



Investigate Ancestry

Welcome to *Chickenology*! In this lesson, students explore the ancestral link between chickens and the *Tyrannosaurus rex* (*T. rex*). What evidence connects these two organisms to each other? Students investigate three separate stations and evaluate each body of evidence supporting the theory that chickens descend from the *T. rex* ancestral line.

Student Prior Knowledge

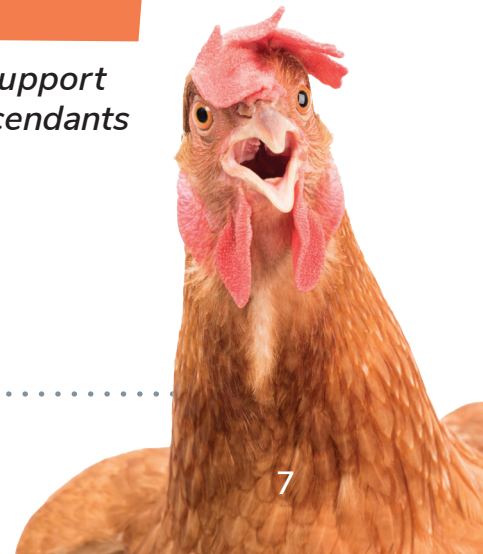
The awareness that organisms pass on traits from one generation to the next is helpful in this lesson. Students should understand that relatedness is an evolutionary relationship between ancestors and their descendants, which demonstrates connections back to a common ancestor.

**Suggested
Timeline**
90 minutes



FOCUS QUESTION

Does scientific evidence support that chickens are the descendants of theropods?



Materials

Teacher

- Dino-Chicken: Exploring Ancestors, p. 12
- display monitor or projector (ready for video resources)
- masking tape
- permanent marker

Students

- Station Cards, pp. 13–15, print in color on cardstock, 1 different card per station
- Station Answers sheets pp. 16–17, 1 per student
- Foldscopes (4), 1 per group
- chicken feathers (4), 1 per group
- magnifying glasses (4), 1 per group

Teacher Preparation

- Print Station Cards.
- Print Station Answers sheets.
- Place a Station Card at each student grouping.
- Place Foldscopes and magnifying glasses at student groupings.
- Place chicken feathers at student groupings.
- Set up computer/projector for video clips.
- Prepare for the wrap-up activity. Using masking tape, create a line on the floor across the length of the learning space. Use the permanent marker to divide the line into quarters, labeling the divisions 1, 2, 3, and 4.

PROCEDURE

1. Divide students into four groups.
2. Display or project the Dino-Chicken: Exploring Ancestors sheet. Select a student to read the Introduction. Then, ask students to examine the diagram (cladogram) on the page.
3. Pose the following questions to students:
 - a. What do you think the diagram represents?
 - b. According to the diagram, which are more closely related, chickens and theropods, or chickens and armored dinos? How can you tell?
 - c. What do you think the dots on the diagram represent?
answer: common ancestors
 - d. What does one line splitting off from another represent?
4. Discuss the answers to the questions as a class.
5. Watch “Tyrannosaurus Rex and its Descendants” at [youtube.com/watch?v=nF4zAQ13aFQ](https://www.youtube.com/watch?v=nF4zAQ13aFQ).
6. Divide the class into three groups. Distribute Station Answers sheets to each student. Students begin stations 1–3 (one group per station), recording answers on the Station Answers sheets. Students cycle through each station. (Each station and response should take 5–10 minutes.)
 - **Station 1** Anatomy (Students explore the skeletal similarities between a *T. rex* and chicken.)
 - **Station 2** Feathers (Students learn of the existence of dinosaur feathers and compare them to chicken feathers under a magnifying glass.)
 - **Station 3** Collagen (Students learn about the discovery of *T. rex* collagen and its similarity to chicken collagen.)

Teaching Suggestions

1. Make the Station Cards available through Google Docs. Students may then click directly on links in the document. They may also type answers to the task questions or create another Google document in which to do so.
2. Preload the Phylogenetic Tree Interpretation, “What is Common Ancestry?,” and “Are Birds Modern-Day Dinosaurs?” video tutorials on student computers or classroom tablets at each station.





Differentiation

Adjust the activity to best meet your students' needs.

- Create heterogeneous groups of students (of varying knowledge and ability levels) to complete stations cards together.
- View these videos as a class for content support.
 - "Phylogenetic Tree Interpretation"
youtu.be/X7UX5g0GJiM
 - "What is Common Ancestry?"
youtu.be/Gi86jDjKu-c

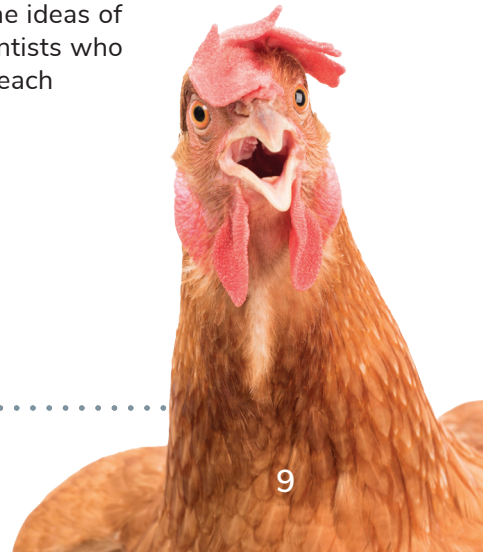
Suggested Wrap-Up

1. Have the class revisit each station and evaluate the strength of each body of evidence they analyzed.
2. Ask students to revisit the Station 1 Card. Ask students to consider these Station 1 questions:
 - a. Is the evidence tested with rigorous, proven methods?
 - b. Is the evidence repeatable—can it be tested in more than one situation or sample?
 - c. Is there any information missing from the evidence?
 - d. Are there any alternative explanations for the evidence?
3. How many of these four requirements does the evidence meet? After considering these questions, ask students to rank this body of evidence according to the following scale:
 - 1 = Not strong
 - 2 = Moderately strong
 - 3 = Very strong
 - 4 = Strong enough to be considered fact
4. Ask students to line up in front of the ranking number they chose. Ask a student at each ranking number to explain their reasoning.
5. Repeat this procedure with the other stations, ranking the strength of evidence at each station.



More Challenges

- Investigate the "Chickenosaurus". What is the idea of the "chickenosaurus"? How is one created? Compare and contrast a chickenosaurus and a dinosaur. How would a chickenosaurus help us learn about organism ancestry?
 - For more information, see the article, "Dino-chicken gets one step closer" at livescience.com/50886-scientific-progress-dino-chicken.html
- Brainstorm a theory: Can you think of any other explanations that might explain or connect the similarities between chickens and theropods?
- Compare phylogenetic trees: Gather several phylogenetic trees. Practice reading and interpreting them. If there are differences between them, compare the points of difference. Why are they different and similar? What does this communicate about the ideas of the scientists who formed each tree?





HOME CONNECTION

Start a conversation about the connection between modern-day birds and their ancestral dinosaurs. Discuss common characteristics between theropods and birds, such as four-chambered hearts, feathers, scales, hollow bones, etc. Then, discuss differences between them, such as metabolisms (endo/ectothermic), leathery/hard-shelled eggs, size, etc. How are modern commercial poultry similar to theropods? How are they different?

SUPPORT INFORMATION

Scientists propose that chickens are a descendant of the *Tyrannosaurus rex*. The *T. rex* is a member of a family of bipedal dinosaurs called theropods. Students are introduced to a phylogenetic tree to determine how dinosaurs and chickens may be related. At the crux of each split in the tree, a common ancestor (or several) is (are) proposed to have existed. The common ancestors are not listed in this tree but note to students that the common

ancestor(s) is not the *T. rex* or chicken. It is an organism with the traits of both in its DNA.

In addition to searching for common ancestors in the fossil record, there are four main bodies of evidence supporting the linkage between the chicken and the *T. rex*. These bodies of evidence, especially anatomical similarities (Station 1), and collagen (Station 3), have been applied to many organisms in search of their lineages. In evaluating the strength of each body of evidence, students learn to think critically and weigh evidence, helping them to contribute to the genesis of sound theory.



Resources

- “Phylogenetic Tree Interpretation”
youtu.be/X7UX5g0GJiM
- “What is Common Ancestry?”
youtu.be/Gi86jDjKu-c
- “Are Birds Modern-Day Dinosaurs?”
youtu.be/eaWb0UUNc00
- “T. rex linked to Chickens, Ostriches”
smithsonianmag.com/science-nature/t-rex-linked-to-chickens-ostriches-180940877





CAREER CONNECTIONS

What types of poultry professionals help make healthy, safe environments for commercial birds? Discuss the ornithologist career with your students.

Ornithologists are scientists specializing in the behavior, physiology, and conservation of birds (Class Aves), their ancestors, and their habitats.



VOCABULARY

- **ancestry.** The evolutionary or genetic line of descent of an organism.
- **clades.** A branch within a phylogenetic tree, which includes a single common ancestor and all of its descendants.
- **fossil.** The remains or impression of a prehistoric organism preserved in petrified form, as a mold or cast in rock.
- **paleontologist.** A scientist who studies the history of life on Earth through fossil and genetic records.
- **phylogenetic tree.** A diagram that depicts the lines of evolutionary descent of different species, organisms, or genes from a common ancestor.

