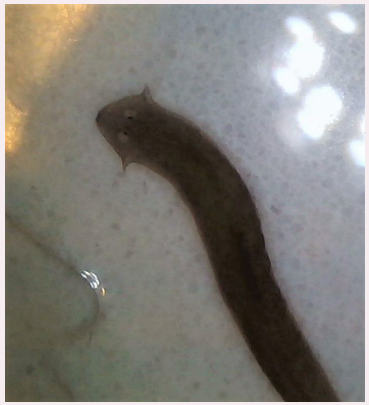
LESSON 12: How do asexual organisms pass on genetic information if they don't have sperm and eggs?

PREVIOUS LESSON *We planned an investigation to break open cells and test if asexual organisms have genetic information using bananas (asexual) and strawberries for a comparison. Then we carried out our investigations and discussed the results as a class.*

THIS LESSON

INVESTIGATION

2 days



In this lesson, we work in small groups to do research about an organism that uses asexual reproduction, and then share what we learn with our classmates. We discuss how the genetic information of offspring from asexual reprodcution compares to that of the parent. Then, we observe and bisect live planaria to see if they look identical after they've regenerated.

NEXT LESSON *We will jigsaw several data readings looking at different traits to see if our gene-to-trait story with MSTN is the same. After constructing simple models and comparing them, we will share out with the class the patterns we observe and discuss whether these traits are harmful or beneficial.*

BUILDING TOWARD NGSS

MS-LS1-5, MS-LS3-1, MS-LS3-2, MS-LS4-5

WHAT STUDENTS WILL DO

Obtain, evaluate, and communicate information about how organisms reproduce asexually and transfer their genetic information to their offspring, which results in offspring with identical genetic information.

Plan and carry out an investigation to see whether asexual reproduction causes offspring identical to their parent.

WHAT STUDENTS WILL FIGURE OUT

- Several different methods of asexual reproduction all result in genetically identical offspring.

Lesson 12 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	10 min	**NAVIGATION AND DIRECTIONS** With teacher support, students plan how they will research and share about organisms that reproduce asexually.	A-D	chart with checklist for evaluating text from Lessons 3 and 7
2	20 min	**SMALL GROUP WORK TO OBTAIN INFORMATION AND PLAN COMMUNICATION** Students work in small groups to do research about an organism that uses asexual reproduction, and plan what they will share with their classmates about that organism.	E-F	computer with internet access, access to presentation software (such as Google slides or MS PowerPoint)
3	15 min	**BEGIN SHARING ABOUT ASEXUALLY REPRODUCING ORGANISMS** Student groups begin taking turns presenting their slide(s) and taking notes about how these various organisms reproduce asexually.	G	*Asexual Reproduction Notes*, computer and projector for presentation of slides
				End of day 1
4	7 min	**FINISH SHARING ABOUT ASEXUALLY REPRODUCING ORGANISMS** Student groups finish taking turns presenting their slide(s) and taking notes about how these various organisms reproduce asexually.	G	*Asexual Reproduction Notes*, computer and projector for presentation of slides
5	8 min	**BUILDING UNDERSTANDINGS DISCUSSION ABOUT ASEXUAL REPRODUCTION** Students participate in a discussion to identify that when organisms reproduce asexually, the offspring have identical genetic information to the parent.	H	*Asexual Reproduction Notes*, chart paper or whiteboard for Punnett square example
6	25 min	**PLANARIA REGENERATION LAB** Students observe live planaria and then cut them in half. Based on what they know about asexual reproduction, students predict how the planaria will look after they've regnerated.	I-M	*Planaria Regeneration Lab Notes*, *Planaria Regeneration Lab Instructions*, Planaria Regeneration Lab
7	5 min	**PROGRESS TRACKER** Students summarize today's learning by adding an entry to their Progress Trackers.	N	
				End of day 2

Lesson 12 • Materials List

	per student	per group	per class
Planaria Regeneration Lab materials		• planarian • plastic dropper • small petri dish • piece of masking tape • spring water (to fill dish to about 1 cm deep) • paper towel • flat glass slide (chilled) • craft knife • classroom microscope and/or hand lens (if available)	• digital microscope connected to computer and projector
Lesson materials	• science notebook • computer with internet access • *Asexual Reproduction Notes* • *Planaria Regeneration Lab Notes* • *Planaria Regeneration Lab Instructions*	• access to presentation software (such as Google slides or MS PowerPoint) • computer and projector for presentation of slides	• chart with checklist for evaluating text from Lessons 3 and 7 • chart paper or whiteboard for Punnett square example

Materials preparation (40 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

Plan for how students will share their slides about asexually reproducing organisms, either by attaching their computers to your projector, or sharing their slide files with you to present.

Day 2: Planaria Regeneration Lab

- **Group size:** 2 students
- **Setup:**
- Be sure to order planaria well in advance of teaching this lesson! When they arrive, care for the planaria as directed in the resources from the supply company.
    - You should have one planarian per student pair.
    - If you will be using the planaria within the next few days, they can stay in the supplied jar with the lid on but unscrewed.
    - No feeding is necessary unless you plan to maintain them longer than a week before the lab. No feeding is necessary after they have been bisected.
    - Keep them in the dark at room temperature, loosely covered.
    - If you will be keeping uncut planaria longer than a week, or if you plan to maintain the planaria in your classroom after they have fully regenerated, they will need to be fed about once a week. Place a pea-sized amount of beef liver or hard-boiled egg yolk into their container and let them eat for 30 min. to 2 hours. There is a video about feeding the planaria at https://www.teachersopensciedfieldtest.org/muscles for reference.
    - After feeding, change the water and replace it with new spring water (never use tap water or distilled water). There is a video about changing the planaria water available at https://www.teachersopensciedfieldtest.org/muscles for reference.

- Connect the digital microscope to your computer (that you can project for the class).
    - Plug in the attached USB cord.
    - Open the camera app on your computer (if your computer already has another camera on it, you will need to click the "switch camera" icon to use the microscope).
    - The microscope's light should go on, and its brightness can be adjusted using the dial on the cord.

- Gather the other materials your students will need. Each partnership should have the following:
    - plastic pipette dropper (the tip can be cut to accommodate moving larger planaria if needed, and the pipettes can be kept for investigating planaria again in Lesson 15)
    - small petri dish with cover
    - spring water (cold, enough to fill the petri dish to about 1 cm deep)
    - flat glass slide, frozen or refrigerated
    - paper towel to wipe drips
    - hobby or craft knife
    - piece of masking tape to label their dish
    - if available, a hand lens and/or classroom microscope (4x power or 10x power)

- Several hours before the lab, or the day before the lab, put the slides students will use in the refrigerator or freezer to chill them. Put some spring water in the refrigerator to chill it.
    - Planaria can tolerate cold down to 9 degrees Celsius, and they will not move so quickly when your students are trying to observe them if they are chilly.
    - Just before you use the planaria in class, pour off some of the water in their storage jar and replace it with refrigerated spring water to lower the temperature.

- **Notes for during the lab:**
    - There are two videos available for reference at https://www.teachersopensciedfieldtest.org/muscles showing the planaria bisection: an overview demonstration and the view as seen through the digital microscope.
    - If you do not have a light-colored desk surface (on which to view dark-colored planaria), place a sheet of white paper under the jar you're viewing and slide you're demonstrating with.
    - Do not try to use a coverslip to immobilize a planarian when observing it - it will squish it.
    - Planaria are considered fragile creatures and as such may not do well to be exposed to a bleached paper towel (on which we are cutting them). Unbleached towels or filter paper are other options. However, white paper towels were used in trials while writing these plans, and no ill effects were observed.

- **Safety:** Do not distribute craft knives until they will be needed. Review with students how to handle and use the knives safely.

- **Storage:** Planaria should be kept in a dark or dimly lit area at room temperature, between 21 and 23 degrees Celsius.

- **Disposal:** After students have observed the planaria in future lessons, we recommend that the planaria be
    - maintained in the classroom to the end of their natural life,
    - donated to another classroom or science department,
    - adopted or taken home by students, with parental permission,
    - donated to a nature center or zoo, or
    - disposed of humanely, as a last resort.

Lesson 12 • Where We Are Going and NOT Going

Where We Are Going

This lesson begins a gradual release of responsibility as students determine their purpose for reading a scientific text. In this lesson, the teacher directly leads the students to their purpose for reading. In Lesson 13, the class will co-construct its purpose for reading. The organisms selected for research in this lesson were chosen in an attempt to include a variety of types of asexual reproduction without getting too complicated. Specifically, reproduction via spores was left out because internet searching yielded information that was well beyond the scope of eighth-grade boundaries.

Where We Are NOT Going

This lesson does not expect students to go into detail about how organisms are able to make copies of themselves or their cells (mitosis, meiosis). The discussion about asexual reproduction will not get into its benefits or drawbacks, as that will be covered in the OpenSciEd Unit 8.6 on natural selection. There are various ways suggested online for cutting planaria, but we will only be making a single cut across the midsection of the body. Students are also not going to discuss the stem cells required for planaria to regenerate.

LEARNING PLAN for LESSON 12

1 · NAVIGATION AND DIRECTIONS

10 min

MATERIALS: chart with checklist for evaluating text from Lessons 3 and 7

Set a purpose for today's work. Display **slide A**.

Say, *Last time we were able to get genetic information out of asexual living things like bananas, so we know they have it. But that left us wondering how asexual organisms pass on genetic information if they dont have sperm and eggs! So today, you're going to work in small groups to do a miniature research project about organisms that reproduce asexually. Your group will be responsible for obtaining information about how a certain asexual organism reproduces, and then you will communicate back to the whole class what you've figured out. We have just today's class to do research, and each group will have only about 2 minutes to share, so it's going to be quick, but we'll learn a lot!*

Give specific directions for today's mini-research project. Display **slide B** and/or refer to your classroom charts about close reading/making meaning from text and evaluating the text.

Say, *We have already had practice during this unit reading and gathering information from scientific text. You have also practiced evaluating sources to consider how reliable they are. For today's research, your group will have a specific organism to research, and you will have to find information online about how that organism reproduces. You will need to ask yourself questions to consider whether the sources you find are reliable. If so, you will need to read the information in a way that helps you make sense of it. Usually we mark up the text to help us focus on our purpose for reading; how will you read closely and carefully on a screen? What tools or strategies can you use?*

Elicit suggestions such as attending to text features (headings, image captions, and so forth), highlighting the text on the screen to call attention to key details, taking notes on paper to remember main ideas, and so on.✱

ADDITIONAL GUIDANCE

Be sure your students understand the school's policy for safe searching online. You might suggest that groups search the question "How do _____ reproduce?" which usually generates student-friendly results. Searching a specific species name often generates more high-level academic results, which are likely too complex for students to understand.

Say, *But you probably know that scientists don't just learn information and keep it to themselves! Science exploration and learning works because people share their ideas. So today we are also going to practice communicating science information with others.*

Display **slide C**. Discuss the questions listed on the slide.

Suggested prompt	Sample student response
Who will be your audience today?	*Us! Our classmates. Each other. The other groups.*
What is your purpose for sharing the information you learn?	*Well each group is going to research a different organism, so we would only learn about one if we didn't share. We have to share so the whole class can learn about more than one living thing.* *We are trying to find out about asexual reproduction and how it works... maybe different groups will learn different things or have different ideas, and it will be good to compare them.... We can look for patterns.*

✱ ATTENDING TO EQUITY

If needed, you could allow students to print out articles they find so they can physically mark them up. Different computers and browsers also offer accessibility tools that allow on-screen annotation, zoom capabilities, and text-to-voice read aloud to support students of differing abilities.

Suggested prompt	Sample student response
What are the constraints for your communication today?	*You said we only get 2 minutes to share.* *We have to be finished with our research and ready to share today, so we can't make a super-detailed or complex presentation.*
How will you communicate this information? Why have you chosen that method?	*We need something simple... not too fancy.* *Since we already have computers out for research, we could make slides.*
Okay, you might not even need slides plural, one might be enough. *What will you put on your slide?✱*	*A photo or drawing of the organism, so we can see what it looks like.* *The name of the organism.* *A little bit about the organism: is it plant or animal or something else? Where does it live?* *How it reproduces without sperm and egg... but just a sentence or two since we don't have long to share.*
But then will you just show your slide/poster to the class? Or do you think we should have you talk about it?	*It would probably help to talk about it. We can make sure we're saying the words correctly, and it might be easier to take notes about important ideas.* *We are doing reading to find our own information; let's hear other groups tell us about theirs.* *Maybe the whole group doesn't have to talk, but at least one person could.*

✱ ATTENDING TO EQUITY

If needed, slide O is provided as a template that could be shared with students (all or a select few) to support them in including all the expected components.

ALTERNATE ACTIVITY	If students do not have access to presentation software such as Google Slides or MS PowerPoint, each group can create a simple poster on chart paper, instead.

ADDITIONAL GUIDANCE	Be sure students understand your school's policy about crediting sources for photos or other images they use on their slide(s).

Share an example slide. Display **slide D**.

Say, *Okay, here's a sample slide I put together about bananas, since we investigated those in our last class. I tried not to put too many words on the slide, but I can explain a little bit more information while I'm sharing about it. Let's see... The banana is a plant that grows in tropical climates and produces the yellow fruit we eat (the Cavendish variety). Banana plants reproduce by sending up shoots (little baby plants) from an underground stem called a rhizome near the base of the "mother" plant. These shoots will continue to grow there after the mother dies, or farmers can cut them off and plant them in new rows. Since the baby plants are just growing off the stem of the mother plant, they have exactly the same genetic information - no eggs or sperm were produced or combined. That was less than two minutes, right? See... just the main ideas and a couple of details about how they reproduce.*

2 · SMALL GROUP WORK TO OBTAIN INFORMATION AND PLAN COMMUNICATION

20 min

MATERIALS: science notebook, computer with internet access, access to presentation software (such as Google slides or MS PowerPoint)

Plan for successful collaboration in groups.

Say, *We need to make sure everyone in your group gets to participate in this work. How will you be sure everyone gets to contribute?*

Elicit responses such as the following:

- Everyone in the group finds a different source to read and then members compare ideas.
- The group should find consensus about how their organism reproduces: everyone should share ideas, listen to others, refer to evidence as needed, and be sure all agree when deciding what information to share.
- Google slides allows for multiple editors, so one person can be responsible for adding each component to the slide (or poster).
- It might be hard for three or four people to take turns talking (or talk in unison!) when telling the class about their organism, so take volunteers to speak, or play rock/paper/scissors to see who speaks.

Assign organisms to groups and begin research.

Say, *I will tell your group which organism you'll be researching and sharing about* (display **slide E**)*, and you can get to work. Some of these organisms can also reproduce sexually, but remember today's purpose is to find out how they use asexual reproduction (without combining sperm and egg), so focus on that. After we're all organized I'll switch to the slide with our constraints and directions so you can refer to that as you work. You have 20 minutes to research and prepare for your presentation to the class; we will begin sharing at ____ (time on the clock 20 minutes from now).*

The following organisms are also listed on **slide E** for you to assign to groups:

- coral
- planaria
- aphids
- potatoes
- hydra
- bacteria
- marbled crayfish (also called marmorkreb)
- spider plants

ADDITIONAL GUIDANCE	Students may benefit from careful planning of groups for today's work rather than numbering off randomly or keeping the same groups they usually have. You might consider grouping students heterogeneously by reading skill or willingness to speak in front of the group. Or, if you have a couple of students who require extra support, you may want to group them together (to make teacher assistance easier) and assign them one of the simpler organisms to research, such as hydra or planaria.

ALTERNATE ACTIVITY	If you have time for more presentations or more in-depth study, and/or would like students to work in partnerships or individually, the following are other asexually reproducing organisms that might make good choices for students to research: yeast, ginger, sea stars, sea anemones, sponges, Bdelloidea rotifers, the brahminy blind snake, and the New Mexico whiptail lizard.

After all groups are settled and know their organisms, switch to **slide F** so they can refer to the expectations.

After about 10 minutes of work time, announce that groups should be starting to create their slides, if they haven't already.

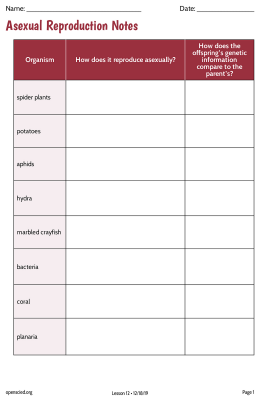
3 · BEGIN SHARING ABOUT ASEXUALLY REPRODUCING ORGANISMS

15 min

MATERIALS: science notebook, *Asexual Reproduction Notes*, computer and projector for presentation of slides

Set expectations for communicating information and listening. Bring the whole class back together with science notebooks and computers (if needed for presentations). Distribute *Asexual Reproduction Notes* or direct students to create a chart in their science notebooks as shown on **slide G**.

Say, *As each group tells about their organism, make a few notes to summarize how that living thing is able to reproduce without sperm or eggs. Then consider how the genetic information of the babies compares to the parent. If you're not sure about that second part right now, make a prediction and we will discuss that during our next class. We probably won't quite have time for each group to share today, but we'll get through as many as we can and finish next time. Remember that the same expectations we have for listening during discussions (eyes on speaker or notes, one person speaking at a time) apply during this sharing time, too.*



Name: _____ Date: _____

Asexual Reproduction Notes

Organism	How does it reproduce asexually?	How does the offspring's genetic information compare to the parent's?
spider plants		
potatoes		
aphids		
hydra		
marbled crayfish		
bacteria		
coral		
planaria		

ADDITIONAL GUIDANCE

If needed, ask the students how they will help make sure everyone hears the information they're communicating. They should have voice volumes that can be heard across the room, and listeners can use a silent signal (such as a hand cupped around an ear) if they cannot hear the speaker.

Groups share their slides about asexually reproducing organisms. You will probably have time for 6 groups to share today, depending on how quickly students can transition between presentations. Plan to begin the next class with presentations from whoever did not get to share today.

End of day 1

4 · FINISH SHARING ABOUT ASEXUALLY REPRODUCING ORGANISMS

7 min

MATERIALS: science notebook, *Asexual Reproduction Notes*, computer and projector for presentation of slides

Remaining groups share their slides about asexuallly reproducing organisms. Begin class today by hearing about any other organisms from groups that did not share last time. Remind students to continue taking notes on *Asexual Reproduction Notes* or in their science notebooks as shown on **slide G**.

5 · BUILDING UNDERSTANDINGS DISCUSSION ABOUT ASEXUAL REPRODUCTION

8 min

MATERIALS: science notebook, *Asexual Reproduction Notes*, chart paper or whiteboard for Punnett square example

Lead a Building Understandings Discussion about asexual reproduction. Display **slide H**.

KEY IDEAS

Purpose of this discussion: Confirm that asexual reproduction results in offspring that are genetically identical to the parent.

Listen for this idea:

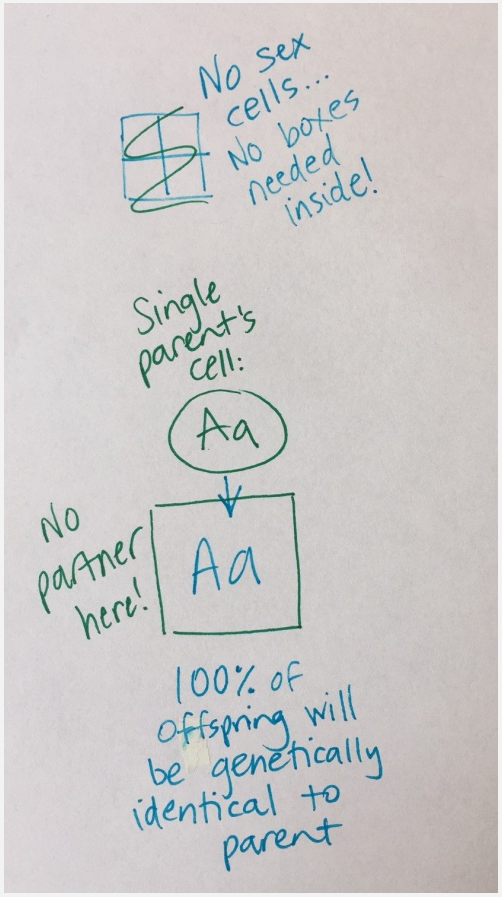
- Several different methods of asexual reproduction all result in genetically identical offspring.

Suggested prompt	Sample student response
What patterns did you find as you listened to the presentations and took notes about these organisms?	*They only needed one parent, not two.* *Sometimes the females just had egg cells... no sperm were involved.* *I kept thinking the genetic information would be the same, right? For parents and offspring?*
Let's talk about that genetic information... if there's only one parent, or only one parent's sex cell, is the genetic information going to be any different?	*Nope.* *No, not unless a mutation happens.*
And mutations are really, really rare, remember? So, if a mutation doesn't happen, how will the offspring produced by these forms of asexual reproduction compare to the parent's?	*The offspring will have exactly the same genetic information as the parent.*
Okay, so if the offspring have exactly the same genetic information as the parent, what do you think those offspring would look like compared to the parent?	*They'd look exactly the same!* *There would be no differences at all.* *They're clones, so they're exactly alike.* *We couldn't tell them apart.*
Well you know we like to find evidence to support what we're figuring out, right? So let's try to collect our own data to determine whether offspring from asexual reproduction look exactly alike. Ready?	*Yes! Let's go!*

ADDITIONAL GUIDANCE

Some of your students may have read in their research about the pros and cons of asexual reproduction, such as it's easier for a whole population to be wiped out by disease if they all have the same genetic information. If students bring up these ideas during discussion, have them phrase their thinking as a question and add it to the DQB. Then it can be carried over into the next unit (OpenSciEd unit 8.6) about natural selection.

Use a Punnett square to show that genetic information of offspring from asexual reproduction is identical to the parent's.
Draw a Punnett square on chart paper or the white board. Lead a discussion about how this model could apply to asexual reproduction, and record the students' thinking on the chart paper or whiteboard as you talk.



Suggested prompt	Sample student response
What is the purpose of a Punnett square?	*It helps us figure out what the possible genotypes (variations of alleles) are that offspring could have.*
Okay, so what do we put at the top and sides of these boxes?	*That's where we would put the sex cells from the parents: two possible egg cells on the top (and what allele they'd have) and two possible sperm along the side.*
So, hang on, what kind of reproduction would that be, though, if we had sperm and eggs?	*That's sexual reproduction.*

Suggested prompt	Sample student response
So what's going to be different if we want to use this model to show asexual reproduction? What should we change?	*We only have one parent, so there's only one cell.* *Let's put that single cell on top, because sometimes it's the female who's doing the reproducing without sperm.* *We can cross off the other parent on the side.* *The asexual organisms we studied don't make separate sex cells with only one chromosome each - they keep their pairs.*
So I think we don't even need the dividing lines here inside, right? We can just have a box with this single cell and its two alleles on top, like you said. So what can we say about the genotype these offspring will inherit?	*It's going to be the same combination as the parent had... that's the only genotype to fill in the box with.* *The offspring will have the exact same genetic information as the parent.*
What percentage of the offspring will have this identical genetic information?	*100 percent of the offspring will be genetically identical to the parent.*

ADDITIONAL GUIDANCE

If students do not see the value in applying a model to a situation where it doesn't really work, explain that working through this model in a new situation (asexual reproduction) helps us understand and articulate how it does work (for sexual reproduction). Also, it is important to discover the limitations of our models (and we don't figure those out until we try applying the model to different situations).

6 · PLANARIA REGENERATION LAB

25 min

MATERIALS: Planaria Regeneration Lab, science notebook, *Planaria Regeneration Lab Notes*, *Planaria Regeneration Lab Instructions*

Review the ethics of working with living things. Display **slide I.**

Say, *We wanted to collect our own data about organisms that use asexual reproduction. So before we work with these organisms, we need to talk about how to treat living things with respect.*

Read with students the expectations we have as scientists when working with living things. Work to establish in your classroom a culture of appreciation for living things, for example remind students to say things like "wow" or "interesting" instead of "eww" or "gross."

Ask, *What did we learn about how planaria reproduce?*

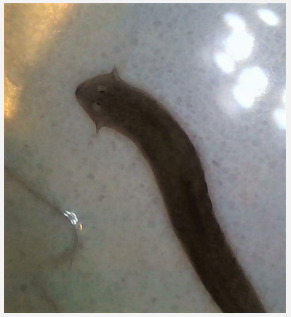
Elicit that they can divide and regrow from the pieces.

Say, *So that's what we're going to try today. We will cut planaria into two pieces: a head end and a tail end, and we'll see how they regrow.*

ADDITIONAL GUIDANCE

Be prepared to present an alternative activity to students whose views or beliefs make this activity uncomfortable or difficult for them. Depending on your state, students may have the legal right to opt out.

Observe planaria as a whole class. Display **slide J** so students can set up their notebooks while you get the microscope/camera adjusted. Plug the digital microscope into a computer that you can project for the whole class to see. Use the waterproof probe to show students the planaria in their jar. You may also use the dropper to move a few planaria to a slide and use the microscope to focus on them (see photo). Direct students to record in their science notebooks what they notice and wonder, and then briefly share out.



Suggested prompt	Sample student response
What do you notice about the planaria?	*They move quickly!* *They have a head end and a tail end.* *It looks like they have eyes.* *Some are a little bigger than others, but they all look pretty much the same.*
What are you wondering?	*What do they eat?* *How will we take care of them?* *How will we cut them?*

Depending on how much detail was shared about planaria during that group's presentation, you may not need to say all of the following: *These brown planaria usually live in the bottoms of ponds or streams, so they like dark places, and water that's between 21 and 23 degrees Celsius (that's about room temperature). Other substances found in tap water can harm them, so we're using natural spring water for them here in the classroom. They typically eat small animals (dead or alive), such as worms. In labs (or this classroom), they're fed beef liver or hard-boiled egg yolk. However, we will not feed our planaria after cutting them because they will be working on regenerating the body parts they need for eating and digestion. I'll show you first how you'll cut them in half, and then you and your partner can observe and cut your own planarian.*

Demonstrate how to cut a planarian into two pieces. See videos at https://www.teachersopensciedfieldtest.org/muscles and *Planaria Regeneration Lab Instructions* for reference. Set the digital microscope in its stand. Display **slide K** and remind students about working carefully with the sharp knives. Remove a planarian and place it onto your cold slide. Switch to projecting the image from your microscope for students to see. Demonstrate how to use the knife to make a careful, clean, quick cut in the middle of the planarian so you now have two pieces: a head end and a tail end. Demonstrate how to use the dropper and spring water to rinse the planaria pieces off the slide and into the dish.

Observe planaria in partnerships. Assign partnerships, distribute *Planaria Regeneration Lab Notes* and *Planaria Regeneration Lab Instructions*, and display **slide L**. Be sure each partnership has a hand lens (or microscope, if available), chilled slide, paper towel, pipette, and dish of spring water. Use a pipette to distribute one planarian (in a small droplet of water) onto each partnership's chilled slide so students can observe the "before" version and make notes and predictions about its appearance.

Facilitate use of craft knives for planaria cutting. After students have had about 2 minutes to observe their planaria and make notes, carefully distribute craft knives, reminding students to recap them immediately after use.

SAFETY PRECAUTIONS

You might have students raise a hand to indicate they've finished with their knife and then you can come over to pass it to another group rather than having students walk around with them.

Clean up and put away materials. Display **slide M**. After each partnership has its planaria pieces in the dish of spring water, direct students to use masking tape to label their dish on the cover. Invite students to name their two planaria pieces, and write those on their tape label. Collect covered dishes in a place in the classroom where you can keep them shaded or in the dark (such as in a box or closet), but maintain their temperature. Students should return their other materials to the appropriate places in the classroom, as well. Also, collect *Planaria Regeneration Lab Notes* to use as a formative assessment.

Say, *We will check back in on our planaria in a few days to see how they're doing. What will you expect to see?*

Elicit responses such as, *The two pieces will look the same. When they're done growing back, we won't be able to tell them apart anymore.*

ADDITIONAL GUIDANCE

There are reminders in upcoming lessons to check in on the planaria as time allows, and Lessons 15 has time built into it for students to observe their planaria again for sure (and relate what they're looking for to that day's figuring out). Brown planaria are said to regenerate fully in 7 to 14 days, but obviously results may vary.

7 · PROGRESS TRACKER

5 min

MATERIALS: science notebook

Update Progress Trackers. Say, *Let's use our Progress Trackers to summarize what we figured out today.* Display **slide N** and give students about 3 minutes to work.

In the example two-column Progress Tracker row for this lesson, each of the columns has been completed with ***possible*** student ideas.

Question	What I figured out in words/pictures
How do asexual organisms pass on genetic information if they don't have sperm and eggs?	Asexual organisms (such as planaria, coral, aphids, spider plants, bacteria, and so forth) can make copies of themselves or divide themselves to produce offspring. The genetic information of these offspring is identical to the genetic information of their "parent."

Navigate to next time's work. Say, *Okay, while we're waiting for our planaria to regenerate, let's think about what to explore next. We have figured out that there are several different ways offspring can inherit genetic information from their parent or parents. But once the baby has that genetic information, then what? Does it always follow the pattern we found with the MSTN gene and myostatin protein and heavily muscled phenotype? Gimme a quick thumbs up or down to predict... Do you think all genes cause proteins that influence different phenotypes? Let's start there next time.*

Additional Lesson 12 Teacher Guidance

SUPPORTING STUDENTS IN MAKING CONNECTIONS IN ELA

CCSS.ELA-LITERACY.W.8.8
Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CCSS.ELA-LITERACY.SL.8.4
Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

In order to complete their research about an asexual organism in this lesson, students must search effectively for multiple sources, evaluate their credibility, and summarize for others what they find. When sharing their findings, students must be concise and clear, speaking so others can understand the key ideas they learned.