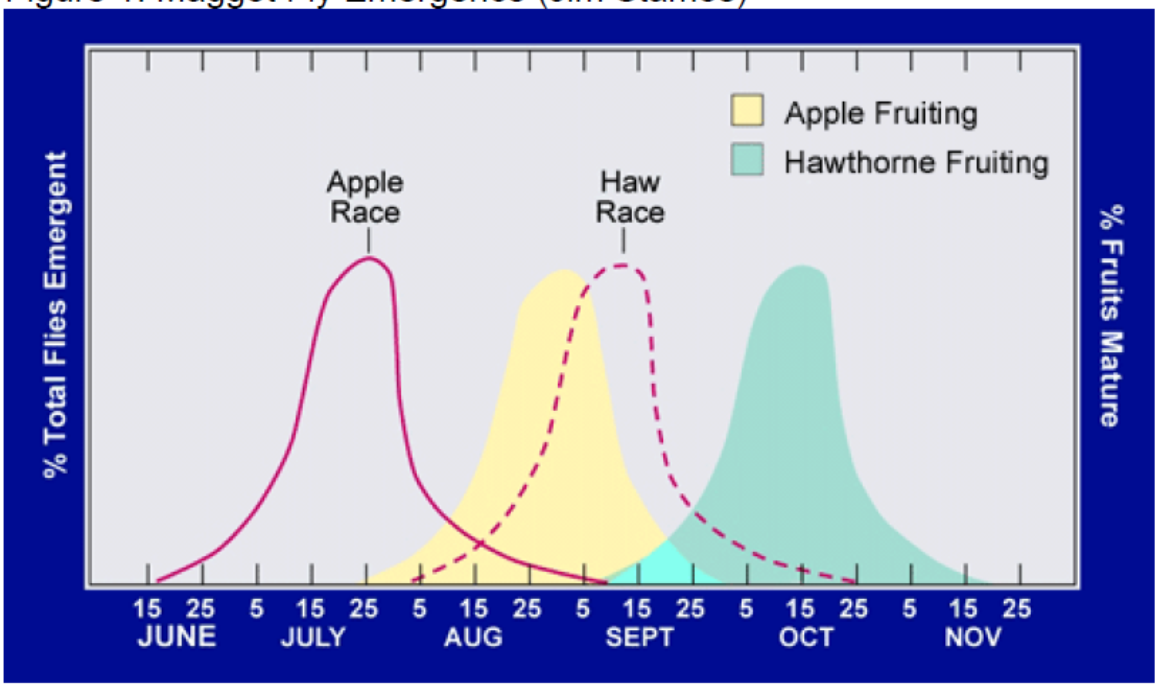
Facts about Hawthorn and Apple Trees

- Both the hawthorn and the apple are woody plants that belong to the Rose family (Newcomb, 1977).
  - Hawthorns are group of about 50 species of trees and shrubs native to North America. They are assigned to the genus *Crataegus.*
  - Early European settlers introduced apples to North America. Apples are assigned to the genus *Malus.*
- The apple is the most widely grown fruit in North America.
- The maggot fly is a major fruit pest in eastern Canada and northeastern United States. Thorough control of the maggot fly is needed to produce high quality and marketable fruit (Reissig, 1991)

Facts about Maggot Fly Reproduction

- Maggot flies that reproduce on apples are known as the apple race, while maggot flies that reproduce on hawthorns are known as the haw race.
- Figure 1 is a general representation of the timing of fly emergence (solid and dashed lines) and fruit ripening (coloured filled-in curves).

Figure 1: Maggot Fly Emergence (Jim Stamos)



- Adult fruits emerge to reproduce before the fruits are mature.
  - The female fly lays fertilized eggs into the ripe fruit.
  - Maggots hatch from the eggs, eat fruit, grow and pupate (Reissig, 1991).
- Apple fruits ripen approximately 1 month earlier than hawthorn fruits, but there is overlap at the end of the end of the apple fruiting season and the beginning of the hawthorn fruiting season (Belocher and Feder, 2002).

Facts about Hawthorn and Apple Fruits

- The typical commercial apple has a diameter of 70 mm, while the typical wild hawthorn has a diameter of 12.5 mm.
- The larger fruits of apple trees provide 5.5 times more depth (based on diameter) to developing maggots than do hawthorn fruits.
  - Parasitoid wasps lay eggs into to maggot's body, with the wasp larvae ultimately killing the maggot.
  - Apple maggots are better able to escape parasitoid wasps by burrowing deeper into the fruit that the wasp can penetrate with its egg-layer (ovipositor)
  - Apple maggots bear 70% fewer parasitoid was eggs than do hawthorn maggots (Berlocher and Feder, 2002).

- The larger fruits of apple trees provide 220 times more food (based on volume) to the growing and developing maggot than the smaller fruits of hawthorns.
    - Apple maggot flies lay more eggs per fruit than do hawthorn maggot flies.
    - The nutritional quality of hawthorn fruit is indicated by the better survival of both types of maggots in hawthorn fruits; 52% of maggot fly eggs survived in hawthorn fruits and 27% of maggot fly eggs survived in apple fruits (Prokopy et al, 1988; Freeman and Herron, 1998).
    - Caterpillars and weevils may also feed on the lager apple, reducing the quantity of food available to apple maggots.

Evolutionary Outcomes in Apple Maggot Flies

- Fidelity to fruit type acts as a strong barrier to gene flow between the two types of maggot flies.
    - There is only a 4 – 6% hybridization rate between hawthorn maggot flies and apple maggot flies (Berlocher and Feder, 2002).
    - Hawthorn maggot flies strongly prefer to mate on and lay fertilized eggs into hawthorns.
    - Apple maggot flies strongly prefer to mate on and lay fertilized eggs into apples.
- Hawthorn and apple maggot flies are genetically distinguishable. They have recognizable genetic profiles (Berlocher and Feder, 2002).

Questions

In small groups, address the following and list the evidence used to make your decisions.

1. What species concept should be used in this case?
2. Are apple maggot flies distinct as a species from hawthorn maggot flies?
3. Propose a biologically reasonable scenario that explains how apple maggot flies evolved.
4. How did you weigh the different pieces of evidence to reach a conclusion to questions 2 &3? What evidence was most important? What evidence was least important?
5. What further information would you need to increase your confidence in the conclusions you reached?

Adapted from As the Worm Turns: Speciation and the Apple Maggot Fly, by Martin G. Kelly, Buffalo State College, National Center for Case Study Teaching in Science, University at Buffalo, State University of New York.

Introduction to Classification

Think about your home, school and neighbourhood. Can you think of any examples of classification systems in use?

Vegetable Activity

Your group will be given examples of 6 vegetables. Look at these examples and figure out which four are in the same species. There are four different species of plants. Three of the species have only one representative, but one species has four different representatives.

What criteria did your group use to figure this out?

_____

_____

_____

_____

_____

_____

_____

Categorical Reasoning in Biology

Introduction

Something that is true about a group or a category will be true for every member of that group or category. For example, you know that all birds are vertebrates. You also know that a robin is a type of bird. Therefore, you could reason that a robin is a vertebrate.
This type of reasoning is known as categorical reasoning. Categorical logic is the basis for classification systems. It examines relationships according to groups or categories of things. The argument can be set up formally as follows:

Premise: All birds are vertebrates.
Given: A robin is a bird.
Conclusion: A robin is a vertebrate.

Questions

1. Using the example above as a model, construct a categorical argument to show that a Labrador retriever is a mammal.

2. Explain your thought processes as you answered question 1.

3. Construct a categorical argument to show that a pine tree is a plant.

4. What is wrong with the categorical argument below?

   Premise: All horses are herbivores.
   Given: Organism X is a herbivore.
   Conclusion: Organism X is a horse.

History of Classification

Classification – the grouping of objects or organisms based on _____

Examples:

Aristotle (394-322 B.C.)

More than two thousand years ago, Aristotle classified organisms as either _____ or _____. The Animals were classified according to the presence or absence of "red blood." Aristotle's "bloodless" and "red-blooded" animals are similar to today's classification of _____ and _____. Animals were further grouped according to their habitats and morphology. Plants were classified by average size and structure as _____, _____, or _____.

Plants		
Herbs	**Shrubs**	**Trees**
Violets, Rosemary, Onions	Blackberry bush, Honeysuckle, Flannelbush	Apple, Oak, Maple
Animals with red blood		
Land	**Water**	**Air**
Wolf, Cat, Bear	Dolphin, Eel, Sea bass	Owl, Bat, Crow

Aristotle's system was based on the view that species were distinct, separate, and unchanging. Aristotle's classification did not account for _____ _____. Many organisms did not fit well into Aristotle's classification such as birds that don't fly and frogs that live both on land and in water. A new classification system was formed about 2000 years later.

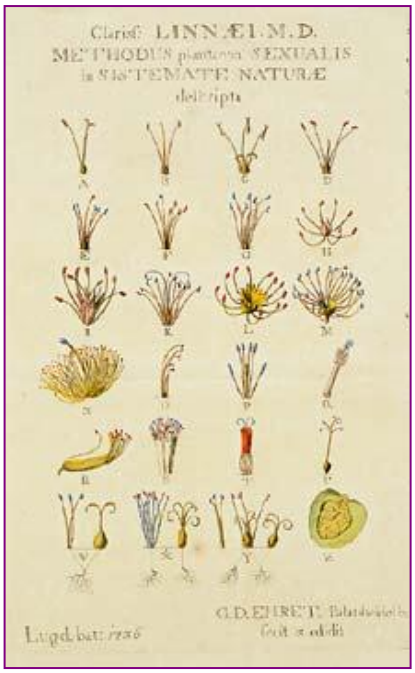
Carolus Linnaeus (1707 – 1778)

Linnaeus was a Swedish naturalist that broadened Aristotle's classification method and formalized it into a scientific system. Like Aristotle, he based his system on _____ _____ of the morphology and the behaviour of organisms.

Linnaeus' system of classification was the first formal system of taxonomic organization. **Taxonomy** is a discipline of biology primarily concerned with _____, _____, and _____ species based on natural relationships.

Interesting facts:

- His Parents wanted him to become a priest but he did poorly at school and was advised to go into medicine.



- Linnaeus classified plants based on stamens and carpels (the male and female parts)

- Many people criticized him. Johann Georg Siegesbeck said ***"What man will ever believe that God Almighty should have introduced such confusion, or rather such shameful whoredom, for the propagation of the reign of plants? Who will instruct young students in such a voluptuous system without scandal?"***

- In reply, Linnaeus named the rather sticky, smelly weed genus *Siegesbeckia* after him.

Binomial nomenclature

Linnaeus's method of naming organisms, called *binomial nomenclature,* is still used today. _____ gives each species a scientific name that has two parts. The first part is the _____ name and the second part is the _____ name that identifies the species. _____ is the basis for binomial nomenclature because Latin is an unchanging language, and, historically, it has been the language of science and education.

- Binomial nomenclature clears up confusion about what species is being referred to.

Examples:

- Binomial nomenclature also is useful because common names can be misleading.

Examples:

Rules for binomial nomenclature:

1) The first letter of the genus name always is capitalized, but the rest of the genus name and all letters of the specific epithet are lowercase.
2) If a scientific name is written in a printed book or magazine, it should be italicized.
3) When a scientific name is written by hand, both parts of the name should be underlined.
4) After the scientific name has been written completely, the genus name often will be abbreviated to the first letter in later appearances. For example, the scientific name of *Cardinalis cardinalis* can be written *C. cardinalis.*

Classification Questions:

1) Why is it important to have a biological classification system?
2) Define and describe binomial nomenclature?
3) State how Aristotle would have classified a Canada goose, a rose bush, and a prairie crocus.
4) Correct the error(s) with each of the the following scientific names using the rules of binomial nomenclature:

   i) Ursus americanus

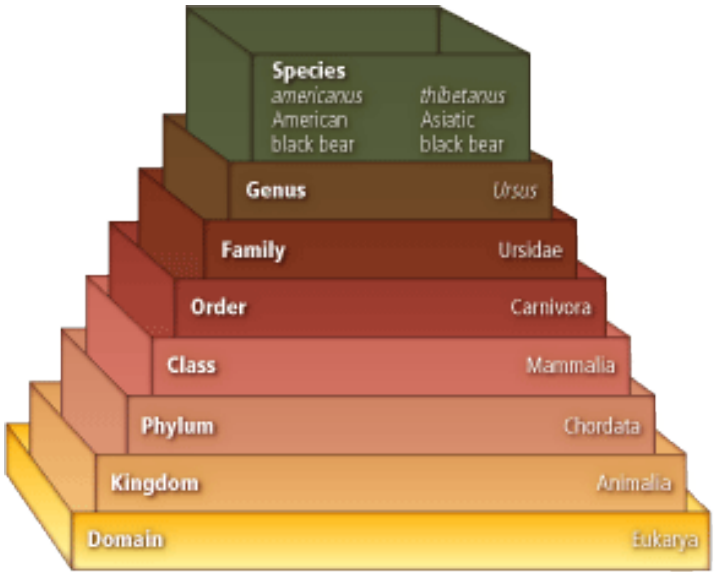
   ii) Ursus Thibetanus

   iii) ursus thibetanus

Classification of Organisms

In biological classification, **rank** is the level (the relative position) in a hierarchy. There are 8 main ranks defined by the nomenclature (naming) rules: Domain, kingdom, phylum/division, class, order, family, genus, species. The most basic rank is that of species, the next most important is genus, and then family.

*Note: Division is often used by botanists (scientists who study plants) instead of phylum



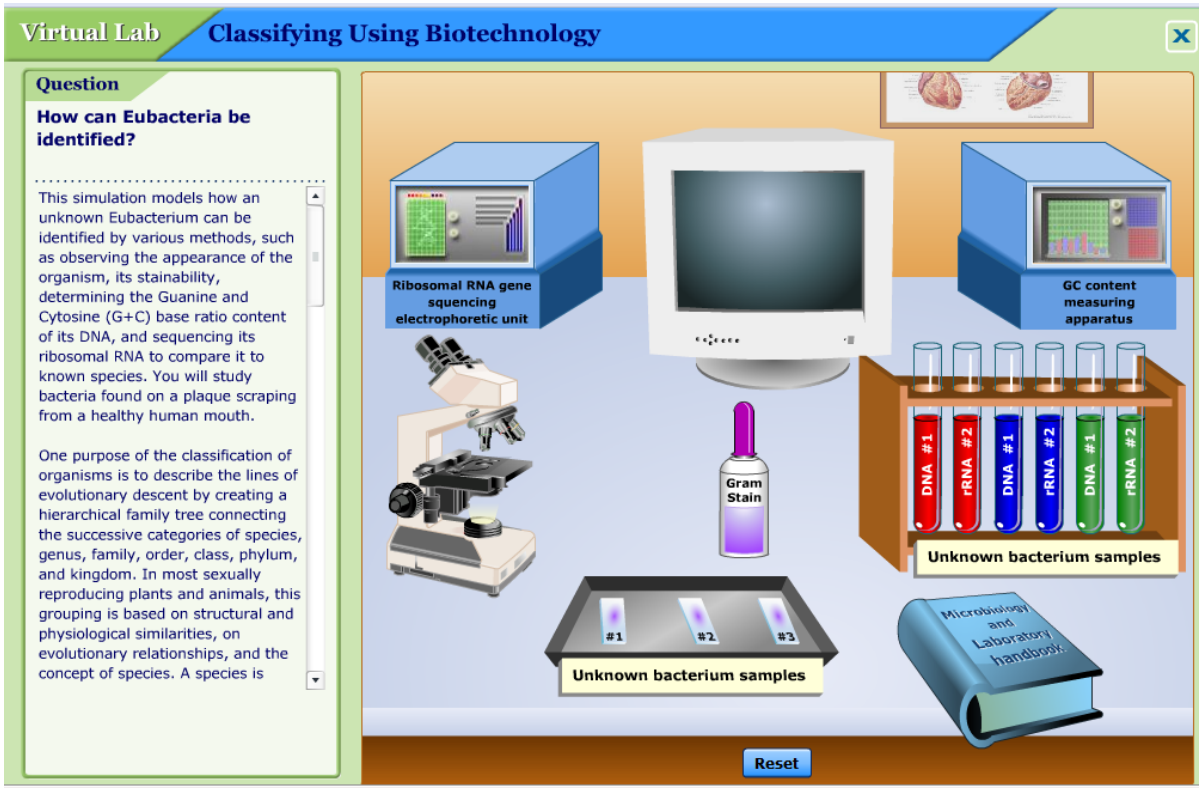
Human	White Oak

Classification Tools:

There are many tools that are used to classify organisms. We will be investigating these tools and analyzing which tools are best for which situations.

- *Do Sharpest Tool in the Shed Project for marks*

Great online activity for using biotechnology to classify organisms:



http://glencoe.mcgraw-hill.com/sites/0078695104/student_view0/unit4/chapter17/virtual_labs.html#

Modern Classification Systems

Tools used to determine evolutionary relationships:

1) **_____ –** Fossils provide a record of species living long ago and allows us to see evidence of evolutionary change

2) **_____ –** Scientists have found that vertebrate embryos exhibit homologous structures inherited from an ancestor during certain phases of development but become totally different structures in the adult forms. Ex: All vertebrate embryos have tails

3) **_____ –** Similar structures in different organisms leads scientists to believe there is a shared ancestry

4) **_____ -** Scientific date also shows that common ancestry can be seen in the complex metabolic molecules that many different organisms share.

** This will be added to with the "Sharpest Tool in the Shed" group project **

Different Forms of Classifying Living Things (Systemics)

Taxonomy

- Describing, naming and ordering groups of things based on characteristics.

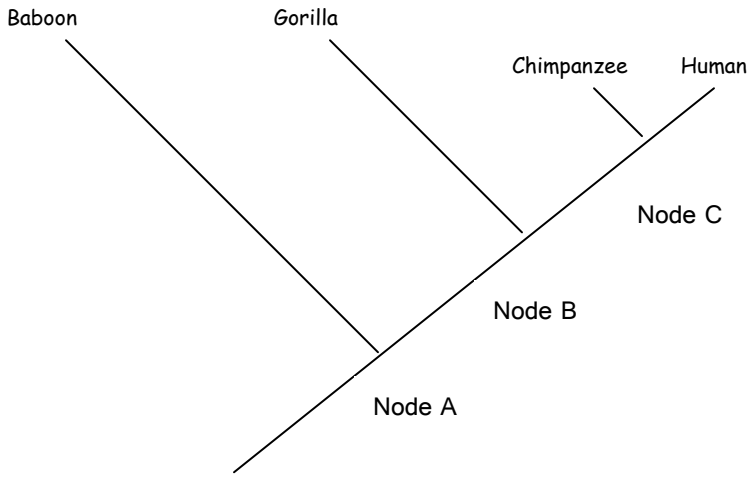
Classification (Linnaeus System—K,P,C,O,F,G,s)

- Organizing info about diversity and arranging them into a hierarchical system

Phylogeny (Carl Woese & Willi Hennig)

- Determining the ancestral relationship of organisms and the group's evolutionary history in the form of a **cladogram** (diagram of a group's evolutionary history)—based mainly on evolution and not on visible similarities between spp.

Hennig (1950's)—developed the cladogram—based on ancestral relationships rather than morphology (Linnaeus).



- Nodes represent a splitting event (thus the end of an ancestral stem)
- Species that split from a node forms 2 sister taxa.
- Each sister taxa is more closely related to each other than any other group.

Example:

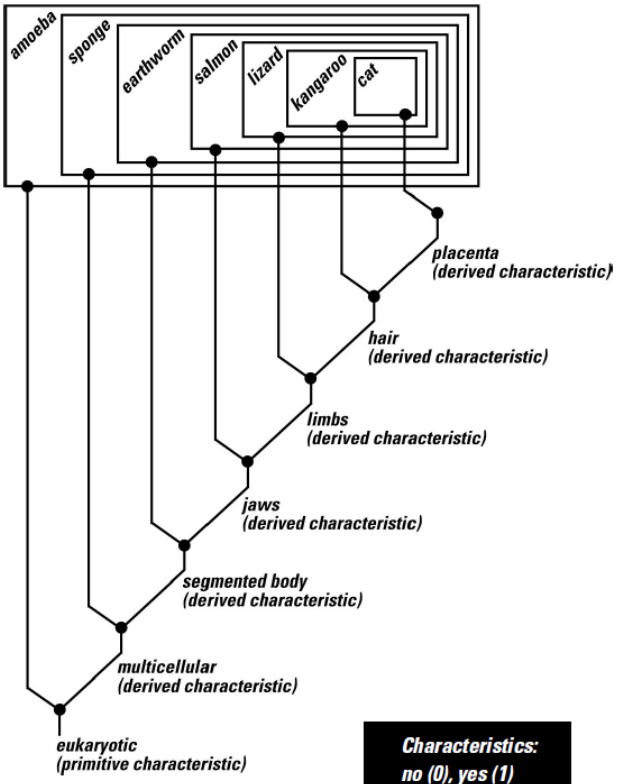
- At node C: a split forms the 2 sister taxa, humans and chimpanzee
- At node B: a split forms the 2 sister taxa, gorillas and the ancestor that leads to human and chimps
- At node A: a split forms the 2 sister taxa, baboon and the ancestors that leads to chimps, humans and gorillas

  - ✪ This cladogram shows we have more in common with chimpanzee and gorillas than with the baboons.
  - ✪ The length of the lines also indicate evolutionary time. Short lines = small amount of time, long lines = large amounts of time. (***However, lines are rarely to scale***)

Cladogram Basics

NOVA Activity **The Missing Link**

In cladistics, similar characteristics that come from a common ancestor are used to divide organisms into groups. A cladogram will begin by grouping organisms based on a characteristic displayed by all the members of the group. Subsequently, the larger group, or clade, will contain increasingly smaller groups (clades) that share the traits of the clades before them, but also exhibit distinct changes as the organism evolves. The example that follows represents a cladogram.



Characteristics: no (0), yes (1)

1. is eukaryotic
2. is multicellular
3. has segmented body
4. has jaws
5. has limbs
6. has hair
7. has placenta

	Characteristic #						
Organism	**1**	**2**	**3**	**4**	**5**	**6**	**7**
amoeba	(1)	(0)	(0)	(0)	(0)	(0)	(0)
sponge	(1)	(1)	(0)	(0)	(0)	(0)	(0)
earthworm	(1)	(1)	(1)	(0)	(0)	(0)	(0)
salmon	(1)	(1)	(1)	(1)	(0)	(0)	(0)
lizard	(1)	(1)	(1)	(1)	(1)	(0)	(0)
kangaroo	(1)	(1)	(1)	(1)	(1)	(1)	(0)
cat	(1)	(1)	(1)	(1)	(1)	(1)	(1)

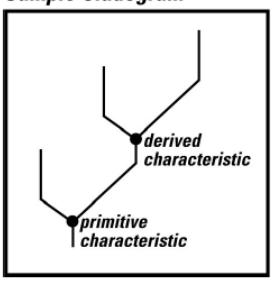
Source: Science at a Distance—Professor John Blamire (www.brooklyn.cuny.edu/bc/ahp/CLAS/CLAS.Clad.html)

To make a cladogram, scientists first collect data on the features of all the organisms they hope to classify. This data is then analyzed to determine which characteristics were present in what could have been a common ancestor and which might have been developed in later times. Use the following instructions to make a cladogram for your set of hardware organisms.

Procedure

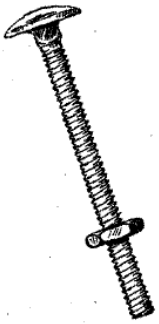
1. Make your cladogram on a separate sheet of paper. Lay out your organisms on a work surface. List all the characteristics you see for each object and make a table of all the traits.
2. Which characteristic do all the objects have in common? This is referred to as a primitive, or original, characteristic. It is of little value in analyzing the relationships within a group since all members possess this characteristic.
3. Again look at the data to determine common characteristics that only a portion of the group has. These are referred to as derived, or advanced, characteristics. They are usually more advanced features that were added to the primitive features found earlier. The largest group of these derived characteristics will be the first to branch from the main trunk of the cladogram. Name the derived characteristic and list all the objects that have that characteristic. Your drawing of the cladogram at this point should look similar to the following:

Sample Cladogram



4. Look for further characteristics that are common to only a portion of the group and add these to the cladogram until the groups can be sorted no further.

Nailing Cladistics



NOVA Activity **The Missing Link**

Cladistics is one way scientists classify organisms. A cladogram shows the nature of evolutionary relationships that may have occurred, similar to a family tree. You will make a cladogram in this activity.

Procedure

Part I

1. Display your set of hardware organisms and match each one to the organisms listed on your *Hardware Organism Key* activity sheet. Make sure you have all the organisms listed.
2. Classify your hardware organisms into groups. On a separate sheet of paper, make a record of your classifications, listing the letter for each organism you have classified. Then list the common characteristics of each of your groups.

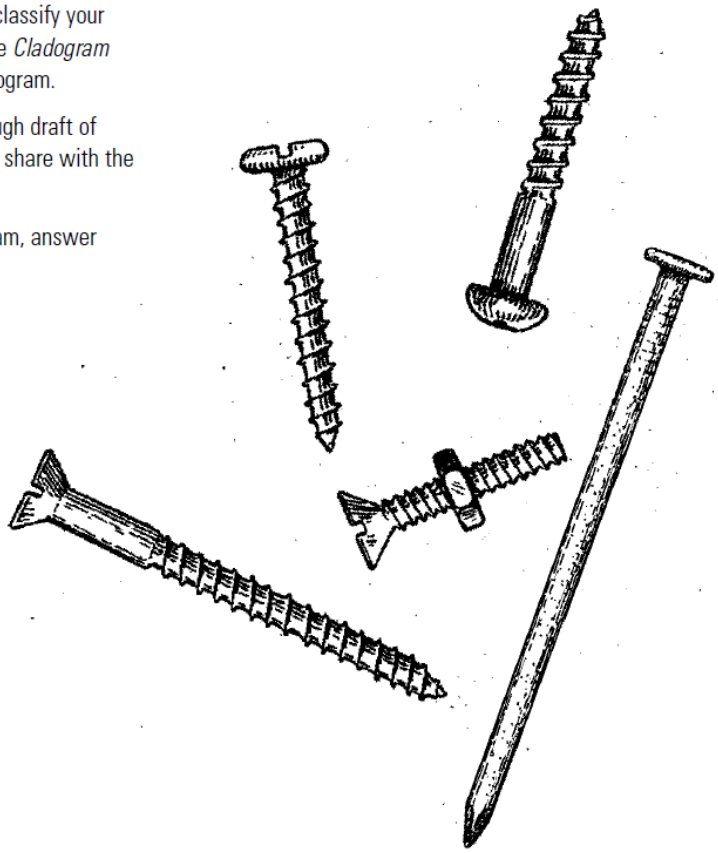
Part II

1. You will now use a different method to classify your organisms. Follow the instructions on the *Cladogram Basics* activity sheet to create your cladogram.
2. After you have created and revised a rough draft of your cladogram, create a final version to share with the class.
3. When you have completed your cladogram, answer the questions.

Questions

Write your answers on a separate sheet of paper.

1. Compare your cladogram with others in the class. Will all correct cladograms be the same? Why or why not?
2. Compare cladistics with the more traditional taxonomy that you did in the Part I of the lesson. How do they differ? What are the advantages and disadvantages of each method?



Dichotomous Key:

A dichotomous key is a device that can be used to easily identify an unknown organism. The word dichotomous comes from two Greek words that together mean, "divided in two parts". A dichotomous key consists of a series of two part statements that describe characteristic of organisms. At each step of a dichotomous key the user is presented with two choices. As the user makes a choice about a particular characteristic of an organism they are led to a new branch of the key. Eventually the user will be led to the name of the organism that they are trying to identify.

Example:
Materials:

- Thumb tack (4)
- Pencil (4)
- Straw (4)
- Cardboard (4)
- Leaves (4)
- Pen (4)
- String (4)

Key:

1A Organic ……leaf
1B Inorganic ……2

2A Plastic ……3
2B Not Plastic ……4

3A Hollow ……straw
3B Solid ……5

4A Cylindrical ……6
4B Flat shape…… ……cardboard

5A Contains fluid ……pen
5B Contains metal ……thumb tack

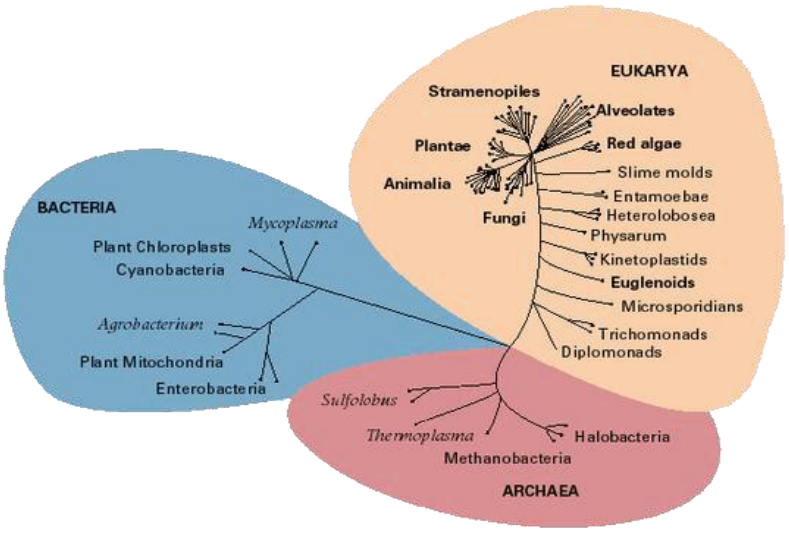
6A Contains lead ……pencil
6B Contains no lead ……string

- **Do Dichotomous Key Activity**

Kingdoms and Domains

Three domains of Life:

This _____ _____ (a tree showing evolutionary relationships) is based on _____ that demonstrate the division of all living things into three broad domains.



- The_____ domain is prokaryotic and is thought to be the oldest. The Bacteria domain which is composed of the organisms in the _____ (the "true" bacteria).
- _____ is the second prokaryotic domain and is also composed of single _____
- The third domain, _____, contains all four of the eukaryotic kingdoms:

i)

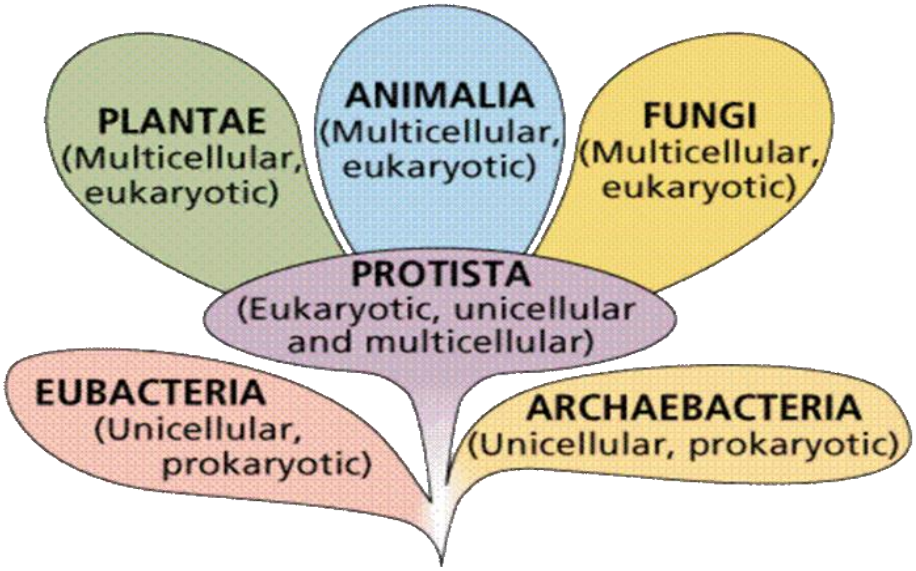
ii)

iii)

iv)

The Kingdoms of Life:

- Biologists have further organized living things into large groups called _____.
- Biologists group organisms into six Kingdoms based on RNA and DNA sequencing and the following other similarities:
  - _____
    - Organisms are either **prokaryotes** or **eukaryotes.**
  - _____
  - _____
    - Organisms are either **unicellular** or **multicellular.**
  - _____
    - Organisms are either **autotrophs** or **heterotrophs**.



What happened to the 5 Kingdoms?

Just a few years ago, living things used to be classified into 5 Kingdoms:

i) Plantae

ii) Animalia

iii) Fungi

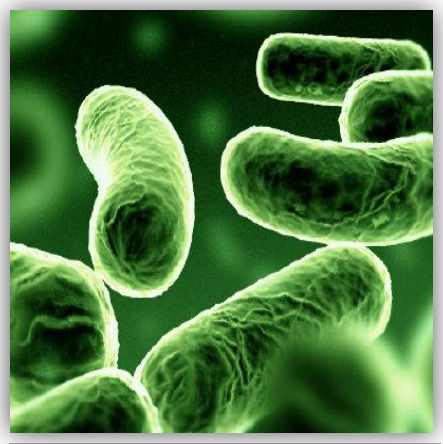
iv) Protista

v) Monera

* The difference is that Archaebacteria _____. Recent RNA testing has shown that Archaebacteria are not closely related to the "true" bacteria, Eubacteria.

I) *The Domain Bacteria*

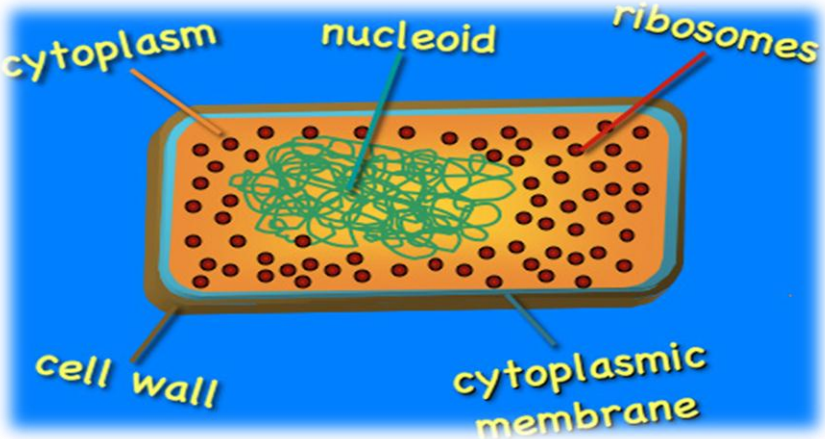
- Contains a single kingdom, **_____**.
  - Some scientists call this kingdom Bacteria.
- Bacteria are prokaryotes and have _____ _____ such as a nucleus or mitochondria
- Bacteria have a _____ instead of a nucleus.
- Like eukaryotic cells, bacteria have _____
- Bacteria are found in practically every environment on Earth.



Bacilli bacteria under an electron microscope

Characteristics of Bacteria

Bacteria have strong exterior **cell walls** made of _____, a molecule complex consisting of sugars and amino acids that form a mesh-like layer outside the plasma membrane.



Kinds of Bacteria

- Bacteria can cause disease, while others are used by humans to _____.
- Bacteria are used to control agricultural pests, to produce various chemicals, and perform genetic engineering.
- Some Bacteria obtain energy from inorganic compounds such as hydrogen sulfide, ammonia, and methane.
- Some Bacteria are _____ and are found in ocean and freshwater ecosystems.
- Some _____ Bacteria are able to live in the absence of oxygen.

- Heterotrophic Bacteria are also important decomposers.

Uses of Bacteria - Cheese production

- Bacteria enables us to eat fermented dairy products such as _____ _____

- Example: *Lactococcus lactis* is used to ferment milk into Cheddar Cheese!

- We've all heard of probiotic yogurts – All yogurts are probiotic! This just means they have "good" bacteria.

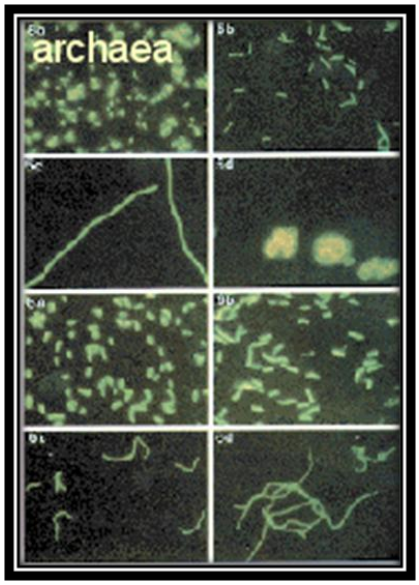
Did you know?

- *Escherichia coli (E. coli)* exists in abundance in _____. It is only dangerous when ingested.

Domain and Bacteria Questions:

1) What are the three domains?
2) How many kingdoms are in each domain and name them.
3) What are the characteristics of the domain Bacteria (include cell wall, cell type, body type, and nutrition). (This question should have quite a long answer)
4) What are some uses of bacteria?
5) How are the six Kingdoms divided up?
6) What were the five Kingdoms? Why did we change to six kingdoms?

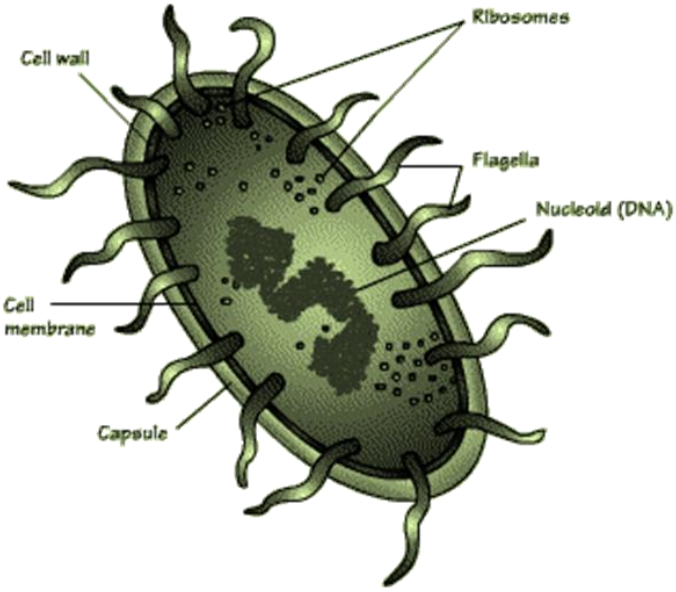
II) The Domain Archaea



- Contains a single kingdom _____.
- Archaebacteria are _____ that have diverged very early from bacteria.
- They are _____ _____ than to bacteria.

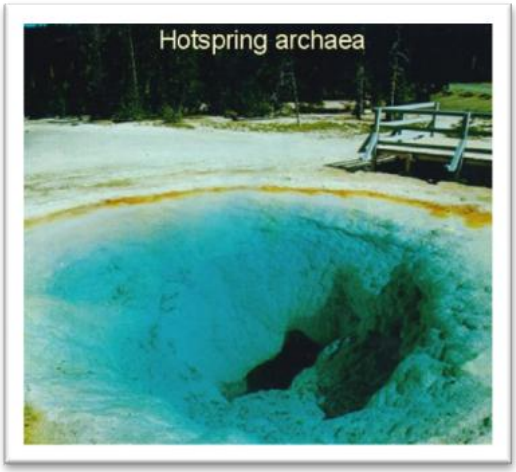
Characteristics of Archaebacteria

- _____
  - The cell walls of archaebacteria ___ _____, as the cell walls of bacteria do.
  - Archaebacteria contain _____ very different from those of _____or _____.
- _____
  - The _____ _____ of archaebacteria are very _____ to those of _____ and different from those of bacteria.



Kinds of Archaebacteria

- **_____**
  - These archaebacteria obtain energy by combining hydrogen gas and carbon dioxide to form methane gas.
  - Methanogens live deep in the mud of swamps and are poisoned by even traces of oxygen.
  - They are common in _____, where they are responsible for _____, and in the guts of animals such as _____ (cud-chewing animals) and _____, where they are responsible for the _____ content of _____.
- **_____**
  - A group of extremophiles called **_____** live in very _____ places (such as hot springs).
  - **_____** inhabit very _____ that can be three times as salty as seawater.
  - Other extremophiles live in very _____ or under enormous pressure.
- **_____**
  - These grow in all the same environments that bacteria do.



Archaebacteria Questions:

Archaebacteria questions:

1) What are the three different types of Archaebacteria and state what makes them distinct from the other two groups.
2) What is one way Archaebacteria are closer related to eukaryotes than Eubacteria?
3) Do you think that you are more likely to find Eubacteria or Archaebacteria in a volcano?
4) Justify the division of prokaryotes into two kingdoms.
5) Name 4 different environments you would find extreme Archaebacteria.

- Complete a compare/contrast frame on Archaebacteria prokaryotic cells versus Eubacteria prokaryotic cells. (for marks)

III) The Domain Eukarya

- Eukarya is made up of four kingdoms:
    a. **Protista**
    b. **Fungi**
    c. **Plantae**
    d. **Animalia**
- Members of this domain are _____.

Characteristics of Eukarya

- _____
    - All eukaryotes have cells with a nucleus and other internal compartments.
- _____
    - The activities of individual cells are coordinated and the cells themselves are in contact, occurs only in eukaryotes.
- _____
    - Meiotic cell division forms haploid games and two gametes unite to form a diploid cell in fertilization.
    - Genetic recombination during meiosis and fertilization causes the offspring of eukaryotes to vary widely, providing for evolution.

Kinds of Eukarya

- A wide variety of Eukaryotes are _____.
    - Most unicellular Eukaryotes are in the kingdom _____.
- _____ contain both unicellular and multicellular organisms, many are aquatic.
- _____ are heterotrophs that are mostly multicellular.
    - Many fungi live on and decompose dead organisms, many others are parasitic.
- _____ and _____ are all _____.

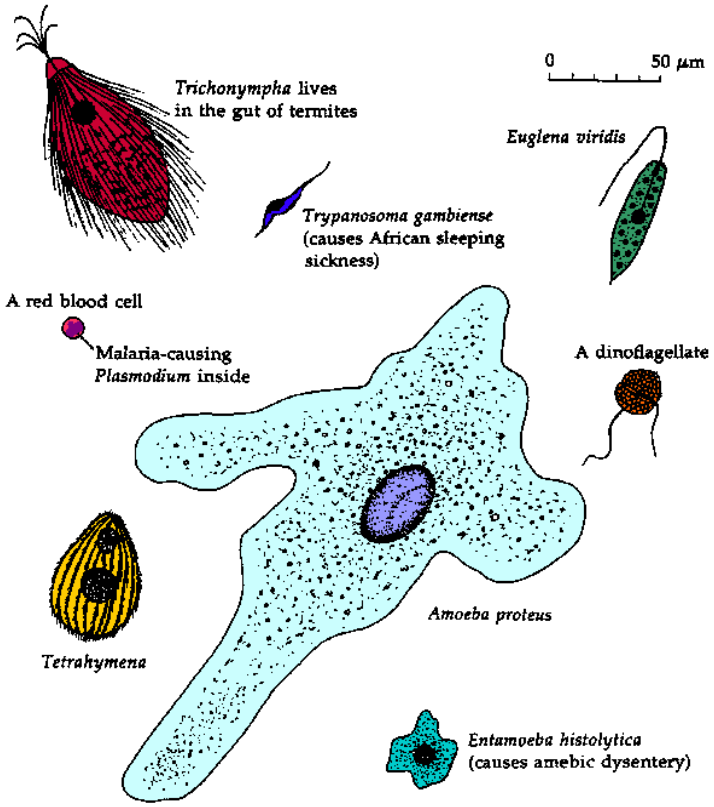
- Almost all plants are autotrophs and have cells with cell walls composed of cellulose.
- All animals are heterotrophs composed of cells that do not have cell walls.
- Most plants and animals have tissues and organs.

Kingdom and Domain Characteristics

Domain	**Kingdom**	**Characteristics**				
		Cell type	**Cell Structure**	**Body Type**	**Nutrition**	**Example**
Bacteria	Eubacteria					Enterobacteria Spirochetes *Lactococcus lactis*
Archaea	Archaebacteria					Methanogens
Eukarya	Protista					Amoebas Euglenas Kelps
Eukarya	Fungi					Yeasts Mushrooms
Eukarya	Plantae					Ferns Pine trees
Eukarya	Animalia					Birds Earthworms

1) Kingdom Protista

- Of the six kingdoms of organisms, _____ is the most diverse.
- They are _____ that are not fungi, plants, or animals.
- Many are _____.
- All single celled eukaryotes (except yeasts) are protists.
- Some protists, such as some kinds of algae, have cell specialization.
- Most are microscopic, but some are as large as trees.



Motility

- Protists that use _____
  - Amoebas are protists that have flexible surfaces with no cell walls or flagella.
  - They move by using extensions of cytoplasm called pseudopodia.
  - Forams have porous shells through which long, thin projections of cytoplasm can be extended.
- Protists that use _____
  - Many protists move by using flagella.

Kinds of Protists

1) _____ - also called protozoa (means "first animal") – heterotrophs

2) _____

- also called algae - autotrophs Distinguished by the type of chlorophyll they contain.

  – Many algae are multicellular and reproduce sexually.

3) _____

  – Slime molds and water molds are often confused with fungi because they aggregate in times of stress to form spore-producing bodies.

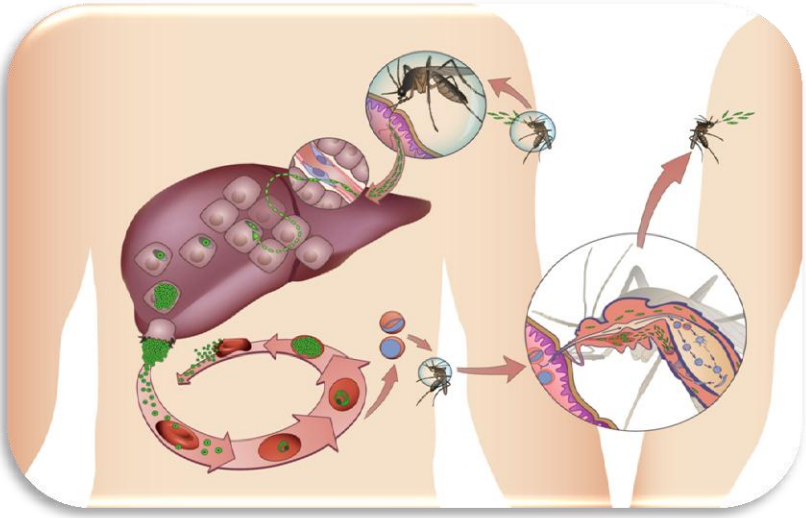
  – heterotrophs, decomposers, external digestion

Malaria

  – Malaria is caused by the protozoa *Plasmodium falciparum* and is spread by the mosquito

  – Each year, malaria kills between _____!

  – Economists suggest that malaria can be controlled for $3 billion US per year through drugs, mosquito eradication, and bite prevention



Eukarya and Protist Questions

1. Organism X is a multicellular, heterotrophic eukaryote whose cells lack cell walls. To which kingdom does organism X belong?

   A Animalia C Fungi

   B Plantae D Archaebacteria

2. List the 3 different groups of Protists. How are each of these defined?

3. Which kingdom in the domain Eukarya is the most diverse?

4. List and explain the three characteristics of the domain Eukarya.

5. State two reasons why you think malaria is so prevalent? (If only $3 billion dollars could contain malaria, why do you think so many people die of it each year?)

World Health Organization

Fact sheet N°94
May 2007

Malaria

Key facts

- Malaria is both preventable and curable.
- A child dies of malaria every 30 seconds.
- More than one million people die of malaria every year, mostly infants, young children and pregnant women and most of them in Africa.

Infection and transmission

Malaria is a disease which can be transmitted to people of all ages. It is caused by parasites of the species *Plasmodium* that are spread from person to person through the bites of infected mosquitoes. The common first symptoms – fever, headache, chills, and vomiting – appear 10 to 15 days after a person is infected. If not treated promptly with effective medicines, malaria can cause severe illness that is often fatal.

There are four types of human malaria – *Plasmodium falciparum, P.vivax, P.malariae,* and *P.ovale. P.falciparum* and *P.vivax* are the most common. *P.falciparum* is by far the most deadly type of malaria infection.

Malaria transmission differs in intensity and regularity depending on local factors such as rainfall patterns, proximity of mosquito breeding sites and mosquito species. Some regions have a fairly constant number of cases throughout the year – these are *malaria endemic* – whereas in other areas there are “malaria” seasons, usually coinciding with the rainy season.

Large and devastating epidemics can occur in areas where people have had little contact with the malaria parasite, and therefore have little or no immunity. These epidemics can be triggered by weather conditions and further aggravated by complex emergencies or natural disasters.

Global and regional risk

Approximately, 40% of the world’s population, mostly those living in the world’s poorest countries, are at risk of malaria. Every year, more than 500 million people become severely ill with malaria. Most cases and deaths are in sub-Saharan Africa. However, Asia, Latin America, the Middle East and parts of Europe are also affected. Travellers from malaria-free regions going to areas where there is malaria transmission are highly vulnerable – they have little or no immunity and are often exposed to delayed or wrong malaria diagnosis when returning to their home country.

Treatment

Early diagnosis and prompt treatment are the basic elements of malaria control. Early and effective treatment of malaria disease will shorten its duration and prevent the development of complications and the great majority of deaths from malaria. Access to disease management should be seen not only as a component of malaria control but a fundamental right of all populations at risk. Malaria control must be an essential part of health care development. In contemporary control, treatment is provided to cure patients rather than to reduce parasite reservoirs.

Antimalarial treatment policies will vary between countries depending on the epidemiology of the disease, transmission, patterns of drug resistance and political and economic contexts.

Drug resistance

The rapid spread of antimalarial drug resistance over the past few decades has required more intensive monitoring of drug resistance to ensure proper management of clinical cases and early detection of changing patterns of resistance so that national malaria treatment policies can be revised where necessary. Surveillance of therapeutic efficacy over time is an essential component of malaria control. Recent efforts to scale-up malaria control in endemic countries throughout the world including increased support for commodities and health systems, as well as the proposed price subsidy on artemisinin-based combination therapies (ACTs) is resulting in greater access to and a vastly increased use of antimalarial medicines, in particular ACTs. This is leading to a much higher degree of drug pressure on the parasite which will almost certainly increase the likelihood of selecting for resistant parasite genotypes. There are currently no effective alternatives to artemisinins for the treatment of *P. falciparum* malaria either on the market or towards the end of the development pipeline.

The parasite's resistance to medicines continues to undermine malaria control efforts. WHO has therefore called for continuous monitoring of the efficacy of recently implemented ACTs, and countries are being assisted in strengthening their drug resistance surveillance systems. In order to preserve the efficacy of artemisinins as an essential component of life-saving ACTs, WHO has called for a ban on the use of oral artemisinin monotherapies, at various levels, including manufacturers, international drug suppliers, national health authorities and international aid and funding agencies involved in the funding of essential antimalarial medicines.

Prevention: vector control and intermittent preventive therapy in pregnant women

The main objective of malaria vector control is to significantly reduce both the number and rate of parasite infection and clinical malaria by controlling the malaria-bearing mosquito and thereby reducing and/or interrupting transmission. There are two main operational interventions for malaria vector control currently available: Indoor Residual Spraying of long-acting insecticide (IRS) and Long-Lasting Insecticidal Nets (LLINs). These core interventions can be locally complemented by other methods (e.g. larval control or environmental management) in the context of Integrated Vector Management (IVM). Effective and sustained implementation of malaria vector control interventions (IRS or LLINs) requires clear political commitment and engagement from national authorities as well as long-term support from funding partners.

Pregnant women are at high risk of malaria. Non-immune pregnant women risk both acute and severe clinical disease, resulting in up to 60% fetal loss and over 10% maternal deaths, including 50% mortality for severe disease. Semi-immune pregnant women with malaria infection risk severe anaemia and impaired fetal growth, even if they show no signs of acute clinical disease. An estimated 10 000 of

these women and 200 000 of their infants die annually as a result of malaria infection during pregnancy. HIV-infected pregnant women are at increased risk. WHO recommends that all endemic countries provide a package of interventions for prevention and management of malaria in pregnancy, consisting of (1) diagnosis and treatment for all episodes of clinical disease and anaemia and (2) insecticide-treated nets for night-time prevention of mosquito bites and infection. In highly endemic falciparum malaria areas, this should be complemented by (3) intermittent preventive treatment with sulfadoxine–pyrimethamine (IPT/SP) to clear the placenta periodically of parasites.

Insecticide resistance

In spite of increased national and international efforts to scale up cost-effective malaria vector control interventions and maximize the protection of populations at risk, significant challenges continue to threaten these objectives and the sustainability of achievements. Challenges include increasing resistance of vector mosquitoes to insecticides, the behaviour and ecology of local malaria vectors – which often change as a result of vector control interventions -- and the diminishing number of available insecticides that can be used against malaria vectors (adulticides).

There are currently no alternatives to DDT and pyrethroids and the development of new insecticides will be an expensive long-term endeavour. Therefore, immediate sound vector resistance management practices are required to assure the continued utility of the currently available insecticides. At present there is only limited evidence of the impact of various resistance mechanisms on the efficacy of vector control interventions, whether they are implemented singly or in combination.

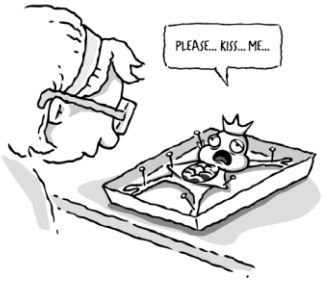
Recent evidence from Africa indicates that pyrethroid and DDT resistance is more widespread than anticipated. It is believed that the same level of resistance will have a more detrimental impact on the efficacy of IRS than on that of LLINs, but evidence for this is very limited. Networks for vector resistance monitoring still need greater strengthening in order to make resistance detection a routine operational feature of national programmes, particularly in countries in Africa and the Eastern Mediterranean region. Regional level databases feeding into a global database accessible by governments, scientists and policy-makers would greatly assist in the rational use and deployment of vector control interventions.

Socioeconomic impact

Malaria causes an average loss of 1.3% annual economic growth in countries with intense transmission. When compounded over the years, this loss has lead to substantial differences in GDP between countries with and without malaria. Malaria traps families and communities in a downward spiral of poverty, disproportionately affecting marginalized populations and poor people who cannot afford treatment or who have limited access to health care. Malaria's direct costs include a combination of personal and public expenditures on both prevention and treatment of disease. In some countries with a very heavy malaria burden, the disease may account for as much as 40% of public health expenditure, 30-50% of inpatient admissions and up to 60% of outpatient visits. Malaria has lifelong effects through increased poverty, impaired learning and decreases attendance in schools and the workplace.

What do I need to know for the Biodiveristy Quiz??

* This is an outline of material we have learned to be used to help you study. Any topic we have taken so far is fair game for the quiz.



- The definition of Biodiversity it's three types (Genetic, Species and Ecosystem)
- The definition of a species and some of the complications of the definition
- The Classification of organisms (Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species) Hint: King Philip Came Over For Good Spaghetti
- Know about how both Aristotle and Linnaeus classified organisms
- Know the rules of Binomial nomenclature
- Know how to use a dichotomous key
- Know the three Domains of life and their characteristics
- Know the defining characteristics (cell wall, cell type, nutrition, body type etc.) and examples of the Kingdoms Eubacteria, Archaebacteria, and Protista.
- Know the characteristics of the Eukaryotes
- Be able to define and explain the following:
  - Taxonomy
  - Binomial nomenclature
  - Fossil record
  - Comparative embryology
  - Comparative anatomy
  - Comparative biochemistry
  - Peptidoglycan

SPELLING COUNTS! (hint: write the hard words out over and over to remember them)

*Remember that it takes **hard work** to do well in Biology.*

"Every job is a self portrait of the person who does it. Autograph your work with excellence."
~ Unknown

Biodiversity Quiz Review

1. Which of the following structures occurs in bacteria?
   a) ribosomes
   b) mitochondria
   c) nuclear membrane
   d) chloroplast

2. What are the two prokaryotic domains?

3. Define Biodiversity and list and describe the three types. Give an example of each.

4. What is the definition of a species? Describe an example of a difficulty with this definition.

5. What is binomial nomenclature and why is it important?

6. How did Aristotle classify organisms (describe in detail)? Where would he have placed a bluejay (a bird)?

7. How does comparative biochemistry determine phylogenetic relationships?

8. Which Domain contains peptidoglycan in the cell walls of its organisms?

9. Name the three domains and list the kingdom(s) in each domain

10. List the four ways Biologists group organisms into six Kingdoms other than RNA and DNA sequencing.

11. Which kingdoms have organisms with a nucleoid?

12. Which organism was used to ferment cheese?

13. Lactococcus Lactis – is there anything wrong with this binomial nomenclature?

14. List the three kinds of Archaebacteria and describe each.

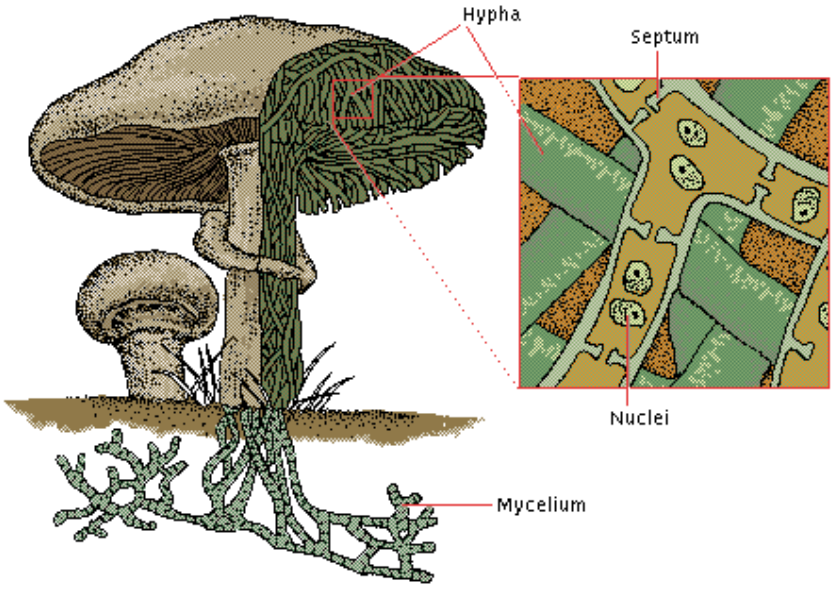
15. List and describe the three characteristics of Eukarya.

16. Name the "species name," the domain, and the kingdom of the organism that causes Malaria

17. List and describe the three groups of protists.

Domain Eukarya -- Kingdom Fungi

- Most fungi are multicellular, yeasts are unicellular.
- The cell walls of all fungal cells contain **chitin**. (a rigid polymer that provides structural support and is also in the exoskeletons of invertebrates)
- The bodies of fungi consist of long strands of cells that are connected end to end and that share cytoplasm.
  - The slender strands of fungi are called **hyphae.**
  - Often hyphae are packed together to form complex reproductive structures, such as mushrooms.
  - A hypha consists of one or more cells surrounded by a tubular cell wall. In most fungi, hyphae are divided into cells by internal cross-walls called **septa** (singular septum). Septa are usually perforated by pores large enough for ribosomes, mitochondria and sometimes nuclei to flow among cells. The structural polymer in fungal cell walls is typically chitin (in contrast plants have cellulose in their cell walls, and animal cells lack walls). Some Fungi however, have non septate hypha, meaning their hypha are not separated by septa.
- Fungi reproduce by a variety of asexual and sexual methods.
- An example of a Fungus is a mushroom.



- Fungi do not move from place to place.

- The general appearance of many fungi is similar to that of plants.
  - Fungi lack the green pigment chlorophyll and the ability to conduct photosynthesis.
- Like animals, fungi are **heterotrophs**.
  - Fungi do not ingest their food.
- Fungi obtain food by secreting digestive enzymes onto whatever they grow on.
- Many fungi are **saprophytes** that live on dead organisms
- Many other fungi are **parasites** that live on living organisms and cause disease that affect plants and animals.

Domain Eukarya -- Kingdom Plantae

- Plants are complex multicellular **autotrophs**.
- Plants have specialized cells and tissues.
- Plants have cell walls made out of **cellulose**
- Plants cannot move from one place to another.
- As autotrophs, plants are the primary producers in most terrestrial food webs.
- Plants also release **oxygen** gas to the atmosphere.
- Plants are very important in the cycling of phosphorus, water, nitrogen, and carbon.
- Plants are a source of food, medicines, dyes, cloth, paper and many other products.

Example of Kingdom Plantae:

Western prairie fringed orchid

Platanthera praeclara

Endangered in Manitoba

- The largest population in the world exists by Tolstoi, MB.
- Pollinated by a specific moth (hawk moth). This moth lives in trees and the flower lives in grassland, so they can only coexist along the borders of these regions.
- These orchid seeds may take up to 12 years to germinate because they have to form a relationship with the fungi in the soil.

Sundew (Carnivorous plant)

- Carnivorous plants (sometimes called **insectivorous plants**) are plants that derive some or most of their *nutrients* (but not *energy*) from trapping and consuming animals or protozoans, typically insects and other arthropods. Carnivorous plants appear adapted to grow in places where the soil is thin or poor in nutrients, especially nitrogen, such as acidic bogs and rock outcroppings

- The sundew in Manitoba traps insects. The insects are attracted by the sweet secretions of sticky secretions. Upon touching these, however, they become entrapped by sticky mucilage which prevents their progress or escape.

A sundew and its prey

Introduction to Kingdom Animalia

Animals are complex _____ _____

- Their cells are mostly diploid, lack a _____, and are organized as tissues.
- Animals are able to move rapidly in complex ways.
  - _____
    _____
    _____
- Most animals reproduce sexually.
- Almost all animals (99%) are _____; they lack a backbone.
- Of more than 1 million living species, only about 42,500 have a backbone; they are referred to as _____.

_____ - a common animal in Manitoba. It lives in the water as a "nymph" for up to two years and flies around for only a couple of weeks

Nine Animal Phyla (sing: phylum)

1. **Phylum _____** → *Sponges*
2. **Phylum _____** → *Hydra, jellyfishes, corals, sea anemones*
3. **Phylum _____** → *Star fish, sea urchins, sea cucumbers*
4. **Phylum _____** → Marine / freshwater flatworms
5. **Phylum _____** → Roundworms
6. **Phylum _____** → leeches and segmented worms

7. **Phylum _____** → snails (gastropods), octopus, squid, nautilus, "bivalves"

8. **Phylum _____** → Crustaceans (e.g. Lobsters, crabs), insects

9. **Phylum _____** → invertebrate chordates, fish, amphibians, reptiles, birds, mammals

******* *All phyla contain **INVERTEBRATES** except for **phylum chordata** which contain the **VERTEBRATES**!*

Questions – Kingdoms Protista, Fungi, Plantae, Animalia.

1. a) Which of the four kingdoms has mostly unicellular cells? b) Is there another kingdom that has unicellular cells as well?

2. List each of the kingdoms of Eukarya and state whether or not each has a cell wall and what the cell wall is made out of.

3. What are the strands of fungal cells called? What do the holes in septa enable to happen in the cells?

4. Are fungi autotrophs or heterotrophs?

5. Are plants autotrophs or heterotrophs?

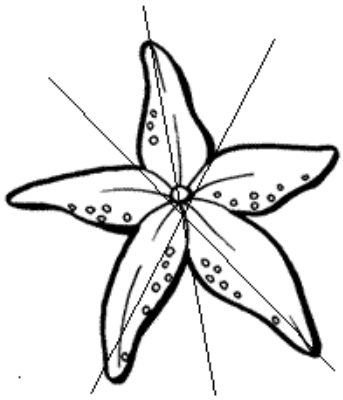
6. Describe two reasons why you think the Western fringed prairie orchid is endangered.

**** Do Animal Phylum project***

Symmetry and Body Plans

There are three types of animal symmetry: ***asymmetry***, ***radial symmetry***, and ***bilateral symmetry***. Symmetry means that if an animal is cut in half, the shapes will match. Animals such as sponges can't be cut into matching halves and are referred to as **asymmetrical**.

- In **radial symmetry**, there is a central line or axis which divides the animal into top and bottom, or front and back. Any cut across that axis will result in repeating structures arranged around the centre like spokes in a wheel. Think of a starfish. The body can be equally divided from a central axis.

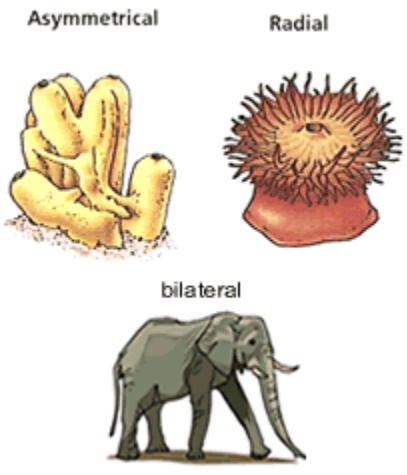


- Notice how the starfish can be divided into five equal parts from a central point. Any animals that have arms or appendages radiating from a central point will show radial symmetry.

- Animals with radial symmetry are not well adapted for movement. That is, most animals with radial symmetry tend to be sessile (non-moving).

- **Bilateral symmetry** refers to the right and left halves of an organism being mirror images of each other. Imagine a line passing through your body, starting at your forehead, going down in between your eyes, splitting your nose and mouth in half, and continuing straight down to separate your body into definite left and right halves.

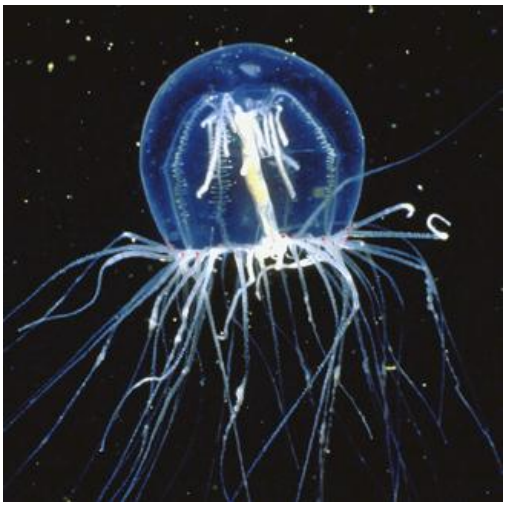
- An imaginary line that splits an organism into bilateral halves is called the **mid-sagittal line**. Humans show bilateral symmetry, as do most animals with four limbs. Snakes and fish show bilateral symmetry too.



What type of symmetry do the following organisms have?

Symmetry (snake): _____

Symmetry (sponge): _____



Symmetry (Jellyfish): _____

Development of Animal Body Plans and Body Cavities

In all animals (except sponges) the embryo becomes LAYERED through GASTRULATION (a process where germ layers are produced).

- These layers are called _____.
- Germ layers form the various tissues and organs of the body as it develops.

<u>There are 3 principle germ layers:</u>

1. _____: covers the outer surface of the embryo → gives rises to outer covering of animals; CNS (in some phyla)

2. _____: in between ectoderm and endoderm → give rise to muscles and most organs between the gut and outer covering of an animal.

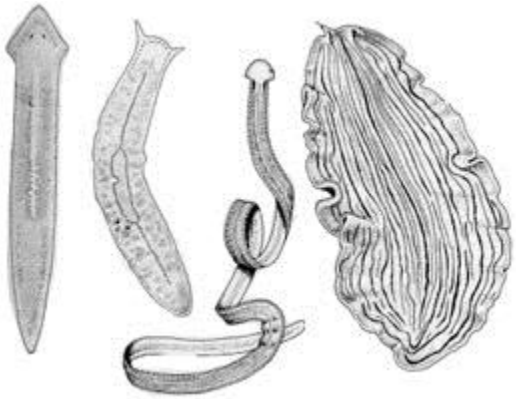
3. _____: inner most layer → lines the primitive gut; gives rise to the lining of the digestive tract (of all animals), and the liver and lungs (of vertebrates).

Animals that have 2 germ layers = _____ (ecto and endo)
Animals that have 3 germ layers = _____(ecto, meso, endo)

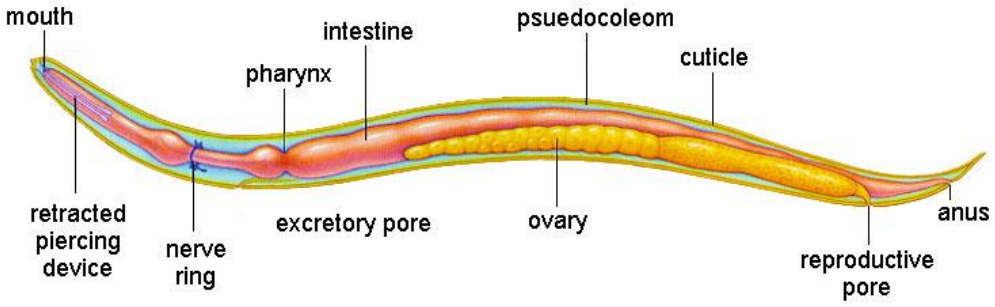
Triploblastic Body Plans:

The arrangement of the 3 germ layers in triploblastic animals may come in one of 3 forms:

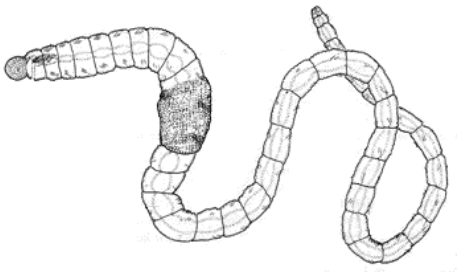
1. _____: a solid body _____ (space = coelom) between the gut and outer body wall. (example: Flatworm—phylum Platyhelminthes)



2. _____: a body with a "tube-within-a-tube." The cavity is filled with fluid separating the gut and the outer body wall. The cavity is **INCOMPLETELY** lined by mesoderm. (example: roundworms—phylum Nematoda)



3. _____: a body that contains a true coelom—a fluid-filled cavity that is **COMPLETELY** lined by mesoderm. This suspends the internal organs. (example: earthworms—phylum Annelida; phylum Mollusca; phylum Arthropoda; Phylum Echinodermata and; Phylum Chordata.)

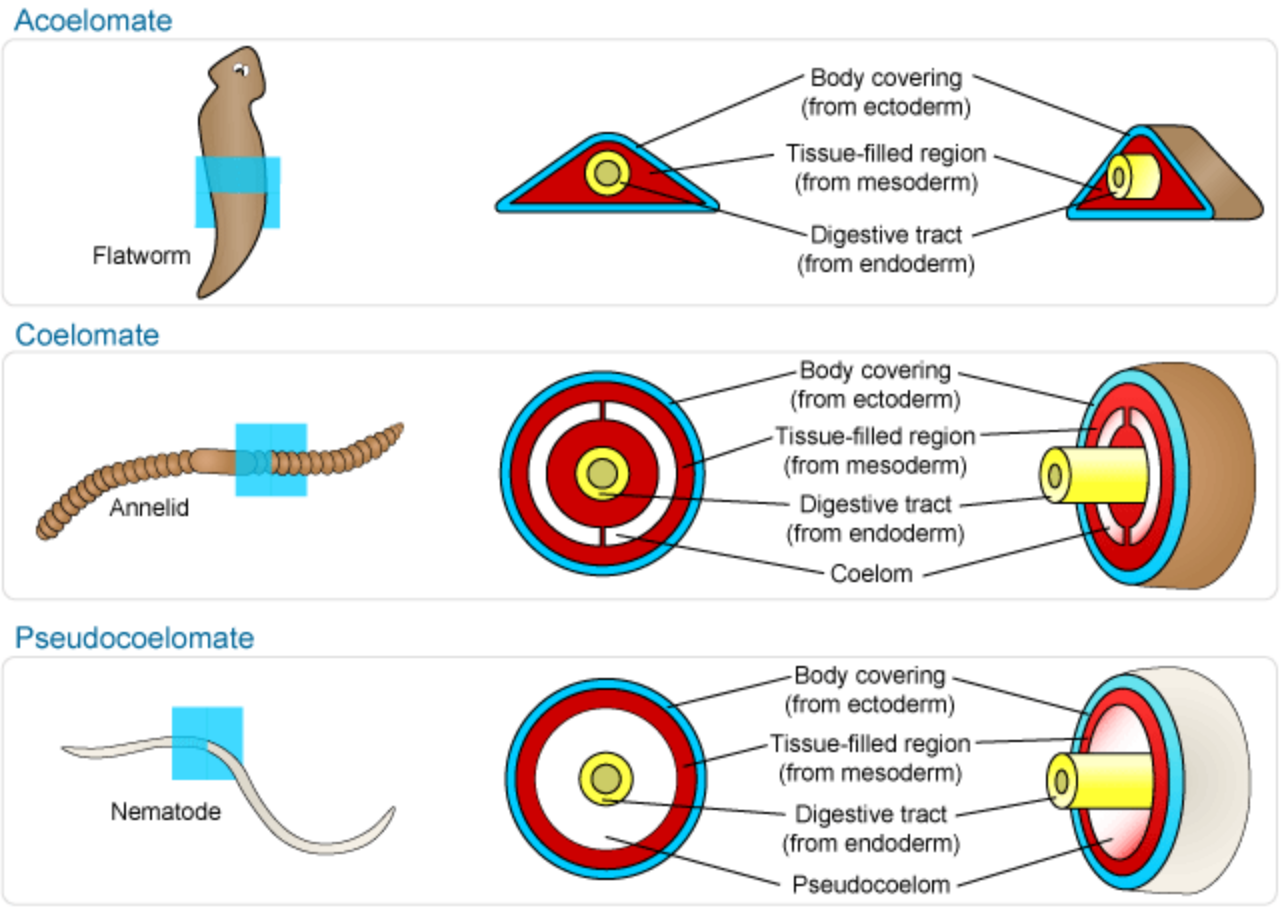


Functions of a Fluid-Filled Body Cavity:

1.

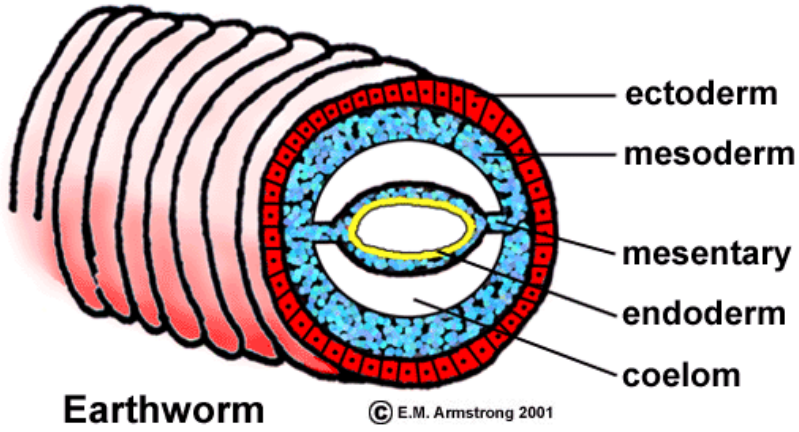
2.

3.


Acoelomate
Flatworm
Body covering
(from ectoderm)
Tissue-filled region
(from mesoderm)
Digestive tract
(from endoderm)
Coelomate
Annelid
Body covering
(from ectoderm)
Tissue-filled region
(from mesoderm)
Digestive tract
(from endoderm)
Coelom
Pseudocoelomate
Nematode
Body covering
(from ectoderm)
Tissue-filled region
(from mesoderm)
Digestive tract
(from endoderm)
Pseudocoelom
Dept. Biol. Penn State ©2002

Questions:

1) What type of Body symmetry is this? _____



2) Can an animal that has radial symmetry, such as a starfish, also have a dorsal and ventral surface? Explain.

3) What is the difference between coelomate and acoelomate animals?

- **Make sure you have the animal phyla notes ***

Final Project:

Part A - Researching Animal Phyla

- Use your textbook and other reliable source to find the following information about each of the phyla:

i) **Group name –** What is the common group name? For example, the Phylum Porifera contains the "Sponges"

ii) **Body symmetry** - Asymmetric, radial, bilateral

iii) **Motility –** Can it move and how does it move?

iv) **Body plan** - Are the animals triploblastic or diploblastic? If the animals are triploblastic, they *acoelomates, pseudocoelomates, or coelomates*?

are

v) **What distinguishes this phylum from other animal phyla?** (What is the reason these animals placed in a separate group?)

vi) **Example –** What is a key example of an animal in this phyla? ***Draw a sketch*** of what this example looks like.

vii) **Interesting fact –** What is an interesting fact about this group of organisms?

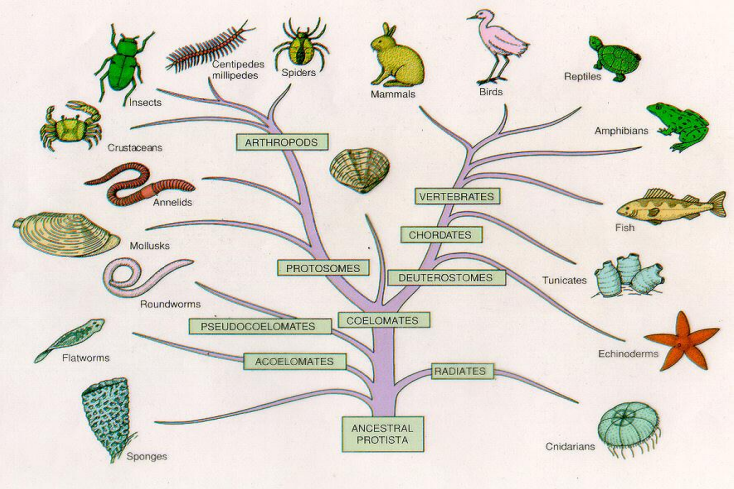
There are nine phyla for you to research: Porifera, Cnidaria, Echinodermata, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Chordata

Due Date: _____

Part B – Making a Taxonomic Flow Chart

You are to create a Flow Chart with the following categories:

- **Archaea**
- **Bacteria**
- **Eukarya**
- **Eubacteria**
- **Archaebacteria**
- **Protista**
- **Fungi**
- **Animalia**
- **Plantae**



For all of the *above* categories, you are to provide the following information:

i) An example organisms
ii) What separates this group from the other groups?
iii) Cell type (Prokaryotic or Eukaryotic)
iv) Cell structure (Does it have a cell wall and what is the cell wall made out of?)
v) Body types (Is it multicellular or unicellular?)
vi) Nutrition: Is it heterotrophic or autrotrophic?

You must also include the following categories in your flow chart

- **Porifera, Cnidaria, Echinodermata, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Chordata**

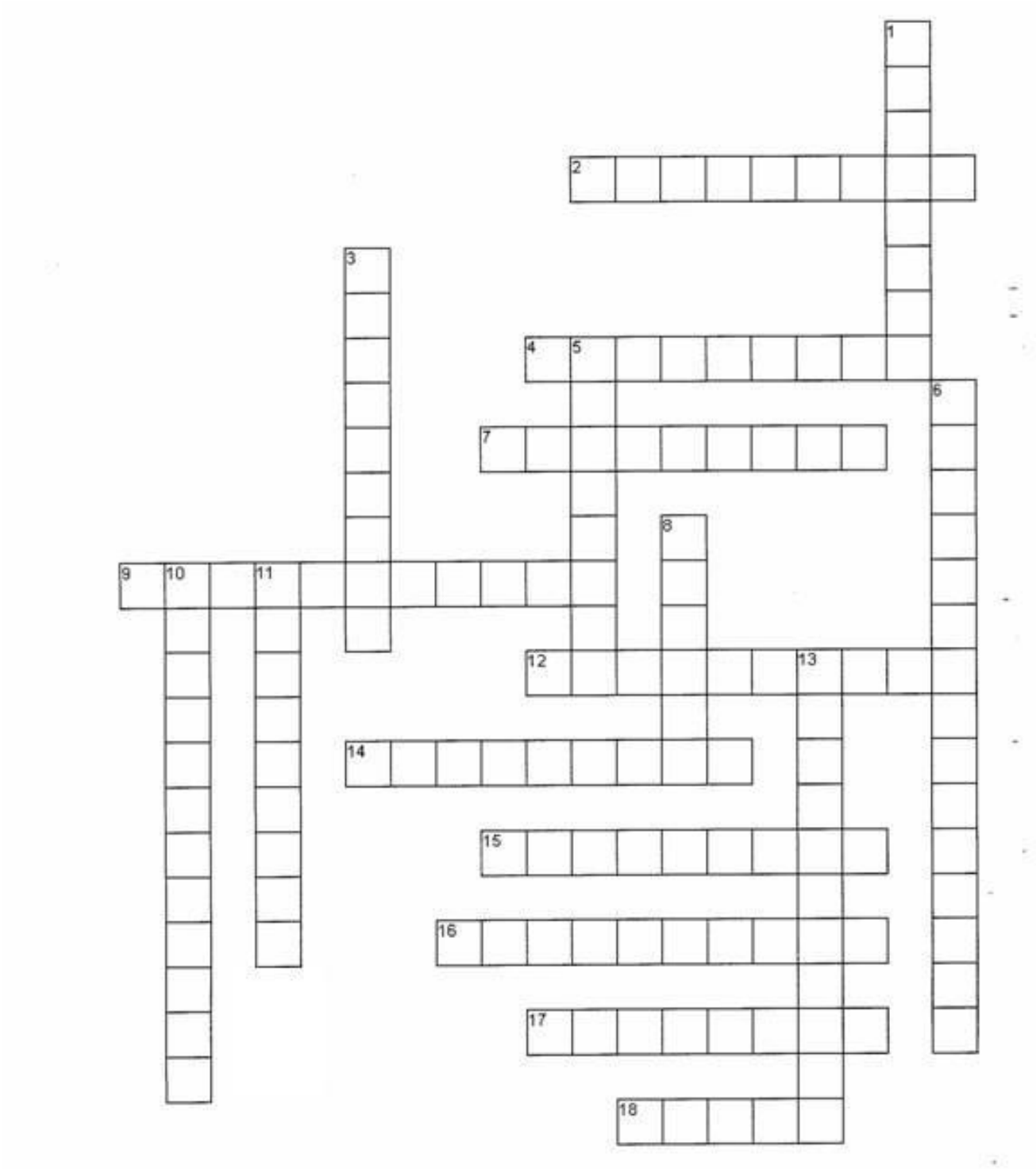
You must include the following information in the animal phyla:

i) Common name
ii) Example
iii) Motility
iv) Body Plan (Are the animals triploblastic or diploblastic? If the animals are triploblastic, are they *acoelomates, pseudocoelomates, or coelomates*?)

Due Date: _____

This will be worth marks. Every category needs to have the required information and the flow chart must be accurate.

Animal Diversity Crossword Puzzle



Animal Diversity Crossword Clues

Across

2. This phylum contains roundworms like pinworms, hookworms, and heartworms.
4. Animals that eat plants and meat are called _____.
7. These animals move throughout the ocean by filling up a body sack with gas so as to generate buoyancy.
9. Arthropods that are found in the ocean are called _____.
12. There are two types of fish; those with bones and those that have _____ instead of bones.
14. All members of this phylum have a nerve cord, similar in some cases to our spinal cord.
15. Sponges feed by _____ water to extract the nutrients found within.
16. Members of this phylum have jointed appendages.
17. This phylum contains sponges that have a glass skeleton.
18. Small mountains of coral found below the surface of the water are referred to as coral _____.

Down

1. This phylum of animals, which contains earthworms, all have segmented bodies.
3. Members of this phylum range from soft jellyfish to hard coral. (hint: the first letter is not pronounced, or silent)
5. Members of this phylum contain squids, octopi, and chitons.
6. This is the scientific terms for flat worms (hint: think of the flat bill of a platypus).
8. Mollusks are grouped together because they all have a _____.
10. Echinoderms replace lost body parts through _____.
11. Annelids are grouped together because they have _____ bodies.
13. Animals in this phylum have the ability to regenerate lost or damaged body parts.

Plant Adaptations to Land Environments:

Read p. 605-607 and answer the following questions:

1) List and describe the five adaptations to life on land
2) Why is a cuticle important on land and not in the water?
3) Why is the stomata important on land and not in the water? Would do you need a stomata if you do not have a cuticle?
4) What is the difference between vascular and non-vascular plants?
5) Provide 2 reasons for the vascularization of plants

Types of Plants

I) Nonvascular Plants

- Plants without a well-developed system of vascular tissue.
- These plants are relatively small.
- They lack vascular tissue to transport water and dissolved nutrients.
- They also lack true roots, stems, and leaves.
- These plants often are found growing in damp, shady areas—an environment that provides the water needed by nonvascular plants for nutrient transport and reproduction
- Mosses are the most familiar example.

II) Vascular Plants

- Contain vascular tissue

a) Seedless Vascular Plants

- They have roots, stems, and leaves and their surfaces are coated with a waxy covering that reduces water loss.
- They reproduce with spores that are resistant to drying.
- Both haploid and diploid phases occupy significant parts of the life cycle.
- Ferns are the most common and familiar example.

b) Nonflowering Seed Plants

- **Gymnosperms** are vascular plants that reproduce using seeds but do not produce flowers.
- Gymnosperms include plants that produce seeds in cones, such as pines and spruces.

c) Flowering Seed Plants

- Most plants that produce seeds also produce flowers.
- Flowering plants are called angiosperms.
- Angiosperms, such as roses, grasses, and oaks, produce seeds in fruits.
- Fruits are structures that enable the dispersal of seeds.
- Seeds enable plants to scatter offspring and to survive long periods of harsh environmental conditions, such as drought and extreme temperatures.

Plants Questions 1:

1) Why are non-vascular plants relatively small?
2) What group of plants do the following belong to:
    a) Western Prairie Fringed Orchid
    b) Peat moss
    c) Fern
    d) Apple Tree
    e) Blue spruce tree
3) Redraw the lifecycle of an angiosperm (p. 675)
4) Is the fruit of an angiosperm male or female?
5) Do all flowering plants have a fruit?
6) What purpose does a seed serve?
7) What is the purpose of a flower? Which group does it belong to?
8) What is the purpose of a cone? Which group does it belong to?
9) List 7 plants that you can think of (that aren't listed above). They have to be from at least three different groups. Identify which group they are in and why.

Do Dichotomous Key Activity