

13

Embryology

INVESTIGATION

IN “A WHALE of a Tale,” you compared skeletons of five whale species to determine their evolutionary relationships. These skeletons came from mature, or fully grown, animals. Although it is possible to identify similarities and differences between mature animals, scientists also look at developing animals for evidence of evolutionary relationships. In this activity, you will look at developing animal embryos and try to identify evolutionary relationships that might not be obvious in the mature animals.

GUIDING QUESTION

How can embryos provide evidence about evolutionary relationships?



This is an embryonic pig transitioning between early and middle stage development. It is approximately 16 millimeters in length. Structures, such as the eye, nose, mouth, forelimb, hindlimb, and ribs, can be identified.

MATERIALS

For each group of four students

colored pencils

For each pair of students

1 set of 12 Embryonic Limb Cards

1 set of 20 Whole Embryo Cards

For each student

1 Student Sheet 13.1, "Comparison of Vertebrate Forelimbs"

PROCEDURE

Part A: Skeletal Forelimb Comparison

1. With your partner, examine the forelimb skeletons of six animals on Student Sheet 13.1, "Comparison of Vertebrate Forelimbs."
2. Compare the bones in the skeletons and identify the following:
 - hand/foot
 - wrist
 - forearm
 - upper arm
3. Use colored pencils to color bones that you think might function the same way. (Use the same color for any structure that performs the same function.)
4. Compare your Student Sheet with the scientifically accepted color-coded diagram provided by your teacher.
5. With your partner, discuss how the structures and functions of the forelimbs you labeled provide evidence about evolutionary relationships between the six animals.

Part B: Embryonic Limb Comparison

6. Obtain a set of 12 Embryonic Limb Cards from your teacher. They show three different limbs—a bat forelimb, a bat hindlimb, and a mouse hindlimb—at three different stages of development: early, middle, and late.
7. For each limb, compare the images on the cards. Sort the cards into three groups: early, middle, and late development. Then see if you can identify which of the cards corresponds to each limb.

8. As you sort, be sure to discuss what information you are using to decide the order. Record this information in your science notebook. Each card has an identifying letter in the corner. Use these letters to record your sorting in your notebook.
9. Based on your observations and final sorting, discuss with your partner whether you see evidence that these animals are related. Be sure to record your ideas in your science notebook.

Part C: Whole Embryo Comparison

10. Now you will look at the embryological development of five whole animals—a human, a snake, a bat, a chicken, and a salmon. You will examine the five embryos one stage at a time.
 - a. Obtain the early-stage Whole Embryo Cards from your teacher. There are five embryos along with the names of the five animals.
 - b. Make and record your observations in your science notebook.
 - c. Identify which animal you think matches each embryo. Each Whole Embryo Card has an identifying letter in the corner. Use these letters to record your decision and rationale in your science notebook.
11. Repeat Step 10 with the middle-stage Whole Embryo Cards. This set of cards shows the next stage of development for the same five animals.
 - a. Identify which early-stage embryo you think matches each middle-stage embryo. Adjust the cards as your thinking changes.
 - b. Record your new sorting and reasoning in your science notebook.
12. Repeat Step 10 with the late-stage Whole Embryo Cards. This third set of cards shows the last stage of development for the same five animals.
13. Share your sorting and reasoning with another pair of students. As a small group, revise your sorting based on your discussion, if necessary.

14. Record your final sorting and reasoning in your science notebook.
15. Based on your observations and final sorting, discuss with your partner what embryological evidence suggests about whether and how the five animals are related. Be sure to record your ideas in your science notebook.

EXTENSION

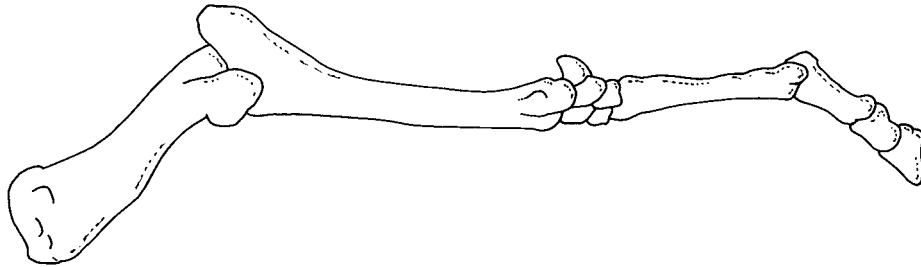
Visit the *SEPUP Third Edition Evolution* page of the SEPUP website at www.sepuplhs.org/middle/third-edition, and go the link for chick embryo development to watch the video of chick embryo development. Try to identify the points in the video that correspond to images on the cards in Part C.

ANALYSIS

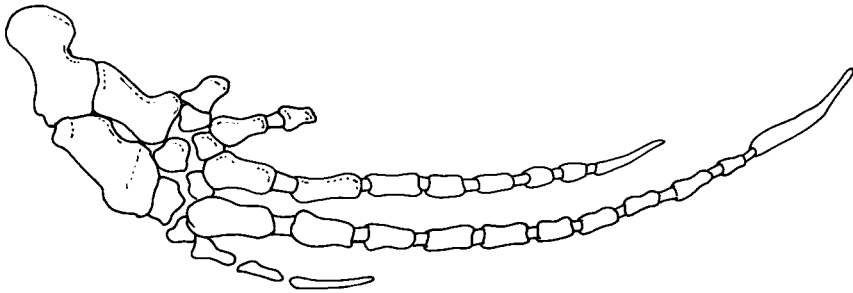
1. Was it easy to identify the type of animal when looking at embryological images? Why or why not?
2. Review the observations you recorded in your science notebook.
 - a. What patterns did you observe?
Hint: A pattern is something that happens in a repeated and predictable way.
 - b. What structures appeared and when?
 - c. What structures disappeared and when?
3. What relationships across different animal species can you see in embryological data that you cannot observe by comparing mature animals? Use data from your investigation to support your answer.

STUDENT SHEET 13.1

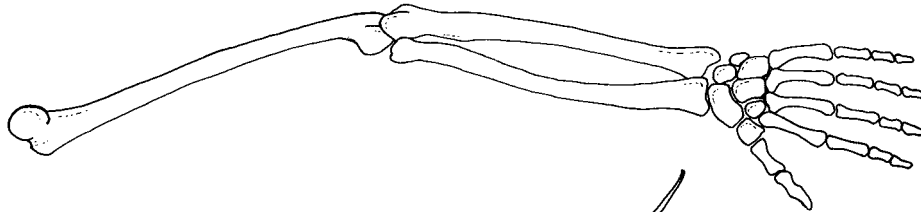
COMPARISON OF VERTEBRATE FORELIMBS



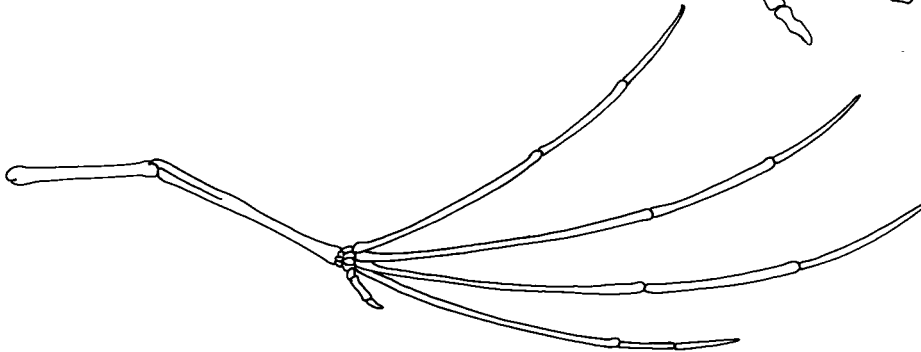
horse



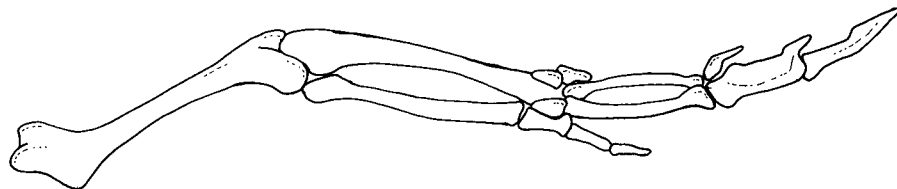
whale



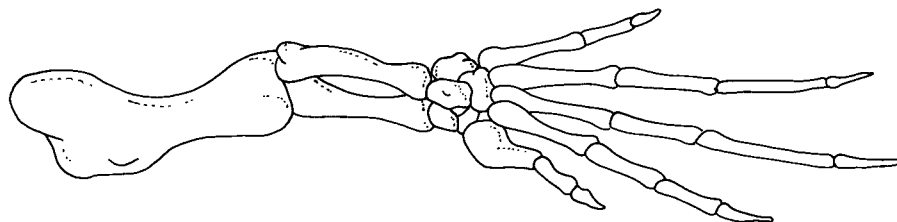
human



bat



bird



crocodile