

Modern evolutionary classification

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10 Modern evolutionary classification

In this activity, students work independently on a collection of tasks and questions to review what they have learned about evolutionary classification. The tasks focus on identifying clades, estimating the relatedness of different branches within a cladogram, identifying derived characters for groups of organisms, identifying the last common ancestor of a given group of organisms, and constructing cladograms according to character charts.

10.1 Aims

- To review the basic terms associated with evolutionary classification (cladogram, clade, speciation event, derived character, last common ancestor).
- To practice reading and constructing cladograms.

10.2 Structure

- Individual work (45 min).

10.3 Material

- Student sheets

10.4 Procedure

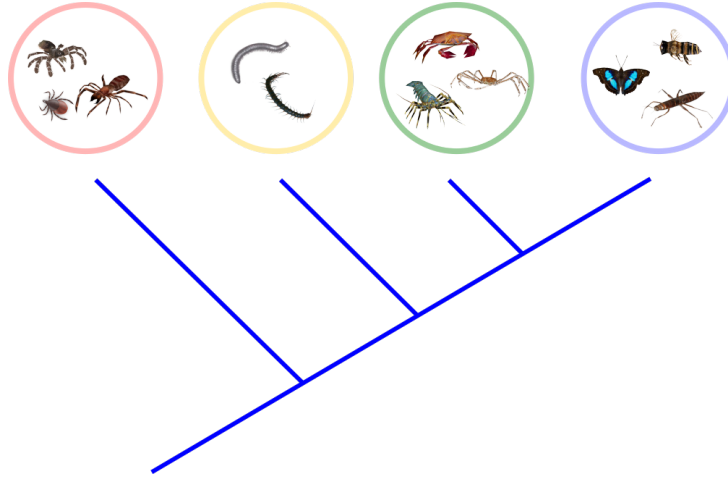
1. Students work individually on the tasks in the student sheet.
2. After completing all the tasks, students may discuss their answers with a neighbor.
3. Finally, the teacher discusses all the tasks and questions with the class, identifying and correcting the student's mistakes.

References

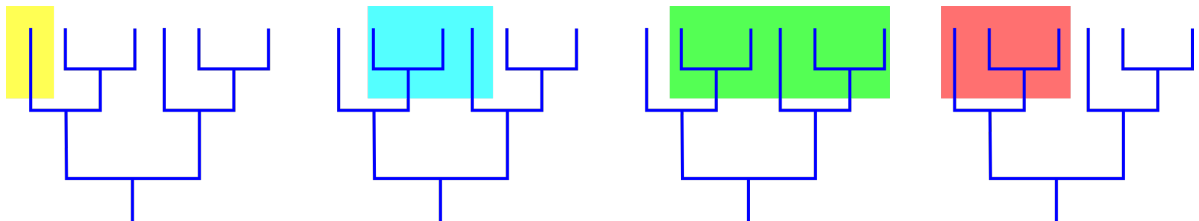
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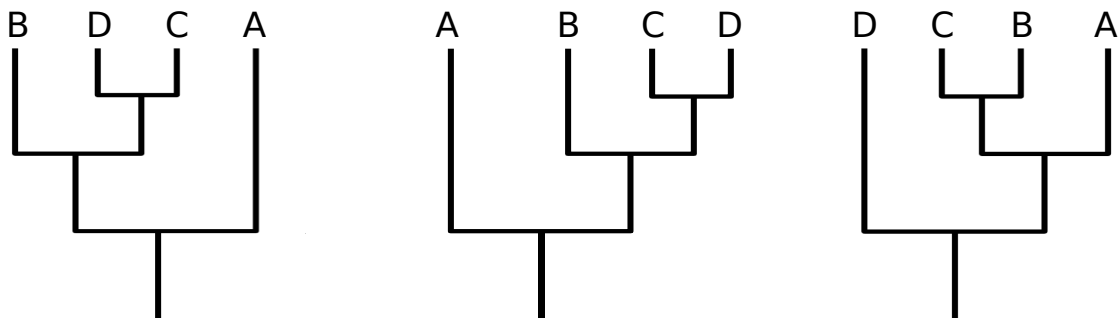
1. The picture below shows the evolutionary relationships between the four major groups of arthropods.



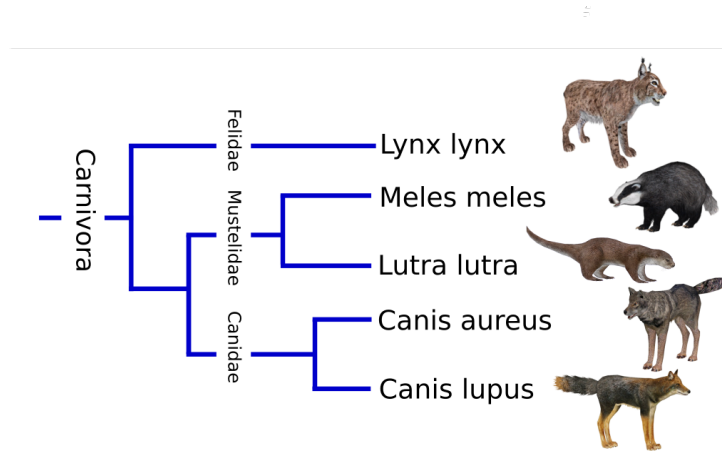
- (a) In the picture above, indicate the last common ancestor of bees, centipedes, ticks and crayfish.
 (b) Which pair of organisms is more closely related: butterflies and crayfish or bees and spiders?
 (c) Which pair of organisms shares a more recent last common ancestor: centipedes and crabs or ticks and butterflies?
2. In the cladograms below, various groups of living organisms are highlighted in color. Which of these groups are clades? Explain.



3. Which of the cladograms below depicts an evolutionary history different from that of the other two? Explain.



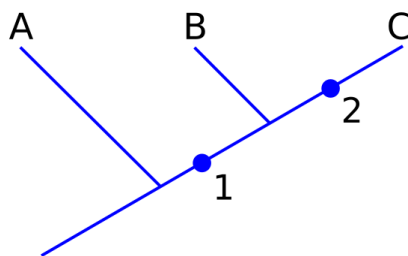
4. The picture below shows evolutionary relationships among some selected members of the order Carnivora.



- How many species are in the picture?
- How many genera are in the picture?
- Indicate in the cladogram at least one speciation event.
- Using this cladogram, explain how the evolutionary classification of the order Carnivora relates to the Linnaean classification of this order.

5. The cladogram below shows relationships among three imaginary groups of organisms: groups A, B, and C. Use the cladogram to answer the following questions:

- Which groups share derived characteristic 1?
- What does the node, or fork, between groups B and C represent?
- Which group split off from the other groups first?
- Which pair, A-B, B-C, or A-C shares the most recent common ancestor?



6. The table below gives you information about the presence or absence of certain characteristics in members of the major vertebrate groups. Use the table to draw a cladogram of these animals. Indicate the evolution of the derived characteristics listed.

	carp	salamander	mouse	lamprey	turtle
backbone	1	1	1	1	1
hinged jaw	1	1	1	0	1
four limbs	0	1	1	0	1
nails or claws	0	0	1	0	1
mammary glands	0	0	1	0	0

0 - indicates that a character is absent.

1 - indicates that a character is present.

Cladogram:

7. You may have noticed that one big vertebrate group was not included in the table above. These animals have backbone, hinged jaws, four limbs, claws, feathers, and do not have mammary glands. Could you place this animal group in the cladogram? Hint: The simple branching structure you have just drawn gets slightly more complicated by including them.