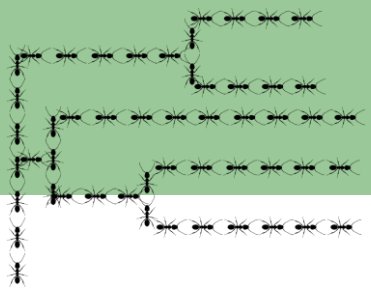
TREE OF LIFE ACTIVITY



ABOUT THIS ACTIVITY

There are more than 6 million described species of organisms on this planet. All of these species are classified into kingdoms, phyla, classes, orders, families, and all the way down to genera and species, allowing for organization and management when studying them. The reasoning behind scientific classification is similar to the reasons why we organize students into school districts, schools, grade levels and even smaller groups within classrooms based on factors like interests or seating arrangement.

This activity provides an overview of which organism groups exist across the tree of life and how they relate to each other. Students attempt to classify a few selected organisms into groups and explore a real phylogenetic tree of life.

North Carolina Standards Alignment

8.L.4.1 Summarize the use of evidence drawn from geology, fossils, and comparative anatomy to form the basis for biological classification systems and the theory of evolution.

Bio 3.5 Analyze how classification systems are developed based upon speciation.

Bio.3.5.1 Explain the historical development and changing nature of classification systems.

Bio.3.5.2 Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees)

HERE'S WHAT YOU'LL NEED

- 35 organism cards (one set per group), available here
- Chart paper & markers for poster
- Antsy Tree of Life worksheet (one per student), see below
- TOL image with correct classifications and colored overlays, available here
- List of organism ID numbers for entry in online phylogenetic tree generator, available here
- Organism chart including classifications of all organisms on the cards and their ID numbers, available here

DIRECTIONS

1. Print organism cards (in color if possible) with images of different organisms (cards available here).
2. Put students in teams of two, three or four.
3. Give students organism cards.
4. Instruct students to complete the activity on the student worksheet provided below. Students will use comparative anatomy to place organisms into groups.
5. Once students have grouped organisms, instruct them to move on to designing their posters. Directions for students are provided on worksheet.
6. Allow students to conduct a gallery walk during which they are observing other groups' posters and making comparisons to their own. Tell students to write down any questions they have about other groups' posters in the form of "I wonder" statements
   - Example: "I wonder why they placed the dolphin in a group with the stingray, since the stingray is flat."
7. If time allows, tell students to revise their groupings based on the questions that they have received from others. If time does not allow, this step can be skipped.

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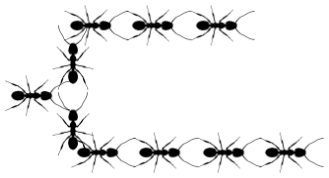
DIRECTIONS CONT.

8. After about 10 minutes, invite students to share their questions with the class and facilitate discussion.
9. Show the TOL image (provided here) that contains the correct classifications and colored overlays of groupings (more information on classifications in the tree here) OR allow students to generate the tree (no coloring) on their own by copying and pasting the TOL ID numbers (provided here) into the "tree elements" box on the online phylogenetic tree generator and press "Visualize in iTOL".
10. Have students complete the "ANSWER INDIVIDUALLY" section of their worksheet while viewing the tree.
11. Discuss students' answers, wrapping in a discussion of biochemical evidence for evolution and the development of DNA analysis (a connection to the biotechnology unit) and its use in scientific classification.

    Questions from student worksheet:
    - ✓ Do you think that the tree of life is based only on comparative anatomy like your groupings were?
    - ✓ What do you think the first classification systems were based on? Why?
    - ✓ How do you think scientists have changed the way they classify organisms over time?
    - ✓ We only looked at 35 species out of millions! How do you think scientists decide where to put a newly discovered species on the tree?
    - ✓ How do you think scientists compare the DNA of organisms?

12. Distribute or project the colored TOL image (provided here) and ask students to write their own definition of what a species is based on the image (they should also consult the organism cards).
    - Explain that scientific classifications are usually written in Latin and that genus and species names are always written in italics (with the genus name starting with a capital letter and the species name in lower case letters) while all other classifications levels are not.
13. After discussion provide the correct answer: *A member of a species can only produce offspring with another individual of its own species. Members of the same species are genetically more similar than individuals from different species.*
    - Example: Horses and donkeys cannot produce fertile offspring.



HELPFUL HINTS

- Ideally, laminate the organism cards to be reused in the future.
- If you would like the students to attach the organism cards onto their posters, tape can be provided during this step.
- It may be helpful to give each group a number so that their posters can be easily referred to during the gallery walk and discussion.
- This activity can be combined with some other activities like "Spirit Ant", "Pipe Cleaner Ant", and "Ant ID".

VOCABULARY

- Phylogeny or phylogenetic tree = the evolutionary history of a group of organisms, especially as depicted in a family tree
- Tree of life (abbr. TOL) = We use this term to describe a phylogenetic tree that includes ALL organisms; it also refers to the "Tree of Life project" which is about generating a genetic database of ALL life, the phylogenetic tree generator you are using in this activity originated from this project
- Taxonomy = the scientific branch dealing with the description, identification, naming, and classification of organisms
- Taxon (pl. taxa) = a taxonomic category; a group that forms a unit such as a species or a genus
- Comparative anatomy = the study of similarities and differences in the anatomy of different species

This activity was developed by Dr. Daniela Magdalena Sorger (post-doctoral scholar at North Carolina Museum of Natural Sciences) and Paige Derouin (7th/8th grade science teacher at Wake Young Men's Leadership Academy in Wake County) as part of the Students Discover Project (studentsdiscover.org).

Name: _____

Antsy Tree of Life

1. **With your group, spend 3 minutes looking at all of the organism cards. Discuss things that you notice about the bodies of the different organisms. Record any observations you make below:**

2. **Brainstorm 5-9 groups that you could place these organisms into. Write your group names below:**

_____ _____ _____

_____ _____ _____

_____ _____ _____

3. **Place all of the organisms into your groups. Record where you placed each organism using its common name.**

Group Name _____	Group Name _____	Group Name _____	Group Name _____	Group Name _____
Organisms	Organisms	Organisms	Organisms	Organisms
Group Name _____	Group Name _____	Group Name _____	Group Name _____	Group Name _____
Organisms	Organisms	Organisms	Organisms	Organisms

4. Make a poster!

With your team, make a poster that displays your groupings on chart paper. Your poster can be laid out any way that makes sense to your team as long as you meet the expectations below:

- ☐ All 35 organisms are included (either images or names)
- ☐ Separation between different groups is clear
- ☐ Groups are labeled with names
- ☐ Color is used

5. Discussion questions

After all groups have created their posters, your teacher will invite you to walk around and view what other groups have created. While you are walking around, make notes about questions you have in the form of "I wonder" statements.

Example: I wonder why group 3 decided to group the dolphin with the fish.

Use the lines below to write 6 statements.

_____

_____

_____

_____

_____

Answer individually:

After viewing the correct Tree of Life, compare your groupings to the tree. Were your groupings similar to the way organisms are grouped on the tree? Why or why not?

_____

_____

Using body structures to determine the relatedness of living things is called comparative anatomy. What other methods do you think scientists can use to classify organisms?

_____

_____

What do you think the first classification systems were based on? Why?

_____

_____

How do you think scientists have changed the way they classify organisms over time?

_____

_____

We only looked at 35 species out of millions! How do you think scientists decide where to put a newly discovered species on the tree?

_____

_____

How do you think scientists compare the DNA of organisms?

_____

_____

Based on the tree, write your own definition of what a <u>species</u> is.

_____

_____