Classification of Living Things

The need for classification
Short history of classification
Classification system
Bases for grouping organisms
Schemes of classification

http://www.west.sd57.bc.ca/fileadmin/sites/west.sd57.bc.ca/Clip_Art_General/
Choose a partner and view this Prezi. You may take notes while doing so.

You will be asked some questions along the way.

Write your answers on one whole sheet of pad paper and submit it at the end of the period.

You may zoom in and out of the figures as needed.

Observe proper behavior in the library!
Why classify?

To work with the diversity of life, a system of biological classification should NAME and ORGANIZE organisms in a LOGICAL MANNER.

Q1. What is endemism?

Q2. What do the figures in the graph say about endemism in the Philippines?

Q3. Give the correct scientific names of an amphibian, reptile, bird, and mammal endemic to the Philippines.

Two important features of a biological classification system

1. Assigns a universally accepted name to each organism

Left: button mushroom, Right: destroying angel mushroom

Q4. These two organisms are commonly known as mushrooms or kabute. Give the scientific name of each.

Q5. Why is it important that the assigned name is “universally accepted?”
Two important features of a biological classification system

2. Places organisms into groups that have **real biological meaning**

<table>
<thead>
<tr>
<th>Artificial classification</th>
<th>Natural classification</th>
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</thead>
<tbody>
<tr>
<td>• Uses only one or a few characteristics</td>
<td></td>
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<tr>
<td>• Superficial</td>
<td>• Uses as many characteristics as possible</td>
</tr>
<tr>
<td></td>
<td>• Can show evolutionary relationships</td>
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</tbody>
</table>
Branches that deal with classification

**TAXONOMY**
- Branch that deals with identification, classification, and naming of organisms
- Sorts closely related organisms and assigns them to separate species
- Sort species into broader taxonomic categories

**PHYLOGENY**
- Evolutionary history of a species/group of species

**SYSTEMATICS**
- Taxonomy + phylogenetics
- Study of biodiversity in the context of evolutionary history
- Classification should reflect evolutionary affinities of species

Short history of classification

Early attempts
• Two major groups: plant and animal kingdom
• Plants: grasses, herbs, trees
• Animals: fish, creeping creatures, fowl, beasts, cattle

4th century BC
• Aristotle classified animals: air dwellers, land dwellers, water dwellers
• Theophrastus classified plants: herbs, shrubs, trees

Mid-1600s
• John Ray used the term “species”
• Species – group of structurally-similar organisms that pass on these similarities to their offspring
• Genus – group of closely-related species

Q6. Why did the early classification systems only include plants and animals?
Q7. What were the bases of Aristotle and Theophrastus for classifying animals and plants?
Short history of classification

18th century

- Scientific names in Latin
- Long names as detailed descriptions of the physical characteristics of an organism

18th century

- Carolus Linnaeus
- Swedish botanist and Father of modern taxonomy
- Used structural similarities as basis for his classification system

Q8. What is the old, polynomial scientific name of the fruit in the picture, and what did it mean? How about its binomial scientific name?

Q9. Linnaeus standardized how we name each organism, though he himself goes by many names. Give as many as you can.

Q10. Write something about the controversial ‘sexual system’ that Linnaeus devised as a means of classification.

http://patentdocs.typepad.com/o/8g00d83451c41469e20136725e660970p-800wi
The Classification System

Binomial nomenclature

Q11. What is the common name of this animal? What does its scientific name mean?

Globicephala macrorhynchus

Binomial, two-part name

Lowercase species name/ specific epithet, usually a Latin description of an important characteristic of the organism/name of founder

Capitalized Genus or generic name

# The Classification System

Conventions for using binomials and names of higher taxonomic categories

<table>
<thead>
<tr>
<th>Capitalize</th>
<th>Italicize OR underline</th>
<th>Spell out</th>
<th>Abbreviate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Genus NOT species</td>
<td>• Genus and species, but NOT above the genus level</td>
<td>• Generic name the FIRST time it is used</td>
<td>• Generic name to its first letter the second and subsequent times used in the same paragraph</td>
</tr>
<tr>
<td>• Latin names of categories above the genus level, NOT english counterparts</td>
<td></td>
<td>• Specific epithet EVERY time it is used</td>
<td>• When the genus but not the species of the organism(s) is known</td>
</tr>
</tbody>
</table>

**Examples:**
- *Varanus mabitang* or **Varanus mabitang**
- Reptilia, reptiles
- *V. mabitang* or **V. mabitang**
- *Varanus* sp. (one unknown species)
- *Varanus* spp. (more than one unknown species)

[http://mampam.50megs.com/gfl/mabitang.jpg](http://mampam.50megs.com/gfl/mabitang.jpg)
The Classification System
Levels of classification

Q12. Write down an original mnemonic device to help aid in memorizing the correct hierarchy of taxonomic groups: domain, kingdom, phylum, class, order, family, genus, species.
The Classification System

The concept of species

<table>
<thead>
<tr>
<th>Early concept of “species”</th>
<th>Morphological concept: emphasizes measurable anatomical differences between species</th>
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<tbody>
<tr>
<td></td>
<td>Lowest category in Linnaeus’ hierarchy</td>
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</table>

<table>
<thead>
<tr>
<th>Biological Species Concept (BSC)</th>
<th>Ernst Mayr (1942)</th>
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<tbody>
<tr>
<td></td>
<td>Groups of interbreeding natural populations, reproductively isolated from other groups</td>
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<td></td>
<td>Based on properties unique to biological systems</td>
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</tbody>
</table>

Q13. How may these Ecuadorian butterflies be classified using the early concept of species? Why is the BSC a more meaningful basis for classification?

The Classification System
Bases for grouping organisms

1. Structural information

Fishes: classes Agnatha, Chondrichthyes, Osteichthyes

- **Petromyzon marinus** (sea lamprey)
- **Taeniura lymma** (blue-spotted ribbontail ray)
- **Amphiprion sp.** (clownfish)

Q14. What structural features qualifies a fish as a member of class Agnatha? class Chondrichthyes? class Osteichthyes?

The Classification System
Bases for grouping organisms

2. Cytological information
   Fungi vs. plants

Auricularia cornea
(jelly ear fungus)

Ipomoea aquatica
(water spinach)

Q15. Name one major difference between fungal and plant cells?

The Classification System
Bases for grouping organisms

3. Embryological information
Phylum Chordata

Q16. Chordates are named for a skeletal structure present in all chordate embryos as well as in some adult chordates. What is this structure and what is it for?

http://www.millerandlevine.com/km/evol/embryos/Haeckel.html
The Classification System
Bases for grouping organisms

4. Behavioral information
   African vultures, American vultures, and storks

   Gyps africanus (African vulture)
   Coragyps atratus (American vulture)
   Mycteria americana (Florida wood stork)

Q17. Describe the peculiar behavior of and possible relationship between two of these birds.
The Classification System
Bases for grouping organisms

5. Biochemical information

Myosin is a protein found in muscle and yeast cells.

Q17. Why do yeast cells have myosin?

The Classification System
Bases for grouping organisms

6. Evolutionary relationships
   • As supported by paleontology
   • As supported by homology

   • General rules:
     1. more # of homologous parts between 2 spp., → more closely related
     2. more complex two similar structures are → less likely it is they have evolved independently

   • Systematists group organisms in ways that show their evolutionary relationships NOT just physical similarities

Q18. Explain the probable basis for one of the general rules shown.

http://evolution.berkeley.edu/evostte/lines/IA-transitional.shtml
The Classification System
Bases for grouping organisms

6. Evolutionary relationships
   • Phylogenetic trees and cladograms: branched diagrams that show evolutionary history of related species

Phylogenetic tree: branch lengths correspond to time estimates

Cladogram: only represents branching pattern; branch lengths do not correspond to time

http://bakerbiology.wikispaces.com/Cladograms
Schemes of Classification

• As in all areas of science, ideas and models in taxonomy change as new information and technology arises

• Arranging the diversity of life into kingdoms is a *work in progress*. 
Schemes of classification
Two-kingdom system (1700s)

**Plantae**
Green, photosynthetic organisms that used energy from the sun

**Animalia**
Mobile organisms that used food for energy
Q19. What technological advancement paved the way for the addition of a new kingdom, Monera?
Schemes of classification

FOUR-kingdom system (1950s)

Plantae
Green, photosynthetic organisms that used energy from the sun

Animalia
Mobile organisms that used food for energy

Fungi
With cell walls of chitin

Monera
Microorganisms
Schemes of classification

Five-kingdom system (Early 1990s)

Fungi

Plantae

Animalia

Protista

Eukaryotic

Prokaryotic

Monera

Q19. Give one major similarity and one major difference between protists and monerans.
Schemes of classification
THREE-DOMAIN system (Early 1990s)

Q20. According to this link, what molecular evidence shows that Archaea is more related to Eukarya than to Bacteria?

http://bcs.whfreeman.com/thelifewire/content/chp27/27020.html

(Choose “step-through” instead of “narrated” if there is no audio in the library PCs)
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