The history and classification of life

“Today many scientists hope for biological categories that consist of a single ancestral lineage and all its evolutionary descendants”

“The really cool thing is, we still don’t know the answer”
Key events in life’s history
3.5 billion years ago oldest fossilized bacteria

2.1 billion years ago eukaryotes appeared
Theory of Endosymbiosis explains the origin of eukaryotic cells from prokaryotic ancestors
1.5 billion years ago multicellular eukaryotes. Multicellularity evolved in several groups giving rise to plants, fungi and animals.
First multicellular organisms were colonies
500 million years ago

"Cambrian explosion" diversification of animal forms

Plants, fungi and animals move on to land
Species has scientific name

*Common names applied to species are often misleading.*

A starfish is not a fish.
A sea horse is not a horse.

*Scientific names are standard and recognized internationally*

Scientific name has a two-word Latin name, like *Homo sapiens*

The first word is the **genus** to which the organism belongs, Homo, means man

The second word represents the **species**, sapiens, means wise or thinking

Variations that you might find: *H. sapiens* or *Homo sp.*
We have classified species into groups

A classification system brings logic and order to the study of living things.

Characteristics used for classification:
characteristics that reflect the relationships between the species
Shared derived characters

![Classification Diagram]
Hierarchical Classification

Did King Phillip Come Over For Good Soup?
Classification for humans

<table>
<thead>
<tr>
<th>Scientific Rank</th>
<th>Taxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain</td>
<td>Eukarya</td>
</tr>
<tr>
<td>Kingdom</td>
<td>Animalia</td>
</tr>
<tr>
<td>Phylum</td>
<td>Chordata</td>
</tr>
<tr>
<td>Class</td>
<td>Mammalia</td>
</tr>
<tr>
<td>Order</td>
<td>Primates</td>
</tr>
<tr>
<td>Family</td>
<td>Hominidae</td>
</tr>
<tr>
<td>Genus</td>
<td>Homo</td>
</tr>
<tr>
<td>Species</td>
<td><em>H. sapiens</em></td>
</tr>
</tbody>
</table>
Classification is a work in progress

Our classification is constantly changing as we learn more about organisms through new technology.

Evolution of classification

1758, Two Kingdoms

1969, Five Kingdom, based on _______

Problems:
- Protista
- Monera
  - two groups that are unrelated
1990, Three Domains

Who are eukaryotes more closely related to?

<table>
<thead>
<tr>
<th></th>
<th>Bacteria</th>
<th>Archaea</th>
<th>Eukarya</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell type</td>
<td>Prokaryotic</td>
<td>Prokaryotic</td>
<td>Eukaryotic</td>
</tr>
<tr>
<td>Cell wall</td>
<td>Contains peptidoglycan</td>
<td>Lacks peptidoglycan</td>
<td>If present contains no peptidoglycan</td>
</tr>
<tr>
<td>Plasma membrane lipids</td>
<td>Ester links between polar heads and fatty acid tails</td>
<td>Ether links</td>
<td>Ester links</td>
</tr>
<tr>
<td>RNA polymerase</td>
<td>One (4 subunits)</td>
<td>Several (8-12 subunits each)</td>
<td>Three (12-14 subunits each)</td>
</tr>
<tr>
<td>Initiator tRNA</td>
<td>Formylmethionine</td>
<td>Methionine</td>
<td>Methionine</td>
</tr>
</tbody>
</table>
Domain Eukarya

Unifying Features about eukaryotes

• Unique cytoskeleton
• Flagella (or their shortened versions, cilia) constructed of an arrangement of 9+2
• Membrane bounded organelles
• DNA is as individual linear molecules (chromosomes)
• Unique ribosomes
Kingdoms of Domain Eukarya

- An important characteristic for dividing eukaryotes into Kingdoms is by:
  - How do they obtain their organic molecules?

  **Kingdom Plantae:** autotrophs
  
  **Kingdom Animalia:**
  Heterotrophs by ingestion
  
  **Kingdom Fungi:** Heterotrophs by absorption

- **How about protists?**
“Kingdom Protista”

Traditional view

What character was used?

Molecular view

So is this kingdom monophyletic???

What happened to the Character used above?
Endosymbiosis of unicellular algae is the key to much of protist diversity: Russian Dolls

How did the endosymbiosis that resulted in chloroplasts differ from the endosymbiosis that led to protist diversity?