

CURRICULUM SUPPLEMENT

For use with the **QUESTIONS** section of Meltdown

ACTIVITY ONE: CLASSIFICATION WITH A DICHOTOMOUS KEY

Materials:

- *Invertebrate species cards (two for each student)*
- *Dichotomous key (for each student)*

Teaching Time: 30 minutes

Preparation Time: 15 minutes

Teacher will need to prepare dichotomous keys and species cards ahead of time.

Background:

Suppose you found a shell lying on the beach and you wanted to know what kind of animal it came from, what's the first thing you'd do? Probably, you'd want to carefully examine it, observing its unique physical characteristics. Physical traits are an important tool that anyone can use when identifying an unknown species.

A dichotomous key is designed to help in identifying something by answering a series of questions about it. If you were using a dichotomous key to identify your shell, you would go through a series of 'yes' or 'no' questions about the characteristics of the shell. Depending on the answer to the question, you'd be guided to another question. When all the questions have been answered you'll arrive at the identity of the unknown shell. A little like the game 20 questions.

In this activity students will use a simple dichotomous key to identify a series of marine invertebrates found in the Arctic (2 versions of this key are available, one visual one written).

When students have identified what group their animal belongs to they will begin a research project studying the classification and life history of their individual species.

Directions:

1. Introduce the concept of classifying species with a class challenge- a game of twenty questions. Pick an everyday object, but don't tell the class what it is. Come up with a narrative about finding a cool object at a thrift store that you were not able to identify. Explain that you think it's something the students have seen before and that you need the class's help in identifying the object.
2. Have students ask you 'yes' or 'no' questions about the object. Continue with questioning until students eventually correctly guess the identity of the mystery object.
3. Explain that the skills they used to correctly identify this mystery object are the same skills we all use to classify objects. Briefly explain the concept of scientific classification, highlighting the importance of close observation to figure out what makes a species unique from other, different species.
4. Get students interested by explaining that scientists use a tool, much like the game '20 questions' to identify individual species. This tool is called a *dichotomous key*.
5. Let students know they'll have a chance to practice using a dichotomous key to identify arctic marine invertebrates.
6. Pass out two invertebrate cards to each student. Encourage them to begin closely inspecting their species, making note of what



unique or familiar characteristics they have that might make them easily identifiable.

7. After students have had time to look at their invertebrate cards, pass out dichotomous keys.
8. Remind students that a dichotomous key works in the same way as the game they've just played. Each answer leads to another question which leads closer to the identity of their species.
9. When students have correctly identified both of their species have them trade with the person next to them; identifying two more.

Discussion:

Debrief the experience as a class:

- Was using the dichotomous key easy or challenging?*
- What made some species harder to identify?*
- What are the limitations of dichotomous key?*
- What other things could you use a dichotomous key to identify?*

Conclusions:

The ability to successfully identify species is important to anyone who wants to better understand an ecosystem. The types of species you find in an area can give you valuable clues about the living conditions and overall health of the ecosystem. In areas like the Bering Sea where little research has been done looking at species populations, identification of species is the first step in learning what sorts of animals live there; this process can lead to discoveries of never before seen animals. A dichotomous key can help scientists decipher whether the animal they've found is a known animal or a new species.

Extension: Create a Dichotomous Key

Give students more experience with dichotomous keys by having them create their own. Have students pick five unrelated everyday objects. Use the blank worksheet provided to help students structure their keys.



Marine Invertebrate Dichotomous Key

1. a. With a hard shell..... Go to 2
b. Without a hard shell..... Go to 5
2. a. Without segmented legs..... Go to 3
b. With segmented legs..... Crustacean
3. a. Shell spirals..... Gastropod
b. Shell flat, or slightly rounded, no spiral..... Bivalve
4. a. Body has radial symmetry..... Go to 6
b. Body does not have radial symmetry..... Go to 7
5. a. Stinging tentacles..... Cnidarian
b. Uses water-filled tube feet for locomotion..... Echinoderm
6. a. Worm like body shape..... Go to 7
b. Body shape is not worm like..... Go to 8
7. a. Body is covered in paired appendages..... Polychaete
b. No appendages present..... Nematode
8. a. Bilateral symmetry..... Rotifer
b. Asymmetric body shape..... Porifera

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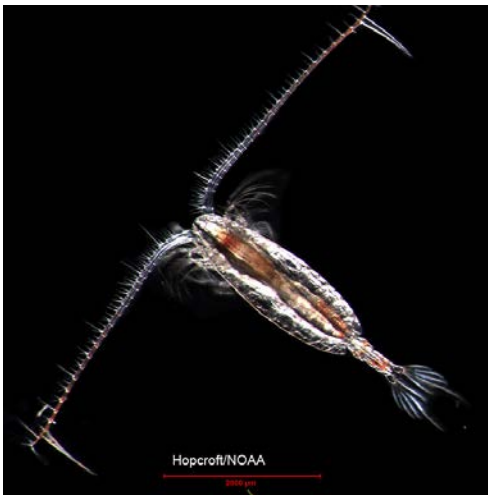
Marine Invertebrate Activity Cards



Snow Crab (crustacean)



Mysid (crustacean)



Copepod (crustacean)



Krill (crustacean)



Amphipod (crustacean)



Snail (gastropod)





Andrey Voronkov/NPI

Clam (bivalve)

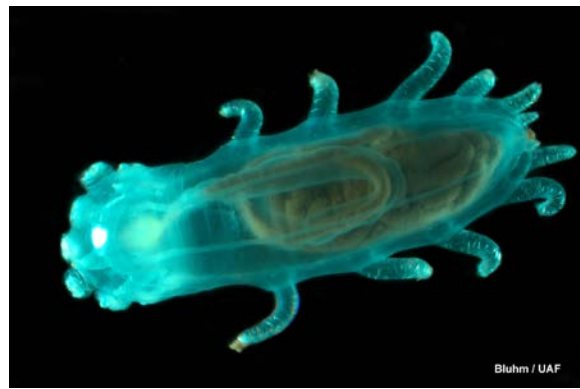


Aglantha digitale
Raskoff/MPC

Hydroid (cnidarian)



Sea anemone (cnidarians)



Bluhm / UAF

Sea cucumber (echinoderm)



Sea star (echinoderm)

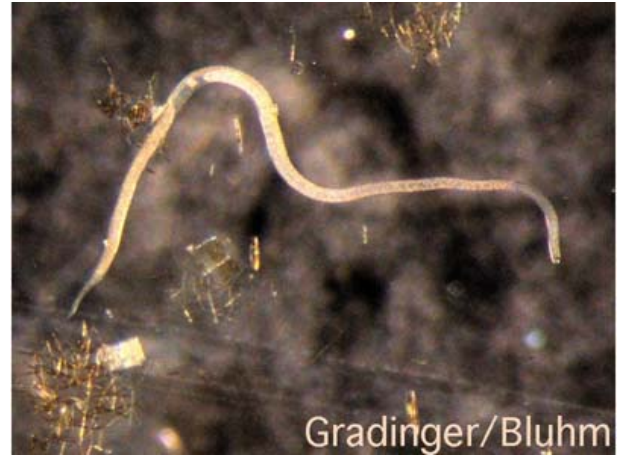


Brittle star (echinoderm)

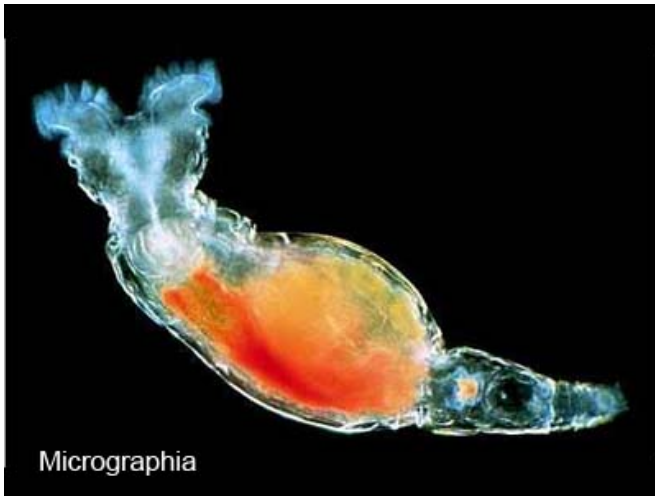




Bristle worm (polychaete)



Round worm (nematode)



Rotifer



Sponge (porifera)

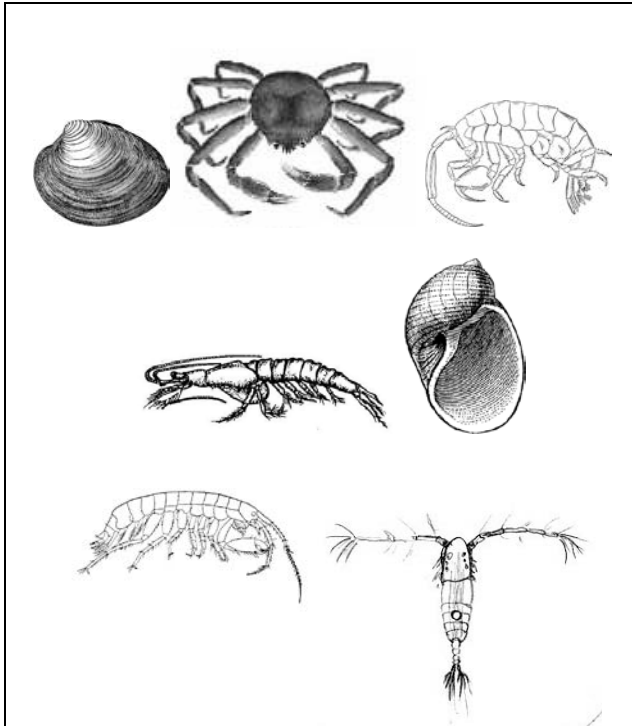
Invertebrate clipart courtesy of FCIT <http://etc.usf.edu/clipart/>
Invertebrate images courtesy of ArcOD <http://www.arcodiv.org/overview.html>



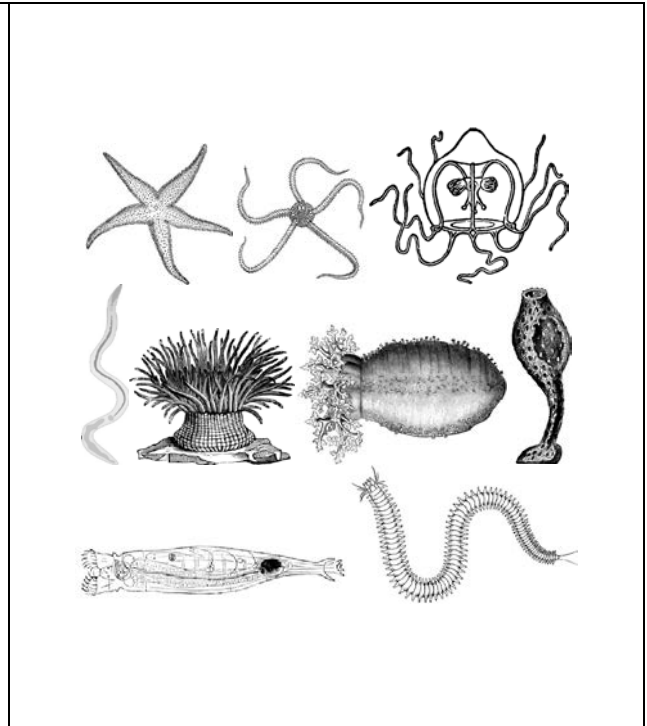
Marine Invertebrate Dichotomous Key

1. a. With a hard shell...

b. Without a hard shell...



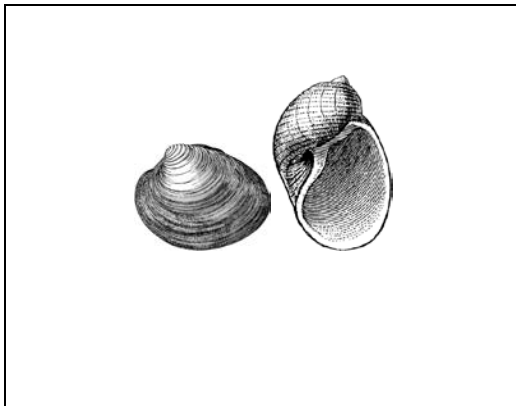
...go to 2



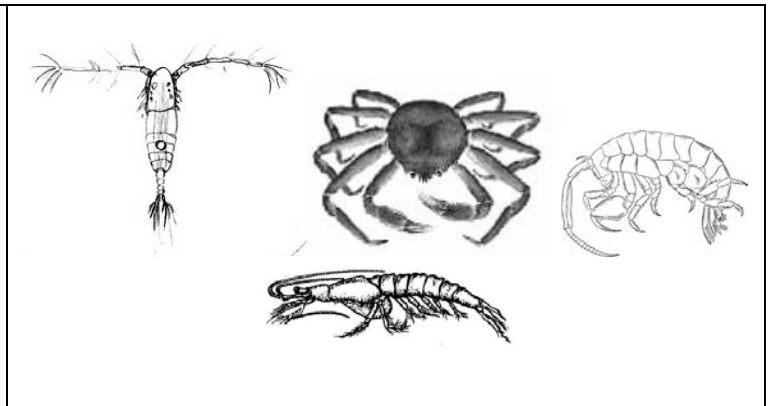
...go to 5

2. a. Without segmented legs...

b. With segmented legs...



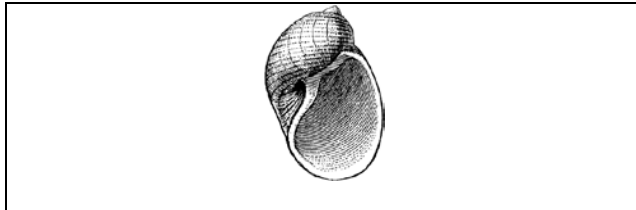
...go to 3



...go to 9

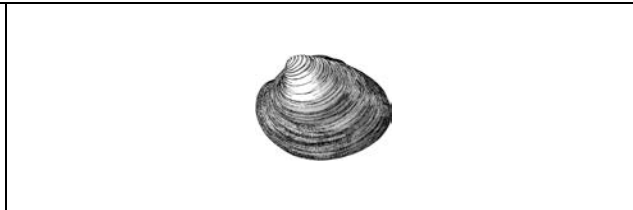


3. a. Shell spirals...



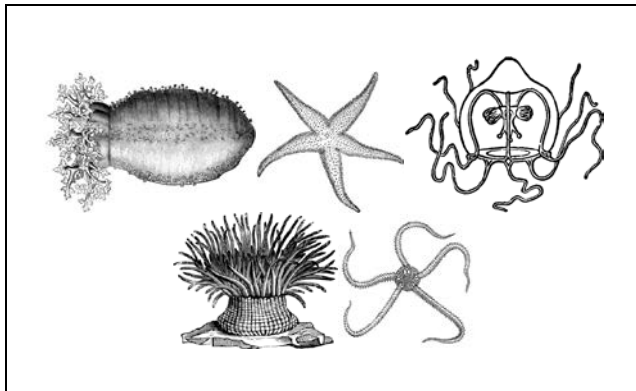
...go to 10

b. Shell flat or slightly rounded, no spiral...



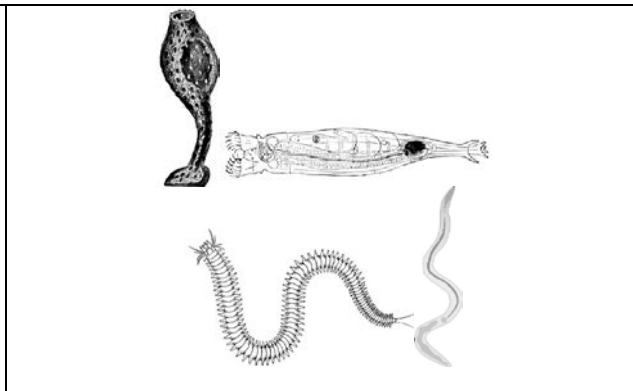
...go to 11

4. a. Body has radial symmetry...



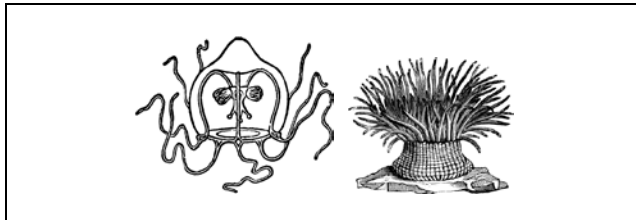
...go to 6

b. Body does not have radial symmetric...



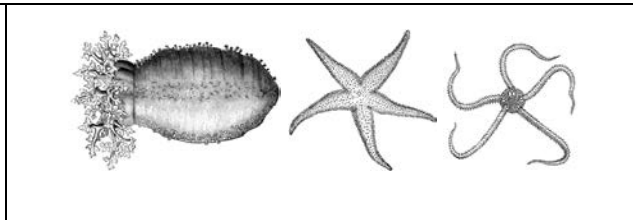
...go to 7

5. a. Stinging tentacles...



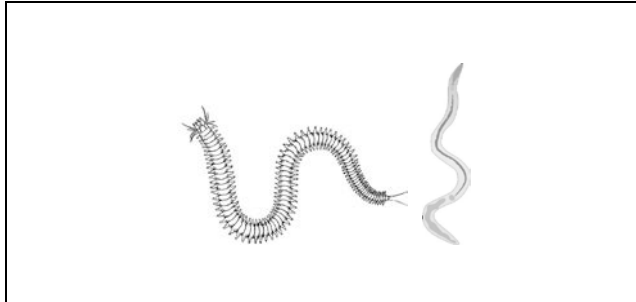
...go to 12

b. Uses water-filled tube feet for locomotion...



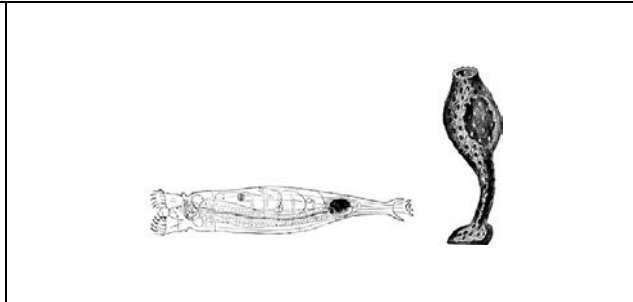
...go to 13

6. a. Worm like body shape...



...go to 8

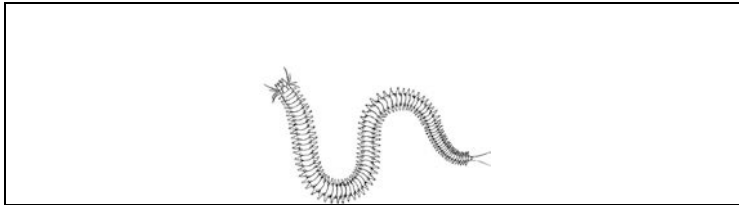
b. Body shape is not worm like...



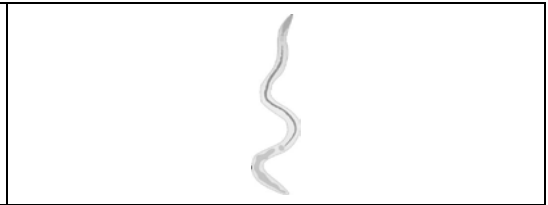
...go to 9



7. a. Body is covered in paired bristle like appendages... b. No appendages present...

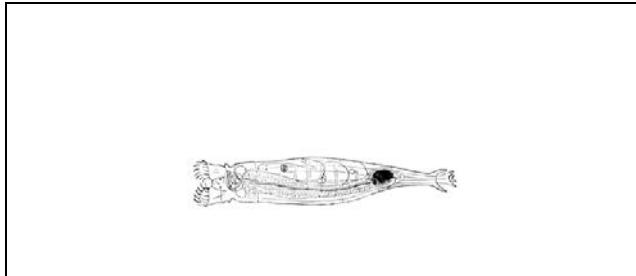


...go to 14

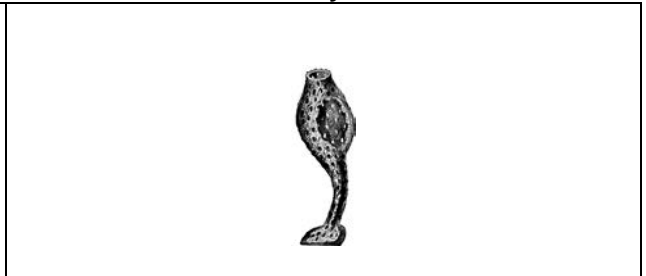


...go to 15

8. a. Bilateral symmetry, with hair-like cilia around mouth... b. Asymmetric body shape without real organs, muscles or nervous system...



...go to 16



...go to 17

9. YOUR INVERTEBRATE IS... A CRUSTACEAN



Crustaceans shown (left to right): Snow crab, mysid, copepod, krill, and amphipod.



10. YOUR INVERTEBRATE IS...
A GASTROPOD



11. YOUR INVERTEBRATE IS...
A BIVALVE CLAM



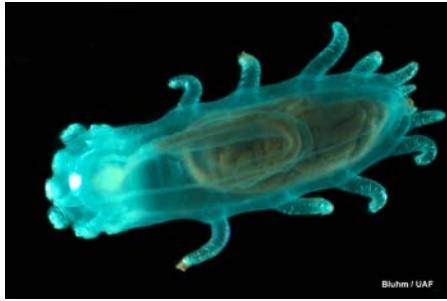
12. YOUR INVERTEBRATE IS...
A CNIDARIAN



Cnidarians (left to right): hydroid, sea anemone



13. YOUR INVERTEBRATE IS...
AN ECHINODERM



Echinoderms (left to right): sea cucumber, sea star, brittle star

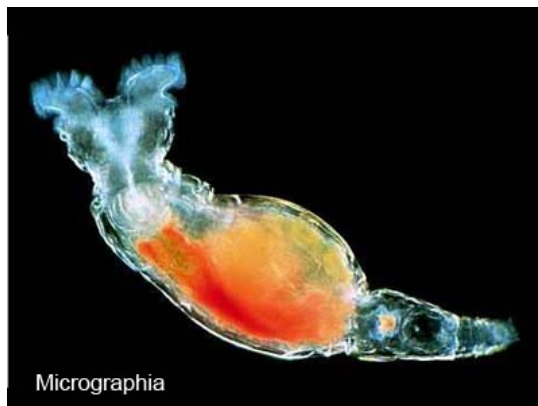
14. YOUR INVERTEBRATE IS...
A POLYCHAETE (BRISTLE) WORM



15. YOUR INVERTEBRATE IS...
A NEMATODE WORM



16. YOUR INVERTEBRATE IS...
A ROTIFER



17. YOUR INVERTEBRATE IS...
A SEA SPONGE (PORIFERA)



Invertebrate clipart courtesy of FCIT <http://etc.usf.edu/clipart/>
Invertebrate images courtesy of ArcOD <http://www.arcodiv.org/overview.html>



Name: _____

Dichotomous Key

List your five objects: _____

1. a. _____

b. _____

2. a. _____

b. _____

3. a. _____

b. _____

4. a. _____

b. _____

5. a. _____

b. _____

6. a. _____

b. _____

7. a. _____

b. _____

8. a. _____

b. _____

