Shape of Life
The Story of the Animal Kingdom

Science in Action!

Exploring Scientists' Connections to the Three Dimensions of NGSS

Overview

In this lesson, students engage in the practice of science. They analyze the approaches of two different scientists to understand how they use the "Three-Dimensional" practices and concepts described in the Next Generation Science Standards (NGSS). First, they brainstorm what they think the components of a good scientific investigation are, then they compare their ideas to those on a graphic organizer which shows one clear approach to the scientific method.

Students then watch a video of a scientist carrying out an investigation and make notes about the process on the graphic organizer. After a discussion about the process, the teacher shares another graphic organizer which helps guide the students through the Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCs)—two of the Three Dimensions of the NGSS, with the Disciplinary Core Ideas (DCIs) being the third.

Third, students observe another video of a scientist in action while recording their thoughts about how the scientist uses the SEPs and CCs. The students and teacher then discuss their ideas about how the SEPs and CCs are being used in the investigation process. Possible adaptations and extensions listed at the end of the lesson include helping to guide students through the process of planning and conducting their own investigation into an observed phenomenon.

Subjects
Science, Writing, Reading

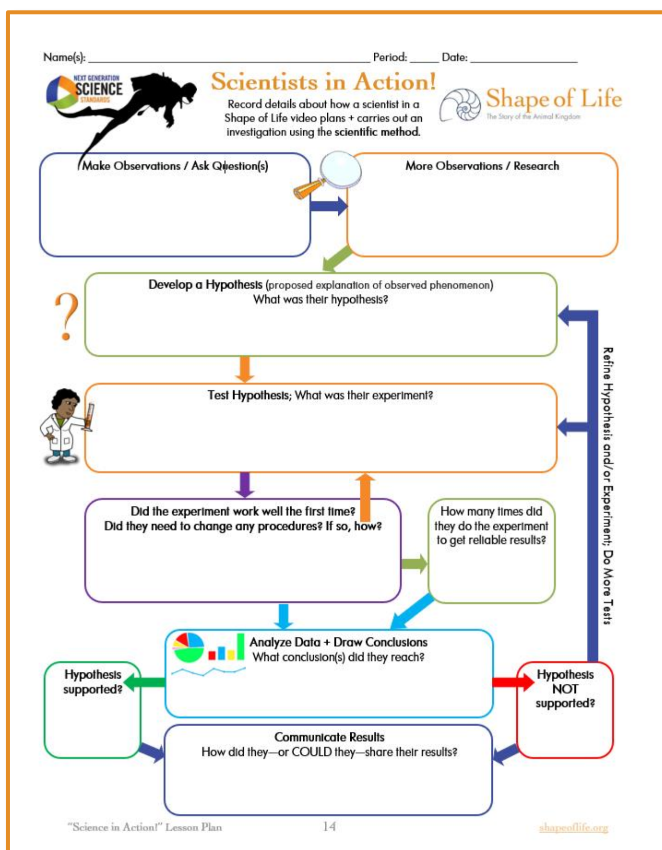
Grades 5–16

Time
45–90 minutes

Vocabulary
Will vary depending on videos used, but can include biological evolution, hypothesis, patterns, scale, proportion, systems, system models, and other terms used in the SEPs and CCs of the NGSS

Objectives

- Students will observe a scientific phenomenon and reflect on ways in which it could be investigated to determine how and/or why it happens.
- Students will demonstrate understanding of the process of planning and conducting a scientific investigation orally and in writing.
- Students will explain ways in which observed professional scientists use the SEPs and CCs of the NGSS orally and in writing.
- Students will plan and conduct their own scientific investigation into an observed phenomenon (if that recommended extension of the lesson is added).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Scientists in Action!

Record details about how a scientist in a Shape of Life video plans + carries out an investigation using the scientific method.

Make Observations / Ask Question(s)	More Observations / Research
Develop a Hypothesis (proposed explanation of observed phenomenon) What was their hypothesis?	
Test Hypothesis; What was their experiment?	
Did the experiment work well the first time? Did they need to change any procedures? If so, how?	How many times did they do the experiment to get reliable results?
Analyze Data + Draw Conclusions What conclusion(s) did they reach?	
Hypothesis supported?	Hypothesis NOT supported?
Communicate Results How did they—or COULD they—share their results?	

Refine Hypothesis and/or Experiment; Do More Tests

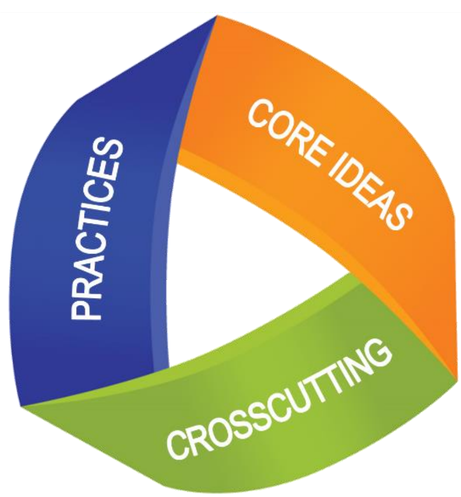
"Science in Action!" Lesson Plan 14 shapeoflife.org

"Scientists in Action!": One of 4 graphic organizers found at the end of the lesson

Standards		Middle School / High School
Next Generation Science Standards	Sample Performance Expectations met, depending on videos used + approach to lesson	HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. MS-LS4-2: Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
	Sample Disciplinary Core Ideas met	LS4: Biological Evolution: Unity and Diversity LS4.A: Evidence of Common Ancestry and Diversity LS4.C: Adaptation LS1: From Molecules to Organisms: Structures and Processes LS1.A: Structure and Function LS1.B: Growth and Development of Organisms
	Crosscutting Concepts (all can be incorporated in lesson)	• Patterns • Cause and Effect • Scale, Proportion, and Quantity • Systems and System Models • Energy and Matter • Structure and Function • Stability and Change
	Science & Engineering Practices (all can be incorporated in lesson)	• Asking Questions + Defining Problems • Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Using Math and Computational Thinking • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information
Common Core ELA	Writing	7
	Speaking & Listening	4, 6
	Language Standards	1, 2, 3, 6

Teacher Background

Three-Dimensional Learning refers to how the Next Generation Science Standards (NGSS) seeks to weave together the Science and Engineering Practices (SEPs), Crosscutting Concepts (CCs), and Disciplinary Core Ideas (DCIs) in student learning. Through the process of DOING science and engineering, students apply the Three Dimensions, helping them see the interconnections among disciplines as they develop their scientific, critical thinking, math, and English Language Arts (ELA) skills. This lesson provides a scaffolded exploration of the SEPs and CCs through the inclusion of graphic organizers that help students dig into the many important practices and concepts that scientists use in their investigations. This will help prepare students to conduct their own meaningful and reliable investigations and share their results with others in compelling ways.



The Three Dimensions of the Next Generation Science Standards (NGSS)

Materials + Preparation

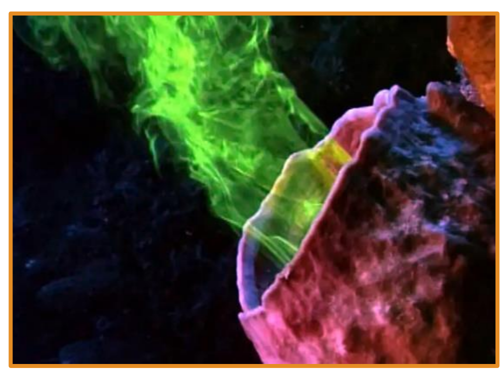
Cristina Diaz: One of 15 inspirational scientists who explains their investigations at shapeoflife.org/scientist

- Two or more Shape of Life videos of inspirational scientists conducting investigations, such as:
    - "Cristina Diaz, Taxonomist: Sponge Biology" (6:47): shapeoflife.org/video/cristina-diaz-taxonomist-sponge-biology
    - "Ian Lawn, Neurobiologist: Anemone Nervous System": shapeoflife.org/video/ian-lawn-neurobiologist-anemone-nervous-system
    - "Kristi Curry Rogers, Paleontologist: How Dinosaurs Grow": shapeoflife.org/video/kristi-curry-rogers-paleontologist-how-dinosaurs-grow
    - "Jenny Clack, Paleontologist: The First Vertebrate Walks on Land": shapeoflife.org/video/jenny-clack-paleontologist-first-vertebrate-walks-land
- Decide if you will:
    - Show the video(s) to the whole class during the "Explain" phase of the lesson and/or
    - Have students watch in groups of 2 – 3
- Science notebook and pencil or pen for each student
- Whiteboard or chart paper and markers
- *Optional:* Computer with Internet connection and data projector if you plan to show all or part of the videos to the whole class

Teaching Suggestions in the 5E Model

Engage

1. "Hook" students and introduce the lesson. (2–3 min.)
    - Show students a brief video of a scientist investigating a phenomenon in nature about an animal (or you could personally demonstrate one). A great option is "Sponges: Filter Feeding Made Visible" (2:17) with Dr. Christina Diaz: shapeoflife.org/video/sponges-filter-feeding-made-visible. Note:
        - A longer video featuring Dr. Diaz and her work is "Cristina Diaz, Taxonomist: Sponge Biology": shapeoflife.org/video/cristina-diaz-taxonomist-sponge-biology
        - A short biography of Dr. Diaz with a "Career Q&A" interview is found here: shapeoflife.org/scientist/dr-cristina-diaz-taxonomist.



"Sponges: Filter Feeding Made Visible"

- *Optional:* Ask students to think about how they might investigate the cause of the phenomenon. For example, how could Dr. Diaz plan and conduct an investigation to show how sponges are able to pump and filter so much water through their bodies so quickly? What are the steps they might take to try to get the most reliable results possible?

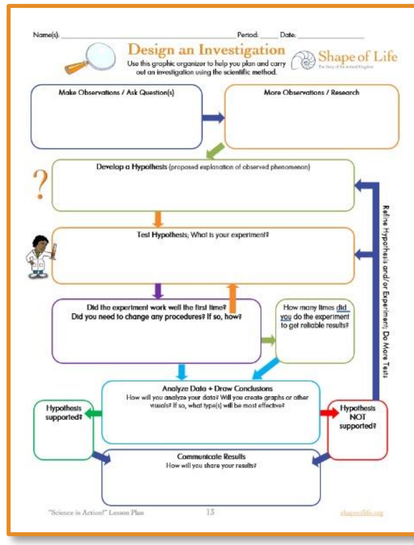
Explore

2. Students brainstorm the components of a scientific investigation. (5 – 10 min.)

- Give the students time to work with a neighbor or small group to discuss the steps in a good scientific investigation. Encourage them to write down all the steps they can think of, then put them in order, using the scientific phenomenon you are discussing as an example.
- Explain to students that they might also try to create a diagram with arrows that shows how a scientist might work through the different steps, revising their experiment, as necessary. Ideas can be recorded in science notebooks or using a computer.
- Tell students when there are 2 more minutes to work, and ask them to prepare to share their best ideas with the class.

3. Discuss the student ideas about scientific investigations. (2 – 5 min.)

- Ask the partners or groups to share their thoughts about the first step in starting an investigation. Record the ideas on the whiteboard or using a computer and data projector. You might also ask a group with an especially good diagram if they would like to share it with the class using a document camera, and reveal only the first step by covering the other steps with another piece of paper.
- Discuss a few ideas for the first step, then ask what they think the next step should be, and so on.



"Design an Investigation" graphic organizer found at the end of the lesson

4. Students compare the "Design an Investigation" organizer to their ideas. (3 – 4 min.)

- Pass out copies of the "Design an Investigation" graphic organizer found at the end of the lesson.
- Ask students, "What similarities and differences are there between the ideas we have been discussing and this organization of the steps in planning and conducting a scientific investigation?" Do the students like this presentation of what is known as the **scientific method**, or what might they change?
- Read through the organizer together (or ask them to do it in pairs or groups) and share their thoughts about it.

5. Students watch one of the scientist Shape of Life videos and consider how the scientist conducts an investigation. (10 – 20 min.)

- Pass out the "Scientists in Action!" organizer at the end of the lesson (or a revised version you decided on as a class).
- Ask the students as a class or in small groups to watch a scientist video together while thinking about how the scientist practices the scientific method.
- The following videos found at shapeoflife.org/scientist are good options to choose from:

- "Kristi Curry Rogers, Paleontologist: How Dinosaurs Grow": shapeoflife.org/video/kristi-curry-rogers-paleontologist-how-dinosaurs-grow

Dr. Kristi Curry Rogers examines a fossil

- "Jenny Clack, Paleontologist: The First Vertebrate Walks on Land": shapeoflife.org/video/jenny-clack-paleontologist-first-vertebrate-walks-land
- "Ian Lawn, Neurobiologist: Anemone Nervous System": shapeoflife.org/video/ian-lawn-neurobiologist-anemone-nervous-system

Dr. Ian Long investigates cnidarian responses to stimuli

- Explain to students that as they watch, they should record their ideas about the investigation on the organizer. Students can also use headphones, if available, to better hear the narration and minimize distractions to other groups.
- Circulate through student groups, answering questions and providing feedback, as necessary.
- When students finish watching and recording their ideas, they should share them with their partner or small group from the first activity, recording any additional ideas on their organizers.

6. Ask students to read more about the scientist they watched. (5 – 7 min.):

- Jenny Clack: shapeoflife.org/scientist/jenny-clack-paleontologist

Dr. Jenny Clack investigates a transitional fossil in the field

- Kristi Curry Rogers: shapeoflife.org/scientist/kristi-curry-rogers-paleontologist
- Ian Long: shapeoflife.org/scientist/ian-lawn-neurobiologist

Explain

7. Discuss the scientist's work as a class and how it relates to the scientific method. (5 min.)

    - Discuss the student ideas about how the scientist planned and conducted the investigation.
    - Clarify any terminology, such as **hypothesis**. Discuss student ideas about what the scientist's hypothesis was, as well as if their hypothesis was confirmed.
    - Work with students to answer any questions they have so they can all fully complete the graphic organizer and understand the scientific method, including how it helps yield more reliable results.

8. Students reflect on more ways scientists engage in the practice of science and apply key Crosscutting Concepts. (10 – 20 min.)

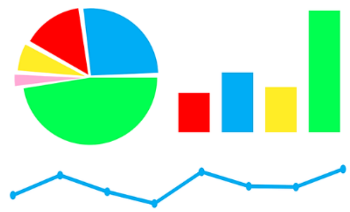
    - Pass out copies of the "Great Scientists in Action!" graphic organizer found at the end of the lesson.
    - Discuss the NGSS Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCs) listed on the sheet. Explain that the students will now watch a different scientist in action and reflect on how they use some or all of the SEPs and CCs in their work.
    - Ask them to watch the second scientist Shape of Life video in groups of 2 – 3 or show it to the class. As they watch, they can record their ideas about the SEPs and CCs on the organizer.

9. Discuss the student ideas as a class. (5 – 7 min.)

    - Go through each of the SEPs and CCs and ask students to share their thoughts about how the scientist demonstrated some or all of them. For example, these are some of the points which could be discussed about Kristi Curry Rogers and Jenny Clack:
        - Started by **Asking Questions**, such as:
            - Curry Rogers: "Did dinosaurs have to live long in order to get big?" and/or "How did dinosaurs get so big?"
            - Clack: "Is there a fossil that shows some transitional traits between life in the water and on land?" And where would you look for that fossil?"

        - **Planning + Carrying Out Investigations:**
            - Curry Rogers: She developed a **hypothesis** that dinosaurs grew quickly. She reasoned that if dinosaurs grew slowly, to reach their large size they would need to be long-lived and would face lots of predatory pressure throughout their lives.
            - Clack: She examined a fossil that might show interesting transitional traits.
        - **Constructing Explanations** and **Engaging in Argument from Evidence** (including looking for **evidence** and making **observations**):
            - Curry Rogers:
                - Modern reptiles grow slowly and don't get gigantic.
                - The **pattern** of blood vessels in bone was evidence of how fast the animal was growing.
                - The observed random pattern of blood vessels in the fossil showed it was growing fast.
            - Clack:
                - She provided evidence of a transitional form that linked marine and terrestrial tetrapods (four-legged animals).
                - Boris had both lungs and gills, so it must have lived both in and out of the water.
                - The same process could be done for the tracks she found.

- **Analyzing and Interpreting Data:**
    - Curry Rogers: The data and analysis revealed the random pattern of blood vessels indicative of fast growth. It helped explain how dinosaurs were able to grow so big.
    - Clack: Analyzing her data and fossil findings revealed an anatomical change and evidence of how the transitional animal lived.



- **Obtaining, Evaluating, + Communicating Information:**
    - Sharing their findings in writing via publications.
    - Working with the Shape of Life team to create videos of their work to disseminate the findings to an expanded audience.

- **Crosscutting Concepts** students could share include:
    - **Patterns:**
        - Curry Rogers: blood vessels
        - Clack: footprints

    - **Cause and Effect**:
        - Dinosaurs grew fast, so the blood vessel pattern is random.
        - You might encourage students to explain "how common ancestry and biological evolution are supported by multiple lines of empirical evidence" (NGSS), such as the common characteristics of modern reptiles, dinosaurs, and birds.
        - You might also discuss how **natural selection** of species through competitive pressures can result in the long-term effects of evolutionary changes over time. (For example, predator pressure selected for dinosaurs that grew fast, which became harder to kill and eat.)

    - **Scale, Proportion, and Quantity**:
        - Number and size of blood vessels
        - Scale of modern reptiles and the extinct dinosaurs

    - **Systems and System Models:**
        - Circulatory system (blood vessels) in dinosaurs
        - Respiratory system in the fossil that Clack named "Boris"

    - **Energy and Matter:** how the bones were preserved in layers of soft sediment, then fossilized over the eons through intense pressure that turned the sediment into rock

    - **Structure and Function**:
        - Blood vessels in bones bring oxygen and nutrients to tissues.
        - Understanding structures and their functions in modern reptiles and extinct animals like dinosaurs and the fossil that Clack named "Boris" helps us understand their evolution.
        - Structure of modern reptiles vs. dinosaurs

    - **Stability + Change**: evolution of organisms

Extend / Enrich

- Students can plan (and possibly also conduct) their own investigations. (30 min. or more)

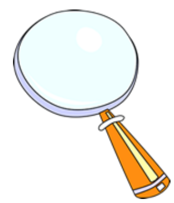
    - Challenge students to think about how they might design their own investigation to prove how and/or why an observed phenomenon occurs. Use prompts like:
        - "How might we design an **investigation** using an organism (living or already deceased)?"
        - "Are there plants, animals, or fungi in our schoolyard that we could investigate? For example, could we test the rate at which different seeds of garden plants germinate and grow under different conditions?"
        - "What materials might we need (and already have) to test interesting phenomena we observe?"
        - "How might we collect data?"
        - "How might we analyze the data and share it with others?"
    - Pass out copies of the "Design an Investigation" organizer found at the end of the lesson. Have students form groups of 2 – 4 and use the organizer, their science notebooks, and/or a computer to help them develop an investigation plan. After groups start developing their ideas, ask the groups with especially interesting ones to share them with the class. This will help them refine their ideas and assist the other groups with developing their plans.
    - Decide as a class which investigation(s) the students want to conduct. Each group might want to conduct their own unique experiment, or the groups could break a larger investigation into smaller parts for each of the groups to investigate.
    - **Ideas for student projects** if they need help generating them:
        - The proportions of different food groups represented in student lunches
        - How and why populations of endangered species are changing
        - Water and/or air quality in your area
        - Groups could test the growth rate of plants under different conditions: varying amounts of light, water, salt, compost mixed into the soil, acidity, etc.

"Eighth grade students from Mira Loma Middle School use a ground tracking system during the 11th annual Science and Technology Education Partnership (STEP) Conference."
Source: Wikimedia Commons:
[commons.wikimedia.org/wiki/File:US_Navy_101013-N-8863V-522_Eighth_grade_students_from_Mira_Loma_Middle_School_use_a_ground_tracking_system_during_the_11th_annual_Science_and_Techn.jpg]

A student proudly presents her research project at a science fair. It is inspiring when students conduct original research and share their results with others.
Image shared via Creative Commons license:
[flickr.com/photos/the-consortium/4504468200/]

        - Investigate the clouds above your school over a period of time and which types of clouds produce the most precipitation. The GLOBE Observer app from NASA can help support these studies and share the data with other groups around the world: observer.globe.gov/do-globe-observer
        - Note at the above link how GLOBE Observer can also help support investigations into mosquitoes, trees, and land cover.
        - Are there more crayfish in freshwater bodies in urban areas or rural areas?
    - Students could also create presentations or videos about their investigations and results. If so, we recommend providing a "Presentation Rubric," such as the one found at the end of the lesson, so they know how they will be assessed.

- Conduct a field study to support students observing natural phenomena and/or carrying out investigations. (Will vary)



    - Take students on a field study to a tidepool, wetland, aquarium, stream, or other natural area where they can observe organisms and their ecosystems firsthand.
    - Be sure students are prepared with appropriate clothing, safety rules, ways to avoid damaging the ecosystem, etc.

- Share more details about Dr. Christina Diaz and her fascinating research:
    - A longer video featuring Dr. Diaz and her work is "Cristina Diaz, Taxonomist: Sponge Biology": shapeoflife.org/video/cristina-diaz-taxonomist-sponge-biology
    - A short biography of Dr. Diaz with a "Career Q&A" interview is found here: shapeoflife.org/scientist/dr-cristina-diaz-taxonomist.

- Discuss current events related to one or more scientist and their research. (1 – 20 min.)

    - Find some local news highlighting scientific findings. This will make the activities and discussions more relevant and personal to the students.
    - Other important findings in the news, such as the impacts of climate change and ocean acidification on coral reefs, would also stimulate thinking and discussion.

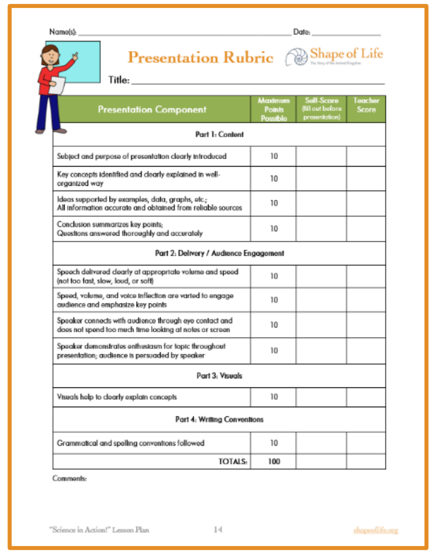
Evaluate

9. Review completed student diagrams and science notebooks.

   Provide feedback on the students' diagrams and notebooks.

10. Students can present the results of their research projects to the class if they will be completing them.

    - Provide a rubric such as the one at the end of the lesson so students know how they will be assessed.
    - Completed projects can also be displayed on classroom and/or school walls.



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Presentation Rubric

Shape of Life

Title: ______

Presentation Component	Maximum Points Possible	Self-Score (fill out before presentation)	Teacher Score
Part 1: Content			
Subject and purpose of presentation clearly introduced	10		
Key concepts identified and clearly explained in well-organized way	10		
Ideas supported by examples, data, graphs, etc.; All information accurate and obtained from reliable sources	10		
Conclusion summarizes key points; Questions answered thoroughly and accurately	10		
Part 2: Delivery / Audience Engagement			
Speech delivered clearly at appropriate volume and speed (not too fast, slow, loud, or soft)	10		
Speed, volume, and voice inflection are varied to engage audience and emphasize key points	10		
Speaker connects with audience through eye contact and does not spend too much time looking at notes or screen	10		
Speaker demonstrates enthusiasm for topic throughout presentation; audience is persuaded by speaker	10		
Part 3: Visuals			
Visuals help to clearly explain concepts	10		
Part 4: Writing Conventions			
Grammatical and spelling conventions followed	10		
TOTALS:	100		

Comments:

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11. Closing discussion / reflection (2 – 5 min.)

    - Close with a discussion of how the SEPs and CCs help scientists and engineers conduct professional, reliable investigations and create innovative, useful products and services. Ask them to think about other types of professionals that use science and engineering, in addition to the ones you have already discussed in the lesson. After a few moments, ask them to share their ideas with a partner.
    - After a minute or two, ask the partners to share their best ideas with the class and discuss.
    - Students can be asked to reflect on what they learned in the lesson by writing in their science notebooks. The graphic organizers that were completed during the lesson should also be added to their notebooks to be used for future reference.

Expand Knowledge + Skills

Scientific Method Background

- "Steps of the Scientific Method." Science Buddies: sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method
- "The Scientific Method." Khan Academy: khanacademy.org/science/high-school-biology/hs-biology-foundations/hs-biology-and-the-scientific-method/a/the-science-of-biology
- "Scientific Method." Stanford Encyclopedia of Philosophy: plato.stanford.edu/entries/scientific-method

Related Lesson Plans / Activities / Videos

- "Cnidarian Adaptations" lesson plan. Shape of Life: shapeoflife.org/sites/default/files/Cnidarian%20Adaptations%20-%20Shape%20of%20Life.pdf
- "Our Chordate Family Tree" lesson plan. Shape of Life: shapeoflife.org/lesson-plan/sol/our-chordate-family-tree
- "A Paleontologist Searches for Bilateral Ancestors." Shape of Life: shapeoflife.org/lesson-plan/sol/paleontologist-searches-bilateral-ancestors
- "Cnidarians: Life on the Move" video. Shape of Life: shapeoflife.org/video/cnidarians-life-move
- "The Secrets of Fossils." Shape of Life: shapeoflife.org/lesson-plan/sol/secrets-fossils
- "Jellyfish and Anemone Anatomy (Cnidaria)." youtube.com/watch?v=eC5-y_oTI2Q

Evolutionary Chronology (most applicable if paleontologists and their research will be explored)

- Bell, G. (2015). *The Evolution of Life*. Oxford University Press. In print or preview online: books.google.com/books?id=80aPBQAAQBAJ
- *Big History: Examines Our Past, Explains Our Present, Imagines Our Future.* DK – Penguin. In print or preview online: books.google.com/books?id=wCcCDQAAQBAJ
- "Evolution: Deep Time." PBS: pbs.org/wgbh/evolution/change/deeptime/paleoz.html
- Marshall, M. "Timeline: The Evolution of Life." New Scientist: newscientist.com/article/dn17453-timeline-the-evolution-of-life

Standards and Three-Dimensional Learning

- "Three Dimensional Learning." Next Generation Science Standards: nextgenscience.org/three-dimensions
- "NGSS EQuIP Rubric: 3-Dimensional Learning." Video. TeachingChannel: nextgenscience.org/sites/default/files/EQuIPRubricforSciencev3.pdf
- NGSS EQuIP Rubric for Lessons & Units: Science. Ver. 3.0: nextgenscience.org/sites/default/files/EQuIPRubricforSciencev3.pdf
- Next Generation Science Standards, including a link to the *Framework for K-12 Science Education* to which this lesson was aligned: nextgenscience.org/framework-k%E2%80%9312-science-education
- Examples of what NGSS looks like for California students can be found in the 2016 Science Framework for California Public Schools: cde.ca.gov/ci/sc/cf/documents/scifwchapter4.pdf
- Common Core State Standards and links to the complete documents: corestandards.org

Appreciation + Thanks

Thank you for using Shape of Life resources and helping to inspire the next generation of thinkers and scientists! We also greatly appreciate all of the scientists who have been collaborating with us and agreed to be filmed.

We welcome your questions or comments.

Lesson plan and supporting resources written, designed, and produced by
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Edited by Nancy Burnett and Natasha Fraley
Shape of Life

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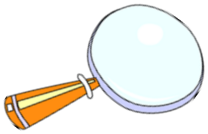

Design an Investigation

Use this graphic organizer to help you plan and carry out an investigation using the **scientific method**.

Shape of Life
The Story of the Animal Kingdom

Make Observations / Ask Question(s)

More Observations / Research

Develop a Hypothesis (proposed explanation of observed phenomenon)

Test Hypothesis; What is your experiment?

Did the experiment work well the first time?
Did you need to change any procedures? If so, how?

How many times did you do the experiment to get reliable results?

Analyze Data + Draw Conclusions
How will you analyze your data? Will you create graphs or other visuals? If so, what type(s) will be most effective?

Hypothesis supported?

Hypothesis NOT supported?

Refine Hypothesis and/or Experiment; Do More Tests

Communicate Results
How will you share your results?

Name(s): ____ Period: _____ Date: __________________

Scientists in Action!

Record details about how a scientist in a Shape of Life video plans + carries out an investigation using the **scientific method.**

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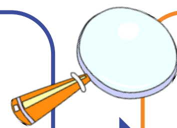
Make Observations / Ask Question(s)



More Observations / Research

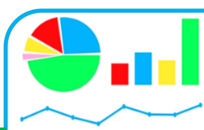
Develop a Hypothesis (proposed explanation of observed phenomenon)
What was their hypothesis?

?

Test Hypothesis; What was their experiment?

Did the experiment work well the first time?
Did they need to change any procedures? If so, how?

How many times did they do the experiment to get reliable results?



Analyze Data + Draw Conclusions
What conclusion(s) did they reach?

Hypothesis supported?

Hypothesis NOT supported?

Refine Hypothesis and/or Experiment; Do More Tests

Communicate Results
How did they—or COULD they—share their results?

Name(s): ____ Period: _____ Date: ________________

Great Scientists in Action

Shape of Life
The Story of the Animal Kingdom

Record details about how the scientists in the Shape of Life videos DO science + advance scientific understanding.

Science + Engineering Practices	
Asking Questions + Defining Problems	
Developing + Using Models	
Planning + Carrying Out Investigations	
Analyzing + Interpreting Data	
Using Math + Computational Thinking	
Constructing Explanations + Designing Solutions	
Engaging in Argument from Evidence	
Obtaining, Evaluating, + Communicating Info.	

Crosscutting Concepts

Did the scientists apply the concepts below in their work? If so, which and how?

Patterns	
Cause + Effect	
Scale, Proportion, + Quantity	
Systems + System Models	
Energy + Matter	
Structure + Function	
Stability + Change	

Name(s): ____ Date: ______________

Presentation Rubric

Shape of Life
The Story of the Animal Kingdom

Title: ____

Presentation Component	Maximum Points Possible	Self-Score (fill out before presentation)	Teacher Score
Part 1: Content			
Subject and purpose of presentation clearly introduced	10		
Key concepts identified and clearly explained in well-organized way	10		
Ideas supported by examples, data, graphs, etc.; All information accurate and obtained from reliable sources	10		
Conclusion summarizes key points; Questions answered thoroughly and accurately	10		
Part 2: Delivery / Audience Engagement			
Speech delivered clearly at appropriate volume and speed (not too fast, slow, loud, or soft)	10		
Speed, volume, and voice inflection are varied to engage audience and emphasize key points	10		
Speaker connects with audience through eye contact and does not spend too much time looking at notes or screen	10		
Speaker demonstrates enthusiasm for topic throughout presentation; audience is persuaded by speaker	10		
Part 3: Visuals			
Visuals help to clearly explain concepts	10		
Part 4: Writing Conventions			
Grammatical and spelling conventions followed	10		
TOTALS:	100		

Comments: