ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
DEPARTMENT OF EDUCATION, INNOVATION & TECHNOLOGY
CENTER FOR EDUCATIONAL OUTREACH

Day 10: What Is Algae?

Mini-lesson	Children learn how to combine evidence from multiple sources with their own knowledge, and state the information in a new way.
Inquiry Circles	Learner teams will select one inquiry question to write a synthesis statement that combines information from multiple sources.
Guided Science Investigation	Children learn about different types of algae which leads to identifying the mystery green substance.

Literacy Strategy: synthesizing information	**Reading TEKS** ELA.3.6H	**CCSS** W.3.2
Science Concept: Algae are a diverse group of organisms found both in marine and freshwater systems. They have an important role as producers in aquatic food chains.	**Science TEKS** **2018–19:** 3.2B **2024–25:** 3.1E	**NGSS** 3-LS4-3
Science and Literacy Connection: As strategic readers, we synthesize information from many sources in order to create our own, new information. During an investigation, we must analyze information from multiple sources to produce evidence that supports our claims and explains our work.		

Mini-Lesson (15 minutes)

OVERVIEW

Scientists put together new information about the world every day! Before they conduct their own investigations, scientists read a lot of text written by other scientists about their work. Scientists "synthesize" what they have read with what they already know and put that information together in a new way. "Synthesis" means making something new by putting things together.

In this unit, three days are dedicated to synthesis:

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- On the first day, you might want to start by modeling how to write a synthesis statement. Use the class Inquiry Chart about pond ecosystems to model this, then support inquiry circle teams in creating a synthesis statement for one of their inquiry questions.
- On the second day, teams can create a synthesis statement for each remaining inquiry question by combining (synthesizing) the findings in **each column** of their Inquiry Chart.
- On the third day, you might have teams create one synthesis statement that combines **all** of their findings on their Inquiry Chart.

Note: You are encouraged to create the "Synthesizing" anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. Post it for easy reference and encourage learners to use the strategy during inquiry circles.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Synthesizing" anchor chart to use as a model
- class Inquiry Chart (pond ecosystem)
- exploratory text, website, or eBook about pond ecosystems to model the strategy

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may use for the lesson; additional teacher actions and considerations are in parentheses.

EXPLAIN THE STRATEGY

Tell what the strategy is (declarative knowledge)

1. *Today we will practice synthesizing our evidence from multiple sources. We will combine information from all our sources and create our own new information. This is different from re-stating what other scientists have written. When I write a synthesis statement, I combine my evidence from multiple sources with my own knowledge, and state the information in a new way.*

Tell when and why to use the strategy (conditional knowledge)

1. *I write synthesis statements because other scientists expect me to show that I have read scientific writing about my topic but they also expect me to write in my own words. I also synthesize because it helps me construct a deeper and broader meaning about my topic across all my resources. As a strategic reader and writer, I synthesize to make sense of lots of information. I write a synthesis statement when I find information from different books, online resources, experts, and videos.*

Tell how to use the strategy (procedural knowledge)

1. *The first thing I will do is look at my pond ecosystem Inquiry Chart and think about what was important from each source. I'll do that as I consider each of my inquiry questions.*
2. *Then I will compare and contrast the important information from each of the sources.*
3. *Next, I check that all of my information fits together in a way that makes sense. If the information across sources is similar, I often do not need to do anything. If my sources*

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contradict, or disagree with, each other, then I need to stop and try to evaluate the claims or statements the authors are making.

4. *Now, I need to think about what I know about this important information and if I can add something from my own knowledge that the authors did not mention directly. I will be careful to include only my knowledge that is factual and that matches what I have read in the writing of other scientists. I will not include opinions or information that I have heard someone in my life say. If what I know is in agreement with what other scientists are saying, I can include it in my synthesis statement.*
5. *Finally, I write a synthesis statement that combines evidence from my sources and my own factual knowledge.*

You might model this strategy by identifying one inquiry question from the class Inquiry Chart (pond ecosystems) and synthesizing the information pertaining to only one question (down a column).

Science Inquiry Circles (30 minutes)

OVERVIEW

Today teams will select one question from their inquiry chart to write a synthesis statement that combines all the information they have for that one question from multiple resources.

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- team Inquiry Chart
- pencils
- exploratory texts/media (see the "Ecosystem Resources" spreadsheet for ideas)

Teacher needs:

- class Inquiry Chart (pond ecosystem)

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *It is time to get into our inquiry circle teams. You will be with the same inquiry team as yesterday.*
2. *We have answered all (or most) of our Inquiry Chart questions. Today we will start on our synthesis statements so we need to be sure we have completed the Inquiry Chart.* (Make adjustments for teams that have not yet completed their inquiry charts.)
3. *Now, inquiry teams will work together on their synthesis statements*

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During Inquiry Circles (20 minutes)

1. *Today your team will work on creating a synthesis statement for one of your inquiry questions. Your team should agree on which inquiry question to focus on today. Once you have selected the question, look at all the information in the column under your chosen question. You probably have information from multiple sources as well as some information from your own knowledge.*
2. *Work together as a team to write a synthesis statement in your science notebooks that combines all the important information from one column in your Inquiry Chart that answers the inquiry question for that column.*
3. (Remind learners they can use the "Synthesizing" anchor chart and the class Inquiry Chart to help them, as well as any other anchor charts they have used.)
4. *My role is to help guide the inquiry circles, but I expect you to work as a team to solve your problems together.* (While teams are working together, walk around the room to facilitate as needed.)

After Inquiry Circles (10 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share the synthesis statement they created (or the question they answered,) as well as what they accomplished and what reading strategies they used. The Lab Director will lead the discussion about today's results. What did the team learn about synthesizing? Which reading strategy did team members use, and how did it help? What other problems did the team encounter? How did the team resolve those problems?*
2. *The Data Scientist will now share with the entire class either their synthesis statement, something the team learned about their ecosystem, a reading strategy, or how the team solved a problem.* (**Encourage teams to share how they developed their synthesis statements.** If you saw a great example in action, encourage that team to share with the entire class.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners will view slides/images of different types of algae to gain a better understanding of the diversity of organisms in this group of phytoplankton. They will also observe their own green substance under the microscope to compare.

Note: The identity of the green substance has not yet been revealed—it is hoped that, by the end of this lesson, learners will discover on their own that their samples are indeed algae!

GUIDING QUESTIONS

Are all algae the same? How many different kinds of algae are there?

BACKGROUND INFORMATION FOR THE TEACHER

All algae are a type of phytoplankton (members of the plankton community) that contain chlorophyll to capture the Sun's energy. However, these plant-like organisms do not have true roots, stems, or vascular tissue. They belong to the kingdom Protista (prostistas are mostly single-celled organisms that are grouped together because they are not animals, plants, or fungi and do not fit into any other kingdom). Scientists who specialize in the study of algae are called phycologists.

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Algae are found almost everywhere on Earth and are important as primary producers in aquatic food chains, feeding the smallest organisms such as zooplankton as well as the biggest ones such as whales. They can also live in extreme environments like ice and hot springs.

Algae can range from microscopic single-celled size to more than 100 feet long! There are seven main groups of algae, which include cyanobacteria (blue-green algae), green algae, brown algae (sargassum and giant kelp), and diatoms.

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- access to the container of the green substance prepared by the teacher
- 1 pipette
- 1 petri dish
- 1 set of *Chlorella vulgaris algae* images
- paper towels
- access to microscope

Teacher needs:

- 88ml (3 oz) container of the green substance
- "What Does Algae Look Like?" ppt
- computer/projector (if using a digital microscope) or a standard microscope
- pipettes
- petri dishes
- paper towels
- *Chlorella vulgaris algae* images
- plastic bags for algae images
- 1 container to be used as a "catch bucket" for the disposal of samples

SETUP

- Prepare a station for viewing with a microscope (or a digital microscope and computer if available).
- Place the container of the green substance at the station with the microscope. Teams will use this container when preparing samples for viewing.
- Set up 1 pipette and 1 petri dish **per team.**
- Provide 1 container to be used as a "catch bucket" for disposing of the samples.
- Print color copies of the *Chlorella vulgaris algae* images (1 set of 6 images per team) and place in plastic bags.
- Set up projector/computer.
- Preview the "What Does Algae Look Like?" PowerPoint before class.
- Project **slide 2** for learners to see as they walk into class.

SAFETY

Review all safety measures for handling containers of the green substance and the microscope.

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DAILY OBSERVATIONS

Observations can be made at any time during the day as long as they are done daily. Observations should take 5–10 minutes, depending on the data each team is collecting.

PROCEDURE

Engage

1. Begin the class by directing learners' attention to the projected image on the screen (**slide 2**).
2. Ask, "*Can you describe what you see?"* (Color, shape, etc.) "*What do you think this is?"* Allow time for responses.
3. Reveal that the image shows a type of algae called diatoms, which are the only type of microalgae that contain silica, a common mineral that looks like glass. There are many other kinds of diatoms in amazing shapes. This slide has been stained blue so that the diatoms show up, otherwise it would be hard to see them.
4. Remind children that, in the last lesson, they learned that algae are primary producers in aquatic ecosystems. Add, *Algae are a type of phytoplankton, a member of the plankton community of microscopic organisms so tiny that many cannot be seen without a microscope. Phytoplankton are plant-like organisms but not true plants because they lack plant structures such as true roots and stems. Plankton live both in freshwater and salt water systems such as lakes, rivers, ponds, and oceans all over the world.*
5. *There is a special unit of measurement for microscopic things such as plankton—it's called a micron* (abbreviation for micrometer or one millionth of a meter). Point out the "µm"symbol on the image.
6. To get an idea of how small 1 micron is, tell them that a human hair is about 60–75 microns across!

Explore

1. As you project the remainding the slides in the PowerPoint, instruct learners to write brief 3–5 word descriptions in their notebooks of each of the slides (**e.g., slide 2: many shapes, looks blue**). Tell them you will discuss these later today.
2. After the slideshow, gather the class around the viewing station you have set up with the standard or digital microscope.
3. Explain that since they are looking at microscopic images, they will have a chance to make a different type of observation of their green substance—looking at it under a microscope!
4. Let them know that you have provided a small container of the green substance. Demonstrate how to prepare **one sample per team** for viewing under the microscope. *Using the pipette, place one drop of your sample onto the petri dish, then slide it under the microscope.*
5. Instruct them to draw what they see and to write down a description in their science notebooks. *When all team members have completed their observations, remove the specimen, and pour it out into the catch bucket. Wipe up any spills!*
6. Explain that each team will have **5 minutes** for observations and that you will be at the station to monitor the proper handling of the microscope.
7. Explain that while one team is at the microscope station looking at their sample, the other teams will look over some digital photos of "the green substance" taken through a microscope. ***Remember: the identity of their samples has not yet been revealed or affirmed.***
8. Instruct all team members to write in their science notebooks any observations and questions in they have about **both** the sample seen under the microscope and the photo images. Data Scientists should make sure their team is doing this.

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9. When ready, ask the Equipment Directors to collect a bag of images for their team (1 bag of *Chlorella vulgaris algae* per team) and have the first team come up for observations using the microscope.

Explain

1. When all teams have completed their work, ask them to share observations/questions about the different types of algae in the photos they examined. (Listen for someone to ask if the model they built at the beginning of the unit is a diatom. You can tell them that the model was indeed a diatom, *Stephanodiscus hantzschii* (**slide 11** in the PowerPoint).
2. *What questions do you have about the samples you viewed under the microscope?* (Does anyone ask or say that their samples are algae? Does anyone make the connection between one of the digital images and their sample?)
3. If they have not already made the discovery that their samples are algae, you may now announce that it is!

Elaborate

1. *Think, as the primary producers in aquatic food chains, where does algae get its energy?* (Accept all responses.) Share: "*From the sun! Algae live in the sunlight zone of aquatic systems: ponds, lakes, ocean, etc. Like land plants, they make their own food using simple substances and light from the Sun."*
2. *Looking at the notes or descriptions you wrote about each of the different slides, what can you now say about algae?* Accept responses and discuss. Answers will vary but should include that there are many different types of algae. (Alternatively, you may ask children to write 1–2 sentences that answers this question in their science notebooks.)

Evaluate

1. Are learner observations/questions more detailed and specific, communicating progress in their thinking?
2. Did they describe the differences between types of algae?
3. Was a connection made between their own samples and the algae images?
4. Did anyone correctly state where algae gets its energy?

Science Language

- **Plankton** are tiny and microscopic organisms that float freely in bodies of water and form the bases of aquatic food chains.
- **Phytoplankton** are the tiny plant-like members of the plankton community and are the primary producers in aquatic systems.
- **Zooplankton** are tiny animals (consumers) in the plankton community. Some are larva that grow up to become larger animals.
- A **larva is** an early, immature form of an animal, like a tadpole.
- **Algae** are phytoplankton capable of making their own food using energy from the Sun. Algae are primary producers.
- **Diatoms** are the only type of microalgae that contain silica.

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- **Silica** is a mineral that looks like glass and is found on Earth. Quartz is an example of a silica mineral.
- A **micron** is a standard of measurement used to measure microscopic things.

Expanded Standards
Reading TEKS **ELA.3.6H:** Listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The student is expected to: (H) synthesize information to create new understanding.
CCSS **W.3.2:** write informative/explanatory texts to examine a topic and convey ideas and information clearly.
NGSS **3-LS4-3:** construct and/or support an argument with evidence, data, and/or a model.
Science TEKS **2018–19: 3.2B:** collect and record data by observing and measuring using the metric system and recognize differences between observed and measured data. **2024-25: 3.1E:** collect observations and measurements as evidence.

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